

Mathematics 9th- Exercise 1.4

➔ REAL AND COMPLEX NUMBERS

UNIT # 01

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1. Simplify the following:

(i) $\frac{3^5}{3^2}$

Solution :-

$$= \frac{3^5}{3^2}$$

$$= 3^{5-2}$$

$$= 3^3$$

$$= 3 \times 3 \times 3$$

$$= 27 \text{ Ans.}$$

(ii) $\frac{2^4 \cdot 5^3}{10^2}$

Solution :-

$$= \frac{2^4 \cdot 5^3}{10^2}$$

$$= \frac{2^4 \cdot 5^3}{(2 \times 5)^2}$$

$$= \frac{2^4 \cdot 5^3}{2^2 \cdot 5^2}$$

$$= 2^{4-2} \cdot 5^{3-2}$$

$$= 2^2 \cdot 5^1$$

$$= 2^2 \cdot 5$$

$$= 4 \cdot 5$$

$$= 20 \text{ Ans.}$$

$$\therefore \frac{a^m}{a^n} = a^{m-n}$$



$$\therefore (a \times b)^n = a^n \times b^n$$

$$\therefore \frac{a^m}{a^n} = a^{m-n}$$



$$(iii) \frac{(a+b)^2 \cdot (c+d)^3}{(a+b) \cdot (c+d)^2}$$

Solution :-

$$\begin{aligned} &= \frac{(a+b)^2 \cdot (c+d)^3}{(a+b) \cdot (c+d)^2} \\ &= (a+b)^{2-1} \cdot (c+d)^{3-2} \\ &= (a+b) \cdot (c+d) \quad \text{Ans.} \end{aligned}$$

$$\therefore \frac{a^m}{a^n} = a^{m-n}$$

2. Simplify using law of exponent:

$$(i) \left(\frac{1}{3}\right)^4 \times \left(\frac{1}{3}\right)^5$$

Solution :-

$$\begin{aligned} &= \left(\frac{1}{3}\right)^4 \times \left(\frac{1}{3}\right)^5 \\ &= \left(\frac{1}{3}\right)^{4+5} \\ &= \left(\frac{1}{3}\right)^9 \quad \text{Ans.} \end{aligned}$$

$$(ii) \left(\frac{3}{4}\right)^5 \times \left(\frac{3}{4}\right)^2$$

Solution :-

$$\begin{aligned} &= \left(\frac{3}{4}\right)^5 \times \left(\frac{3}{4}\right)^2 \\ &= \left(\frac{3}{4}\right)^{5+2} \\ &= \left(\frac{3}{4}\right)^7 \quad \text{Ans.} \end{aligned}$$



$$\therefore a^m \times a^n = a^{m+n}$$



$$(iii) \left(-\frac{4}{5}\right)^3 \times \left(-\frac{4}{5}\right)^5$$

Solution :-

$$= \left(-\frac{4}{5}\right)^3 \times \left(-\frac{4}{5}\right)^5$$

$$= \left(-\frac{4}{5}\right)^{3+5}$$

$$= \left(-\frac{4}{5}\right)^8 \quad \text{Ans.}$$

$$\therefore a^m \times a^n = a^{m+n}$$

$$(iv) \left(-3 \times 5^2\right)^3$$

Solution :-

$$= \left(-3 \times 5^2\right)^3$$

$$= (-3)^3 \times (5^2)^3$$

$$= -3^3 \times 5^6 \quad \text{Ans.}$$

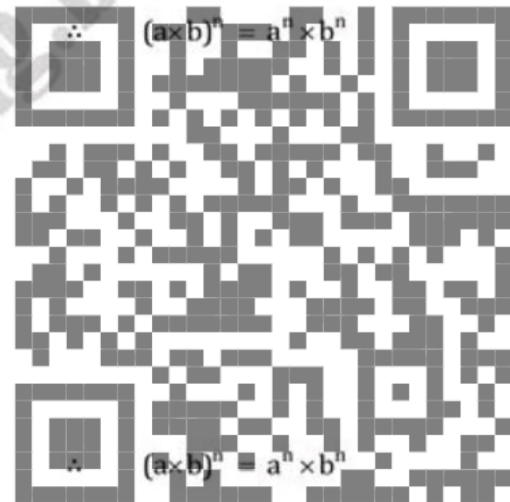
$$(v) \left[3 \times (-4)^2\right]^3$$

Solution :-

$$= \left[3 \times (-4)^2\right]^3$$

$$= 3^3 \times (-4^2)^3$$

$$= 3^3 \times 16^3 \quad \text{Ans.}$$



$$(vi) \left(-\frac{a}{bc}\right)^5 \times \left(-\frac{a}{bc}\right)^4$$

Solution :-

$$= \left(-\frac{a}{bc}\right)^5 \times \left(-\frac{a}{bc}\right)^4$$

$$= \left(-\frac{a}{bc}\right)^{5+4}$$

$$= \left(-\frac{a}{bc}\right)^9 \text{ Ans.}$$

$$\therefore a^m \times a^n = a^{m+n}$$

$$(vii) \left(-\frac{c}{d}\right)^2 \left(-\frac{c}{d}\right)^3 \left(-\frac{c}{d}\right)^5$$

Solution :-

$$= \left(-\frac{c}{d}\right)^2 \left(-\frac{c}{d}\right)^3 \left(-\frac{c}{d}\right)^5$$

$$= \left(-\frac{c}{d}\right)^{2+3+5}$$

$$= \left(-\frac{c}{d}\right)^{10} \text{ Ans.}$$

$$\therefore a^m \times a^n \times a^p = a^{m+n+p}$$



$$(viii) mn^2t^4n^3m^5t^7$$

Solution :-

$$= mn^2t^4n^3m^5t^7$$

$$= m^{1+5}n^{2+3}t^{4+7}$$

$$= m^6n^5t^{11} \text{ Ans.}$$

$$\therefore a^m \times a^n \times a^p = a^{m+n+p}$$



(ix) $a^2c^5b^2a^3c^3b^4a^4$

Solution :-

$$= a^2c^5b^2a^3c^3b^4a^4$$

$$= a^2a^3a^4b^2b^4c^3c^5$$

$$= a^{2+3+4}b^{2+4}c^{3+5}$$

$$= a^9b^6c^8 \quad \text{Ans.}$$

$$\therefore a^m \times a^n \times a^p = a^{m+n+p}$$

(x) $10x^4y^6x^2z^2y^3$

Solution :-

$$= 10x^4y^6x^2z^2y^3$$

$$= 10x^4x^2y^6y^3z^2$$

$$= 10x^{4+2}y^{6+3}z^2$$

$$= 10x^6y^9z^2 \quad \text{Ans.}$$

$$\therefore a^m \times a^n = a^{m+n}$$

(xi) $\frac{3}{5}r^3s^2r^7t^2s^2$

Solution :-

$$= \frac{3}{5}r^3s^2r^7t^2s^2$$

$$= \frac{3}{5}r^3r^7s^2s^2t^2$$

$$= \frac{3}{5}r^{3+7}s^{2+2}t^2$$

$$= \frac{3}{5}r^{10}s^4t^2 \quad \text{Ans.}$$

$$\therefore a^m \times a^n = a^{m+n}$$



$$(xii) -\left(-\frac{1}{m}\right)^4 \left(-\frac{1}{m}\right)^5 \left(-\frac{1}{m}\right)^3$$

Solution :-

$$= -\left(-\frac{1}{m}\right)^4 \left(-\frac{1}{m}\right)^5 \left(-\frac{1}{m}\right)^3$$

$$\therefore a^m \times a^n \times a^p = a^{m+n+p}$$

$$= -\left(-\frac{1}{m}\right)^{4+5+3}$$

$$= -\left(-\frac{1}{m}\right)^{12}$$

$$= \left(\frac{1}{m}\right)^{12} \text{ Ans.}$$

3. Simplify using the law of exponent:

$$(i) \left(5^2\right)^3$$

Solution :-

$$= \left(5^2\right)^3$$

$$= 5^{2 \times 3}$$

$$= 5^6 \text{ Ans.}$$

$$(ii) \left\{ (xy)^3 \right\}^5$$

Solution :-

$$= \left\{ (xy)^3 \right\}^5$$

$$= \{xy\}^{3 \times 5}$$

$$= \{xy\}^{15}$$

$$= x^{15} y^{15} \text{ Ans.}$$



$$\therefore (a^m)^n = a^{mn}$$

$$\therefore \{(ab)^m\}^n = (ab)^{mn} = a^{mn} b^{mn}$$



$$(iii) \left\{ (-4)^2 \right\}^5$$

Solution :-

$$= \left\{ (-4)^2 \right\}^5$$

$$= (-4)^{2 \times 5}$$

$$= (-4)^{10} \quad \text{Ans.}$$

$$\therefore (a^m)^n = a^{m \times n}$$

$$(iv) \left\{ (-3)^3 (-4)^2 \right\}^3$$

Solution :-

$$= \left\{ (-3)^3 (-4)^2 \right\}^3$$

$$= \left\{ (-3)^3 (-4)^2 \right\}^3$$

$$= (-3)^{3 \times 3} (-4)^{2 \times 3}$$

$$= (-3)^9 (-4)^6 \quad \text{Ans.}$$

$$(v) \left(\frac{b^2}{5} \right)^3$$

Solution :-

$$= \left(\frac{b^2}{5} \right)^3$$

$$= \left(\frac{b^{2 \times 3}}{5^{1 \times 3}} \right)$$

$$= \frac{b^6}{5^3} \quad \text{Ans.}$$



$$(vi) \left\{ \left(-\frac{4}{9} \right)^2 \right\}^3$$

Solution :-

$$= \left\{ \left(-\frac{4}{9} \right)^2 \right\}^3$$

$$= \left(-\frac{4}{9} \right)^{2 \times 3}$$

$$= \left(-\frac{4}{9} \right)^6$$

$$= \frac{(-4)^6}{(9)^6} \quad \text{Ans.}$$

$$(vii) \{(z^3)^2\}^4$$

Solution :-

$$= \{(z^3)^2\}^4$$

$$= \{(z^3)^{2 \times 4}\}$$

$$= \{z^{3 \times 2 \times 4}\}$$

$$= z^{24} \quad \text{Ans.}$$

$$(viii) \{(mm^2m^3m^4)^2\}^5$$

Solution :-

$$= \{(mm^2m^3m^4)^2\}^5$$

$$= \{(m^{1+2+3+4})^2\}^5$$

$$= \{(m^{10})^2\}^5$$

$$= m^{10 \times 2 \times 5}$$

$$= m^{100} \quad \text{Ans.}$$

$$\therefore (a^m)^n = a^{m \times n}$$

$$\therefore \{(a^m)^n\}^p = a^{m \times n \times p}$$

$$\therefore a^m \times a^n = a^{m+n}$$

$$\therefore \{(a^m)^n\}^p = a^{m \times n \times p}$$



$$(ix) \quad -[(-0.1)^2(-0.1)^3(-0.1)^4]^2$$

Solution :-

$$= -[(-0.1)^2(-0.1)^3(-0.1)^4]^2$$

$$= \cancel{-}[(\cancel{-}0.1)^2(\cancel{-}0.1)^3(\cancel{-}0.1)^4]^2$$

$$= [(0.1)^2(0.1)^3(0.1)^4]^2$$

$$= [(0.1)^{2+3+4}]^2$$

$$= (0.1)^{9 \times 2}$$

$$= (0.1)^{18} \quad \text{Ans.}$$

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Mathematics 9th- Exercise 1.5

➔ REAL AND COMPLEX NUMBERS

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1. Write the following complex numbers in the form of $a+ib$ for the given ordered pairs.(i) $(1, 2)$

Solution:

$$= (1, 2)$$

$$\therefore a + ib$$

$$= 1 + 2i \quad \text{Ans.}$$

(ii) $(2, 2)$

Solution:

$$= (2, 2)$$

$$\therefore a + bi$$

$$= 2 + 2i \quad \text{Ans.}$$

(iii) $(3, 4)$

Solution:

$$= (3, 4)$$

$$\therefore a + ib$$

$$= 3 + 4i \quad \text{Ans.}$$

(iv) $(-1, 1)$

Solution:

$$= (-1, 1)$$

$$\therefore a + ib$$

$$= -1 + i \quad \text{Ans.}$$

(v) $(-2, 2)$

Solution:

$$= (-2, 2)$$

$$\therefore a + bi$$

$$= -2 + 2i \quad \text{Ans.}$$



(vi) $(-3, 4)$

Solution:

$$= (-3, 4)$$

$$\therefore a + bi$$

$$= -3 + 4i \quad \text{Ans.}$$

2. Identify real and imaginary parts for the following complex numbers.

(i) $1 + 2i$

Solution:

$$1 + 2i$$

$$\text{Re}(z) = 1$$

$$\text{Im}(z) = 2$$

(ii) $9i + 4$

Solution:

$$9i + 4$$

$$\text{Re}(z) = 4$$

$$\text{Im}(z) = 9$$

(iii) $(-5, 6)$

Solution:

$$(-5, 6)$$

$$\text{Re}(z) = -5$$

$$\text{Im}(z) = 6$$

(iv) $-1 - i$

Solution:

$$-1 - i$$

$$\text{Re}(z) = -1$$

$$\text{Im}(z) = -1$$



$$(v) \left(-\frac{3}{4} \right) - \left(-\frac{4}{5} \right) i$$

Solution:

$$\left(-\frac{3}{4} \right) - \left(-\frac{4}{5} \right) i$$

$$\operatorname{Re}(z) = -\frac{3}{4}$$

$$\operatorname{Im}(z) = -\frac{4}{5}$$

$$(vi) 2i - 1$$

Solution:

$$2i - 1$$

$$\operatorname{Re}(z) = -1$$

$$\operatorname{Im}(z) = 2$$

3. Find the conjugate of the following complex numbers.

$$(i) 3 + 2i$$

Solution:

$$z_1 = 3 + 2i$$

$$\overline{z_1} = \overline{3 + 2i}$$

$$\overline{z_1} = 3 - 2i \quad \text{Ans.}$$

$$(ii) (4, 9)$$

Solution:

$$z_2 = (4, 9)$$

$$\overline{z_2} = \overline{(4, 9)}$$

$$\overline{z_2} = (4, -9)$$

$$\overline{z_2} = 4 - 9i \quad \text{Ans.}$$



(iii) $(-1, 1)$

Solution:

$$z_3 = (-1, 1)$$

$$z_3 = -1 + i$$

$$\overline{z_3} = \overline{-1 + i}$$

$$\overline{z_3} = -1 - i \quad \text{Ans.}$$

(iv) $1 - i$

Solution:

$$z_4 = 1 - i$$

$$\overline{z_4} = \overline{1 - i}$$

$$\overline{z_4} = 1 + i \quad \text{Ans.}$$

(v) $\left(\frac{3}{4}\right) + \left(\frac{4}{5}\right)i$

Solution:

$$\left(\frac{3}{4}\right) + \left(\frac{4}{5}\right)i$$

$$z_5 = \left(\frac{3}{4}\right) + \left(\frac{4}{5}\right)i$$

$$\overline{z_5} = \overline{\left(\frac{3}{4}\right) + \left(\frac{4}{5}\right)i}$$

$$\overline{z_5} = -\frac{3}{4} + \frac{4}{5}i \quad \text{Ans.}$$

(vi) $3i + 1$

Solution:

$$z_6 = 3i + 1$$

$$\overline{z_6} = \overline{3i + 1}$$

$$\overline{z_6} = -3i + 1$$

$$\overline{z_6} = 1 - 3i \quad \text{Ans.}$$



4. Verify that $\overline{\overline{z}} = z$, for the following complex numbers.

(i) $\left(\frac{4}{7}\right) + \left(\frac{9}{10}\right)i$

Solution:

$$z = \left(\frac{4}{7}\right) + \left(\frac{9}{10}\right)i$$

$$\bar{z} = \overline{\left(\frac{4}{7}\right) + \left(\frac{9}{10}\right)i}$$

$$\bar{z} = \frac{4}{7} - \frac{9}{10}i$$

$$\overline{\bar{z}} = \overline{\frac{4}{7} - \frac{9}{10}i}$$

$$\overline{\bar{z}} = z \quad \text{Proved}$$

(ii) $\left(-\frac{9}{11}\right) + \left(\frac{10}{9}\right)i$

Solution:

$$z = \left(-\frac{9}{11}\right) + \left(\frac{10}{9}\right)i$$

$$\bar{z} = \overline{\left(-\frac{9}{11}\right) + \left(\frac{10}{9}\right)i}$$

$$\bar{z} = -\frac{9}{11} - \frac{10}{9}i$$

$$\overline{\bar{z}} = \overline{-\frac{9}{11} - \frac{10}{9}i}$$

$$\overline{\bar{z}} = -\frac{9}{11} + \frac{10}{9}i$$

$$\overline{\bar{z}} = z \quad \text{Proved}$$



$$(iii) \frac{1}{2} - 3i$$

Solution:

$$z = \frac{1}{2} - 3i$$

$$\bar{z} = \overline{\frac{1}{2} - 3i}$$

$$\bar{z} = \frac{1}{2} + 3i$$

$$\overline{\bar{z}} = \overline{\frac{1}{2} + 3i}$$

$$\overline{\bar{z}} = \frac{1}{2} - 3i$$

$$\overline{\bar{z}} = z$$

Proved

$$(iv) 2 + 3i$$

Solution:

$$z = 2 + 3i$$

$$\bar{z} = \overline{2 + 3i}$$

$$\bar{z} = 2 - 3i$$

$$\overline{\bar{z}} = \overline{2 - 3i}$$

$$\overline{\bar{z}} = 2 + 3i$$

$$\overline{\bar{z}} = z$$

Proved

$$(v) -2 - 3\left(-\frac{10}{9}\right)i$$

Solution:

$$z = -2 - 3\left(-\frac{10}{9}\right)i$$

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$$\bar{z} = \overline{-2-3\left(-\frac{10}{9}\right)i}$$

$$\bar{z} = -2+3\left(-\frac{10}{9}\right)i$$

$$\overline{\bar{z}} = \overline{-2+3\left(-\frac{10}{9}\right)i}$$

$$\overline{\bar{z}} = -2-3\left(-\frac{10}{9}\right)i$$

$$\overline{\bar{z}} = z \quad \text{Proved}$$

(vi) $4x + 3iy$

Solution:

$$z = 4x + 3iy$$

$$\bar{z} = \overline{4x + 3iy}$$

$$\bar{z} = 4x - 3iy$$

$$\overline{\bar{z}} = \overline{4x - 3iy}$$

$$\overline{\bar{z}} = 4x + 3iy$$

$$\overline{\bar{z}} = z \quad \text{Proved}$$

5. Find the values of x and y, when.

(i) $x + yi = -5 + 5i$

Solution:

$$x + yi = -5 + 5i$$

$$x = -5$$

$$y = 5$$

$$(x, y) = (-5, 5)$$

$$x + yi = -5 + 5i \quad \text{Ans.}$$



$$(ii) \quad x^2 + iy^2 = \frac{16}{9} + \frac{9}{25}i$$

Solution:

$$x^2 + iy^2 = \frac{16}{9} + \frac{9}{25}i$$

$$x^2 = \frac{16}{9}, \quad y^2 = \frac{9}{25}$$

$$\sqrt{x^2} = \sqrt{\frac{16}{9}}, \quad \sqrt{y^2} = \sqrt{\frac{9}{25}}$$

$$\sqrt{x^2} = \sqrt{\frac{4^2}{3^2}}, \quad \sqrt{y^2} = \sqrt{\frac{3^2}{5^2}}$$

$$x = \frac{4}{3}, \quad y = \frac{3}{5}$$

$$(x, y) = \left(\frac{4}{3}, \frac{3}{5} \right)$$

$$(iii) \quad y^2 + \frac{x}{3}i = 121 - \frac{9}{5}i$$

Solution:

$$y^2 + \frac{x}{3}i = 121 - \frac{9}{5}i$$

$$y^2 = 121, \quad \frac{x}{3} = -\frac{9}{5}$$

$$\sqrt{y^2} = \sqrt{11^2}, \quad x = -\frac{9}{5} \times 3$$

$$y = 11, \quad x = -\frac{27}{5}$$

$$(y, x) = \left(11, -\frac{27}{5} \right)$$



$$(iv) \quad \frac{\sqrt{5}}{3}x - \frac{3}{\sqrt{2}}yi = \frac{6\sqrt{3}}{\sqrt{2}} + \frac{2\sqrt{2}}{9}i$$

Solution:

$$\frac{\sqrt{5}}{3}x = \frac{6\sqrt{3}}{\sqrt{2}} \quad , \quad -\frac{3}{\sqrt{2}}y = \frac{2\sqrt{2}}{9}$$

$$x = \frac{6 \times 3\sqrt{3}}{\sqrt{2} \times \sqrt{5}} \quad , \quad y = \frac{2\sqrt{2} \times \sqrt{2}}{-3}$$

$$x = \frac{18\sqrt{3}}{\sqrt{10}} \quad , \quad y = \frac{2(\sqrt{2})^2}{-3}$$

$$y = \frac{4}{-3}$$

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Mathematics 9th- Exercise 1.6

→ REAL AND COMPLEX NUMBERS

UNIT # 01

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1. Perform the indicated operations of the following complex numbers.

(i) $(3, 2) + (9, 3)$

Solution:

$$\Rightarrow (3, 2) + (9, 3)$$

$$\therefore (a, b) + (c, d) = (a + c, b + d)$$

$$\Rightarrow (3, 2) + (9, 3) = (3 + 9, 2 + 3)$$

$$\Rightarrow (3, 2) + (9, 3) = (12, 5) \quad \text{Ans.}$$

(ii) $\left(\frac{3}{2}, \frac{2}{3}\right) + \left(\frac{2}{3}, \frac{3}{2}\right)$

Solution:

$$\Rightarrow \left(\frac{3}{2}, \frac{2}{3}\right) + \left(\frac{2}{3}, \frac{3}{2}\right)$$

$$\therefore (a, b) + (c, d) = (a + c, b + d)$$

$$\Rightarrow \left(\frac{3}{2}, \frac{2}{3}\right) + \left(\frac{2}{3}, \frac{3}{2}\right) = \left(\frac{3}{2} + \frac{2}{3}, \frac{2}{3} + \frac{3}{2}\right)$$

$$\Rightarrow \left(\frac{3}{2}, \frac{2}{3}\right) + \left(\frac{2}{3}, \frac{3}{2}\right) = \left(\frac{(3 \times 3) + (2 \times 2)}{6}, \frac{(2 \times 2) + (3 \times 3)}{6}\right)$$

$$\Rightarrow \left(\frac{3}{2}, \frac{2}{3}\right) + \left(\frac{2}{3}, \frac{3}{2}\right) = \left(\frac{9+4}{6}, \frac{4+9}{6}\right)$$

$$\Rightarrow \left(\frac{3}{2}, \frac{2}{3}\right) + \left(\frac{2}{3}, \frac{3}{2}\right) = \left(\frac{13}{6}, \frac{13}{6}\right) \quad \text{Ans.}$$



$$(iii) (2xy, 5y^2) - \left(\frac{1}{2}xy, 6y^2 \right)$$

Solution:

$$\Rightarrow (2xy, 5y^2) - \left(\frac{1}{2}xy, 6y^2 \right) \quad \therefore (a, b) - (c, d) = (a - c, b - d)$$

$$\Rightarrow (2xy, 5y^2) - \left(\frac{1}{2}xy, 6y^2 \right) = \left(2xy - \frac{1}{2}xy, 5y^2 - 6y^2 \right)$$

$$\Rightarrow (2xy, 5y^2) - \left(\frac{1}{2}xy, 6y^2 \right) = \left(\frac{4xy - xy}{2}, -y^2 \right)$$

$$\Rightarrow (2xy, 5y^2) - \left(\frac{1}{2}xy, 6y^2 \right) = \left(\frac{3xy}{2}, -y^2 \right) \quad \text{Ans.}$$

$$(iv) (15, 12) - (10, -9)$$

Solution:

$$\Rightarrow (15, 12) - (10, -9) \quad \therefore (a, b) - (c, d) = (a - c, b - d)$$

$$\Rightarrow (15, 12) - (10, -9) = (15 - 10, 12 + 9)$$

$$\Rightarrow (15, 12) - (10, -9) = (5, 21) \quad \text{Ans.}$$

$$(v) \left(\frac{4}{5}, \frac{8}{15} \right) - \left(\frac{4}{5}, \frac{6}{10} \right)$$

Solution:

$$\Rightarrow \left(\frac{4}{5}, \frac{8}{15} \right) - \left(\frac{4}{5}, \frac{6}{10} \right) \quad \therefore (a, b) - (c, d) = (a - c, b - d)$$

$$\Rightarrow \left(\frac{4}{5}, \frac{8}{15} \right) - \left(\frac{4}{5}, \frac{6}{10} \right) = \left(\frac{4}{5} - \frac{4}{5}, \frac{8}{15} - \frac{6}{10} \right)$$

$$\Rightarrow \left(\frac{4}{5}, \frac{8}{15} \right) - \left(\frac{4}{5}, \frac{6}{10} \right) = \left(\frac{4}{5} - \frac{4}{5}, \frac{2 \times 8 - 3 \times 6}{30} \right)$$



$$\Rightarrow \left(\frac{4}{5}, \frac{8}{15} \right) - \left(\frac{4}{5}, \frac{6}{10} \right) = \left(0, \frac{16-18}{30} \right)$$

$$\Rightarrow \left(\frac{4}{5}, \frac{8}{15} \right) - \left(\frac{4}{5}, \frac{6}{10} \right) = \left(0, \frac{2}{30} \right)$$

$$\Rightarrow \left(\frac{4}{5}, \frac{8}{15} \right) - \left(\frac{4}{5}, \frac{6}{10} \right) = \left(0, -\frac{1}{15} \right) \quad \text{Ans.}$$

(vi) $(1, 2) (1, -2)$

Solution:

$$\Rightarrow (1, 2) (1, -2)$$

$$\therefore (ac - bd, ad + bc)$$

$$\Rightarrow (1, 2) (1, -2) = [(1)(1) - (2)(-2), (1)(-2) + (2)(1)]$$

$$\Rightarrow (1, 2) (1, -2) = [1 + 4, -2 + 2]$$

$$\Rightarrow (1, 2) (1, -2) = (5, 0) \quad \text{Ans.}$$

(vii) $(4, -5) (5, -4)$

Solution:

$$\Rightarrow (4, -5) (5, -4)$$

$$\therefore (a, b) - (c, d) = (ac - bd, ad + bc)$$

$$\Rightarrow (4, -5) (5, -4) = [(14)(5) - (-5)(-4), (4)(-4) + (-5)(5)]$$

$$\Rightarrow (4, -5) (5, -4) = (20 - 20, -16 - 25)$$

$$\Rightarrow (4, -5) (5, -4) = (0, -41) \quad \text{Ans.}$$

(viii) $\left(\frac{\sqrt{3}}{2}, \frac{\sqrt{6}}{\sqrt{2}} \right) \left(\frac{2\sqrt{3}}{4}, \frac{2\sqrt{3}}{2\sqrt{2}} \right)$

Solution:

$$\Rightarrow \left(\frac{\sqrt{3}}{2}, \frac{\sqrt{6}}{\sqrt{2}} \right) \left(\frac{2\sqrt{3}}{4}, \frac{2\sqrt{3}}{2\sqrt{2}} \right)$$

$$\therefore (a, b)(c, d) = (ac - bd, ad + bc)$$



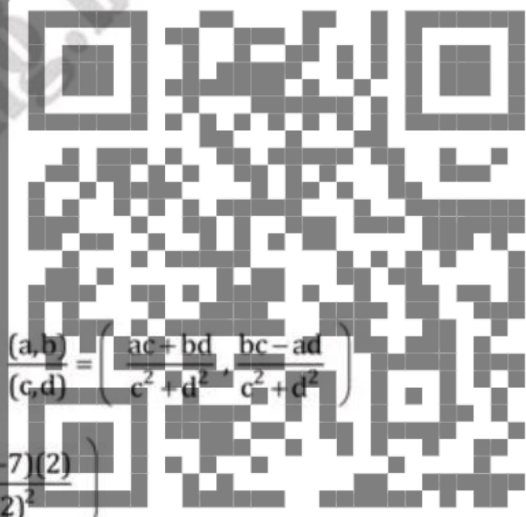
$$\begin{aligned}
 &= \left[\left(\frac{\sqrt{3}}{2} \right) \left(\frac{2\sqrt{3}}{4} \right) - \left(\frac{\sqrt{6}}{\sqrt{2}} \right) \left(\frac{2\sqrt{3}}{2\sqrt{2}} \right), \left(\frac{\sqrt{3}}{2} \right) \left(\frac{2\sqrt{3}}{2\sqrt{2}} \right) + \left(\frac{\sqrt{6}}{\sqrt{2}} \right) \left(\frac{2\sqrt{3}}{4} \right) \right] \\
 &= \left(\frac{2(\cancel{\sqrt{3}})^2}{4} - \frac{2\sqrt{18}}{2(\cancel{\sqrt{18}})^2}, \frac{2(\cancel{\sqrt{3}})^2}{4\sqrt{2}} + \frac{2\sqrt{18}}{4\sqrt{2}} \right) \\
 &= \frac{\cancel{6}^3}{\cancel{8}^4} - \frac{2 \times 3\sqrt{2}}{4}, \frac{\cancel{6}^3}{2\cancel{4}\sqrt{2}} + \frac{3\cancel{6}\sqrt{2}}{2\cancel{4}\sqrt{2}} \\
 &= \frac{3}{4} - \frac{3\sqrt{2}}{2}, \frac{3}{2\sqrt{2}} + \frac{3}{2} \\
 &= \frac{3}{4} - \frac{3\sqrt{2}}{2}, \frac{3}{2\sqrt{2}} + \frac{3}{2} \\
 &= \left(\frac{3-6\sqrt{2}}{4}, \frac{3+3\sqrt{2}}{2\sqrt{2}} \right) \quad \text{Ans.}
 \end{aligned}$$

(ix) $(3, -7) \div (3, 2)$

Solution:

$\Rightarrow (3, -7) \div (3, 2) \quad \therefore$

$$\begin{aligned}
 \Rightarrow \frac{(3, -7)}{(3, 2)} &= \left(\frac{(3)(3) + (-7)(2)}{(3)^2 + (2)^2} \right) \\
 &= \left(\frac{9-14}{9+4}, \frac{-21-6}{9+4} \right) \\
 &= \left(\frac{-5}{13}, \frac{-27}{13} \right) \quad \text{Ans.}
 \end{aligned}$$



(x) $(4, 5) \div (2, -3)$

Solution:

$$\Rightarrow (4, 5) \div (2, -3) \quad \therefore \frac{(a,b)}{(c,d)} = \left(\frac{ac+bd}{c^2+d^2}, \frac{bc-ad}{c^2+d^2} \right)$$

$$\Rightarrow \frac{(4,5)}{(2,-3)} = \left(\frac{(4)(2)+(5)(-3)}{(2)^2+(-3)^2}, \frac{(5)(2)-(4)(-3)}{(2)^2+(-3)^2} \right)$$

$$= \left(\frac{8-15}{4+9}, \frac{10+12}{4+9} \right)$$

$$= \left(\frac{-7}{13}, \frac{22}{13} \right) \quad \text{Ans.}$$

2. Simplify and write your answer in form of $a + ib$

(i) $\frac{-1}{1+i}$

Solution:

$$= \frac{-1}{1+i}$$

Multiplying and dividing by its conjugates:

$$= \frac{-1}{1+i} \times \frac{1-i}{1-i}$$

$$= \frac{-1(1-i)}{(1+i)(1-i)}$$

$$= \frac{-1+i}{(1)^2-(i)^2}$$

$$= \frac{-1+i}{1-i^2}$$

$$= \frac{-1+i}{1-(-1)}$$

$$= \frac{-1+i}{1+1}$$

$$= \frac{-1}{2} + \frac{1}{2}i$$

$$\Rightarrow a + ib = \frac{-1}{2} + \frac{1}{2}i \quad \text{Ans.}$$



$$\therefore (a+b)(a-b) = (a^2-b^2)$$

$$\therefore i^2 = -1$$



(ii) $(1+i)^4$

Solution:

$$= (1+i)^4$$

$$= [(1+i)^2]^2$$

$$= [(1)^2 + 2(1)(i) + (i)^2]^2$$

$$\therefore (a+b)^2 = a^2 + 2ab + b^2$$

$$= (1 + 2i + i^2)^2$$

$$\therefore i^2 = -1$$

$$= (\cancel{1} + 2i - \cancel{1})^2$$

$$= (2i)^2$$

$$\therefore i^2 = -1$$

$$= 4i^2$$

$$= 4(-1)$$

$$= -4$$

$$a + ib$$

$$= -4 + 0i$$

(iii) $\frac{2-6i}{3-i} - \frac{4+i}{3+i}$

Solution:

$$= \frac{2-6i}{3-i} - \frac{4+i}{3+i}$$

$$= \frac{(2-6i)(3+i) - (3-i)(4+i)}{(3-i)(3+i)}$$

$$(a-b)(a+b) = (a^2 - b^2)$$

$$= \frac{6+2i-18i-6i^2 - (12+3i-4i-i^2)}{(3)^2 - (i)^2}$$

$$= \frac{6-16i-6(-1) - (12-1-(-1))}{9-i^2}$$

$$= \frac{6+6-16i - (12+1-i)}{9-(-1)}$$

$$= \frac{12-16i-13+i}{9+1}$$

$$= \frac{-1-15i}{10}$$

$$= \frac{-1}{10} - \frac{3}{2}i$$

$$= -\frac{1}{10} - \frac{3}{2}i \quad \text{Ans.}$$



$$(iv) \frac{1}{(2+3i)(1+i)}$$

Solution:

$$= \frac{1}{(2+3i)(1+i)}$$

$$= \frac{1}{2+2i+3i+3i^2}$$

$$\therefore i^2 = -1$$

$$= \frac{1}{2+5i+3(-1)}$$

$$= \frac{1}{2-3+5i}$$

$$= \frac{1}{-1+5i} \times \frac{-1-5i}{-1-5i}$$

$$= \frac{1}{-(1-5i)} \times \frac{1+5i}{1+5i}$$

$$= \frac{1(1+5i)}{-(1-5i)(1+5i)}$$

$$\therefore (a+b)(a-b) = a^2 - b^2$$

$$= \frac{1+5i}{-(1)^2 - (5i)^2}$$

$$\therefore i^2 = -1$$

$$= \frac{1+5i}{-(1-25i^2)}$$

$$= \frac{1+5i}{-(1-25(-1))}$$

$$= \frac{1+5i}{-(1+25)}$$

$$= \frac{1+5i}{-26}$$

$$= \frac{1}{-26} - \frac{5}{26}i \quad \text{Ans.}$$



3. If $z_1 = -4 + 6i$ and $z_2 = 2\frac{1}{2} - 2i$, verify that : $\overline{z_2} = \frac{5}{2} - 2i$

(i) $\overline{z_1 + z_2} = \overline{z_1} + \overline{z_2}$

Solution:

Taking L.H.S

$$\overline{z_1 + z_2}$$

$$\overline{z_1 + z_2} = \overline{-4 + 6i + \frac{5}{2} - 2i}$$

$$\overline{z_1 + z_2} = \frac{\overline{-8 + 12i + 5 - 4i}}{2}$$

$$\overline{z_1 + z_2} = \frac{\overline{-3 + 8i}}{2}$$

$$\overline{z_1 + z_2} = \frac{-3 - 8i}{2}$$

$$\overline{z_1 + z_2} = \frac{-3}{2} - \frac{8}{2}i$$

$$\overline{z_1 + z_2} = \frac{-3}{2} - 4i$$

Now taking R.H.S

$$\overline{z_1} + \overline{z_2}$$

First we find $\overline{z_1}$

$$\overline{z_1} = \overline{-4 + 6i}$$

$$\overline{z_1} = -4 - 6i$$

Now find $\overline{z_2}$

$$\overline{z_2} = \overline{\frac{5}{2} - 2i}$$

$$\overline{z_2} = \frac{5}{2} + 2i$$

Now, adding $\overline{z_1} + \overline{z_2}$

$$\overline{z_1} + \overline{z_2} = -4 - 6i + \frac{5}{2} + 2i$$

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$$= \frac{-8 - 12i + 5 + 4i}{2}$$

$$= \frac{-3 - 8i}{2}$$

$$= -\frac{3}{2} - \frac{8}{2}i$$

$$\overline{z_1} + \overline{z_2} = -\frac{3}{2} - 4i$$

$$\text{L.H.S} = \text{R.H.S} \quad \text{Hence Proved.}$$

$$(ii) \quad \overline{z_1 - z_2} = \overline{z_1} - \overline{z_2}$$

Solution:

Taking L.H.S

$$\overline{z_1 - z_2}$$

$$= \overline{-4 + 6i - \left(\frac{5}{2} - 2i\right)}$$

$$= -4 + 6i - \frac{5}{2} + 2i$$

$$= \frac{-8 + 12i - 5 + 4i}{2}$$

$$= \frac{-13 + 16i}{2}$$

$$= -\frac{13}{2} + \frac{16i}{2}$$

$$\overline{z_1 - z_2} = -\frac{13}{2} + 8i$$

Now taking R.H.S

$$\overline{z_1} - \overline{z_2}$$

First we find $\overline{z_1}$

$$\overline{z_1} = \overline{-4 + 6i}$$

$$\overline{z_1} = -4 - 6i$$



Now find $\overline{z_2}$

$$\overline{z_2} = \overline{\frac{5}{2} - 2i}$$

$$\overline{z_2} = \frac{5}{2} + 2i$$

Now, subtracting $\overline{z_1} - \overline{z_2}$

$$\overline{z_1} - \overline{z_2} = -4 - 6i - \left(\frac{5}{2} + 2i \right)$$

$$= -4 - 6i - \frac{5}{2} - 2i$$

$$= \frac{-8 - 12i - 5 - 4i}{2}$$

$$= \frac{-13 - 16i}{2}$$

$$\overline{z_1 - z_2} = \frac{-13}{2} - 8i$$

L.H.S = R.H.S Hence Proved.

4. If $z_1 = 2 - 5i$ and $z_2 = 2 + 3i$, verify that:

(i) $\overline{z_1 z_2} = \overline{z_1} \cdot \overline{z_2}$

Solution:

Taking L.H.S

$$\overline{z_1 z_2}$$

$$= \overline{(2 - 5i)(2 + 3i)}$$

$$= \overline{4 + 6i - 10i - 15i^2}$$

$$= \overline{4 - 4i - 15(-1)}$$

$$= \overline{4 - 4i + 15}$$

$$= \overline{19 - 4i}$$

$$\overline{z_1 z_2} = 19 + 4i$$

$$i^2 = -1$$



Now taking R.H.S

$$\overline{z_1} \cdot \overline{z_2}$$

First we find $\overline{z_1}$

$$\overline{z_1} = \overline{2-5i}$$

$$\overline{z_1} = 2+5i$$

Now find $\overline{z_2}$

$$\overline{z_2} = \overline{2+3i}$$

$$\overline{z_2} = 2-3i$$

Now, $\overline{z_1} \cdot \overline{z_2}$

$$\overline{z_1} \cdot \overline{z_2} = (2+5i)(2-3i)$$

$$= 4-6i+10i-15i^2$$

$$i^2 = -1$$

$$= 4+4i-15(-1)$$

$$= 4+15+4i$$

$$\overline{z_1} \cdot \overline{z_2} = 19+4i$$

$$\text{L.H.S} = \text{R.H.S}$$

Hence Proved.

2. If $z_1 = 2-5i$ and $z_2 = 2+3i$, verify that:

(ii) $\overline{\left(\frac{z_1}{z_2}\right)} = \frac{\overline{z_1}}{\overline{z_2}}$

Solution:

Taking L.H.S

$$\overline{\left(\frac{z_1}{z_2}\right)} = \overline{\left(\frac{2-5i}{2+3i}\right)}$$

$$= \frac{\overline{2-5i}}{\overline{2+3i}} \times \frac{\overline{2-3i}}{\overline{2-3i}}$$

$$= \frac{4-6i-10i+15i^2}{(2)^2-(3i)^2}$$

$$\therefore (a+b)(a-b) = a^2 - b^2$$

$$i^2 = -1$$



$$= \frac{4 - 16i + 15(-1)}{4 - 9i^2}$$

$$= \frac{4 - 15 - 16i}{4 - 9(-1)}$$

$$= \frac{-11 - 16i}{4 + 9}$$

$$= -\frac{11}{13} - \frac{16i}{13}$$

$$\overline{\begin{pmatrix} z_1 \\ z_2 \end{pmatrix}} = -\frac{11}{13} + \frac{16}{13}i$$

Now taking R.H.S

$$\frac{\overline{z_1}}{z_2} = \frac{\overline{2 - 5i}}{2 + 3i}$$

$$\frac{\overline{z_1}}{z_2} = \frac{2 + 5i}{2 - 3i} \times \frac{2 + 3i}{2 + 3i}$$

$$= \frac{4 + 6i + 10i + 15i^2}{(2)^2 - (3i)^2}$$

$$= \frac{4 + 16i + 15(-1)}{4 - 9(-1)}$$

$$= \frac{4 - 15 + 16i}{4 + 9}$$

$$\frac{\overline{z_1}}{z_2} = -\frac{11}{13} + \frac{16i}{13}$$

$$\text{L.H.S} = \text{R.H.S}$$

Hence Proved.



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MATHEMATICS (SINDH BOARD)

CLASS : 9 EXERCISE : 2.6 QUES : Example : 1

Find the value of $(8.573)(28.74)$ by using logarithm:

Solution:

$$\text{Let, } x = 8.573 \times 28.74$$

Taking log on both sides:

$$\log x = \log 8.573 \times 28.74$$

$$\therefore \log mn = \log m + \log n$$

$$\log x = \log 8.573 + \log 28.74$$

$$\log x = 0.9332 + 1.4585$$

$$\log x = 2.3917$$

$$x = \text{Antilog } 2.3917$$

$$x = 246.4$$

$$\begin{array}{r} 8.573 \times 10^0 \\ 0.9332 \\ 2.874 \times 10^1 \\ 1.4585 \end{array}$$

$$\begin{array}{r} \text{Ch} = 2 + 1 = 3 \\ 246.4 \end{array}$$

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MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : Example : 2

Find the value of $\frac{213.1}{34.22}$ by using logarithm:

Solution:

$$x = \frac{213.1}{34.22}$$

Taking log on both sides:

$$\log x = \log \frac{213.1}{34.22}$$

$$\therefore \log \frac{m}{n} = \log m - \log n$$

$$\log x = \log 213.1 - \log 34.22$$

$$\log x = 2.3286 - 1.5343$$

$$\log x = 0.7943$$

$$x = \text{Antilog } 0.7943$$

$$x = 6.227$$

$$\begin{array}{l} 213.1 \\ 2.131 \times 10^2 \\ 2.3286 \end{array}$$

$$\begin{array}{l} 34.22 \\ 3.422 \times 10^1 \\ 1.5343 \end{array}$$

$$\begin{array}{l} 0.7943 \\ \text{Ch} = 0 + 1 = 1 \\ 6227 \end{array}$$

MORE!!!



MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

2

EXERCISE

2.6

Ex: 3: Calculate $\sqrt[2.34]{3.41 \times 37.92}$ by using logarithm table

Solution:

$$\text{Let } x = \sqrt[2.34]{3.41 \times 37.92}$$

Taking log on both sides:

$$\log x = \log \left(\frac{3.41 \times 37.92}{2.34} \right)^{1/2}$$

$$\log x = \log \left((3.41)^{1/2} \times (37.92)^{1/2} \right)^{1/2}$$

$$\therefore \log mn = \log m + \log n$$

$$\therefore \log \frac{m}{n} = \log m - \log n$$

$$\log x = \log (3.41)^{1/2} + \log (37.92)^{1/2} - \log (2.34)^{1/2}$$

$$\log x = \frac{1}{2} \log 3.41 + \frac{1}{2} \log 37.92 - \frac{1}{2} \log 2.34$$

$$\log x = \frac{1}{2} (0.5328) + \frac{1}{2} 1.5788 - \frac{1}{2} 0.3692$$

$$\log x = 0.2664 + 0.7894 - 0.1846$$

$$\log x = 1.0558 - 0.1846$$

$$\log x = 0.8712$$

$$x = \text{Antilog } 0.8712$$

$$x = 7.433 \quad \text{Ans}$$

R. W
3.41
 3.41×10^0
Ch = 0
mantissa = 0.53
37.92
 37.92×10^1

$$\therefore \log m^n = n \log m$$

FOR MORE!!

Adanjee



MATHEMATICS (SINDH BOARD)

CLASS : **9** EXERCISE : **2.6** QUES: **Example : 4**

Find the number of digits in 4^5 :

Solution:

$$\text{Let } x = 4^5$$

Taking log on both Sides:

$$\log x = \log 4^5$$

$$\log x = 5 \log 4$$

$$\log x = 5 (0.6021)$$

$$\log x = 3.0105$$

Since the number of digits = $3 + 1 = 4$

Since the number of digit in 4^5 is 4

$$\therefore \log m^n = n \log m$$

$$4 \times 10^0$$

$$Ch = 0$$

$$Matissa = 4.000$$

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MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : 1

Find the values of the following by using logarithms :

(i) 57.86×4.385

Solution :

Let: $x = 57.86 \times 4.385$

Taking log on both sides:

$$\log x = \log 57.86 \times 4.385$$

$$\therefore \log mn = \log m + \log n$$

$$\log x = \log 57.86 + \log 4.385$$

$$\log x = 1.7624 + 0.6420$$

$$\log x = 2.4044$$

$$x = \text{Antilog } 2.4044$$

$$x = 253.7$$

Ans

$$\begin{aligned} &= 57.86 \times 10^1 \\ &= 57.86 \times 10^1 \\ &\text{Ch} = 1 \\ &\text{Mantissa} = 0.7624 \end{aligned}$$

$$\begin{aligned} &4.385 \times 10^0 \\ &= 4.385 \times 10^0 \\ &\text{Ch} = 0 \\ &\text{Mantissa} = 0.6420 \\ &\text{Antilog } 2.4044 \\ &\text{Ch} = 2 + 1 \\ &\text{Ch} = 3 \end{aligned}$$



FOR MORE!!!



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : 1

Find the values of the following by using logarithms :

(ii) $25.753 \times 0.5341 \times 490.8$

Solution :

Let: $x = 25.753 \times 0.5341 \times 490.8$

Taking log on both Sides:

$$\log x = \log 25.753 \times 0.5341 \times 490.8$$

$$\therefore \log mn = \log m + \log n$$

$$\therefore \log mnp = \log m + \log n + \log p$$

$$\log x = \log 25.753 + \log 0.5341 + \log 490.8$$

$$\log x = 1.4108 + (-1.7276) + 2.6909$$

$$\log x = 1.4108 + (-1.7276) + 2.6909$$

$$\log x = 1.4108 - 0.2724 + 2.6909$$

$$\log x = 4.1017 - 0.2724$$

$$\log x = 3.8293$$

$$x = \text{Antilog } 3.8293$$

$$x = 6750.$$

$$\boxed{x = 6750} \text{ Ans}$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : 1

Find the values of the following by using logarithms :

(iii) $\frac{25.753}{0.5341}$

Solution:

Let $x = \frac{25.753}{0.5341}$

Taking log on both sides:

$$\log x = \log \frac{25.753}{0.5341}$$

$$= \log m - \log n$$

$$\log x = \log 25.753 - \log 0.5341$$

$$\log x = 1.4108 - (-1.7276)$$

$$\log x = 1.4108 - (-1 + 0.7276)$$

$$\log x = 1.4108 - (-0.2724)$$

$$\log x = 1.4108 + 0.2724$$

$$\log x = 1.6832$$

$$x = \text{Antilog } 1.6832$$

$$x = 48.21$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : 1

Find the values of the following by using logarithms :

(iv) $\frac{790.6 \times 30.32}{25.753}$

Solution :

Let $x = \frac{790.6 \times 30.32}{25.753}$

Taking log on both sides :

$\log x = \log \frac{790.6 \times 30.32}{25.753}$

$\therefore \log mn = \log m + \log n$

$\therefore \log \frac{m}{n} = \log m - \log n$

$\log x = \log 790.6 + \log 30.32 - \log 25.753$

$\log x = 2.8979 + 1.4814 - 1.4108$

$\log x = 4.3793 - 1.4108$

$\log x = 2.9685$

$x = \text{Antilog } 2.9685$

$x = 930.1$

$\boxed{x = 930.1} \text{ Ans}$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : 1

Find the values of the following by using logarithms :

(v) $\frac{2391 \times 30.72}{23.34}$

Solution :

Let $x = \frac{2391 \times 30.72}{23.34}$

Taking log on both Sides :

$$\log x = \log \frac{2391 \times 30.72}{23.34}$$

$$\therefore \log mn = \log m + \log n$$

$$\therefore \log \frac{m}{n} = \log m - \log n$$

$$\log x = \log 2391 + \log 30.72 - \log 23.34$$

$$\log x = 3.3785 + 1.4874 - 1.3681$$

$$\log x = 4.8659 - 1.3681$$

$$\log x = 3.4978$$

$$x = \text{Antilog } 3.4978$$

$$x = 3146.29$$

Ans



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : 1

Find the values of the following by using logarithms :

(vi) $\frac{99.87}{(8.369) \times (0.785)}$

Solution :

Let $x = \frac{99.87}{8.369 \times 0.785}$

Taking log on both Sides :

$$\log x = \log \frac{99.87}{8.369 \times 0.785}$$

$$\therefore \log \frac{m}{n} = \log m - \log n$$

$$\log x = \log 99.87 - \log 8.369 - \log 0.785$$

$$\log x = 1.9994 - 0.9226 - (-0.1051)$$

$$\log x = 1.9994 - 0.9226 + 0.1051$$

$$\log x = 2.1045 - 0.9226$$

$$\log x = 1.1819$$

$$x = \text{Antilog } 1.1819$$

$$x = 15.201$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : 1

Find the values of the following by using logarithms :

(vii) $\sqrt[5]{2.709} \times \sqrt[7]{1.239}$

Solution :

Let $x = (2.709)^{1/5} \times (1.239)^{1/7}$

Taking log on both sides:

$\log x = \log (2.709)^{1/5} \times (1.239)^{1/7}$

$\therefore \log mn = \log m + \log n$

$\log x = \log (2.709)^{1/5} + \log (1.239)^{1/7}$

$\therefore \log m^n = n \log m$

$\log x = \frac{1}{5} \log 2.709 + \frac{1}{7} \log 1.239$

$\log x = \frac{1}{5} (0.4328) + \frac{1}{7} (0.0930)$

$\log x = 0.08656 + 0.01328$

$\log x = 0.09984$

$x = \text{Anti log } 0.09984$

$x = 1.2584$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : 1

(viii) $\frac{(26.62)^{1/2} \times (87.19)^3}{\sqrt{69.53}}$ 5.5194×6628.267
 8.3384

Let $x = \frac{(26.62)^{1/2} \times (87.19)^3}{(69.53)^{1/2}}$

Taking log on both sides:

$\log x = \log \frac{(26.62)^{1/2} \times (87.19)^3}{(69.53)^{1/2}}$

$\therefore \log mn = \log m + \log n$

$\therefore \log \frac{m}{n} = \log m - \log n$

$\log x = \log(26.62)^{1/2} + \log(87.19)^3 - \log(69.53)^{1/2}$

$\therefore \log m^n = n \log m$

$\log x = \frac{1}{2} \log 26.62 + 3 \log 87.19 - \frac{1}{2} \log 69.53$

$\log x = \frac{1}{2} \times 1.4252 + 3 \times 1.940 - \frac{1}{2} \times 1.8421$

$\log x = 0.7126 + 5.82 - 0.92105$

$\log x = 6.5326 - 0.92105$

$\log x = 5.61155$

$x = \text{Antilog } 5.61155$

$x = 408836$

410126



MATHEMATICS (SINDH BOARD)

410126.0

CLASS

9

CHAPTER

2.6

EXERCISE

2.6

Q.1 Find the values of the following by using logarithms

viii- $(26.62)^{1/2} \times (87.19)^3$

$\sqrt{69.53}$

Solution:

let $x = \frac{(26.62)^{1/2} \times (87.19)^3}{\sqrt{69.53}}$

Taking logarithm on both sides:

$\log x = \log \frac{(26.62)^{1/2} \times (87.19)^3}{(69.53)^{1/2}}$

$\therefore \log mn = \log m + \log n$

$\therefore \log \frac{m}{n} = \log m - \log n$

$\log x = \log (26.62)^{1/2} + \log (87.19)^3 - \log (69.53)^{1/2}$

$\therefore \log m^n = n \log m$

$\log x = \frac{1}{2} \log (26.62) + 3 \log (87.19) - \frac{1}{2} \log (69.53)$

$\log x = \frac{1.4252}{2} + 3(1.9404) - \frac{1}{2}(1.8421)$

$\log x = 0.7126 + 5.8212 - 0.9210$

$\log x = 5.6126$

$x = \text{Antilog } 5.6126$

$x = 409826.465$

410204



MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

2

EXERCISE

2.6

Q1: Find the values of the following by using logarithms:

viii. $\frac{(26.62)^{1/2} \times (87.19)^3}{\sqrt{69.53}}$

Solution:

Let, $x = \frac{(26.62)^{1/2} \times (87.19)^3}{\sqrt{69.53}}$

Taking log on both sides:

$$\log x = \log \frac{(26.62)^{1/2} \times (87.19)^3}{\sqrt{69.53}}$$

$$\therefore \log mn = \log m + \log n \quad \therefore \log \frac{m}{n} = \log m - \log n$$

$$\log x = \log (26.62)^{1/2} + \log (87.19)^3 - \log (69.53)^{1/2}$$

$$\therefore \log m^n = n \log m$$

$$\log x = \frac{1}{2} \log (26.62) + 3 \log (87.19) - \frac{1}{2} \log (69.53)$$

$$\log x = \frac{1}{2} (1.4252) + 3 (1.9405) - \frac{1}{2} (1.8421)$$

$$\log x = 0.7126 + 5.8215 - 0.9210$$

$$\log x = 6.5341 - 0.9210$$

$$\log x = 5.6130$$

$$x = \text{Antilog } 5.6130$$

$$x = 410204.103 \quad \text{Ans}$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : 1

(ix) $\frac{(4308)^3 \times \sqrt{80.06}}{(0.3387)^3}$

Solution:

Let $x = \frac{(4308)^3 \times \sqrt{80.06}}{(0.3387)^3}$

Taking log on both sides:

$\log x = \log \frac{(4308)^3 \times \sqrt{80.06}}{(0.3387)^3}$

$\therefore \log mn = \log m + \log n \quad \therefore \log \frac{m}{n} = \log m - \log n$

$\log x = \log (4308)^3 + \log (80.06)^{\frac{1}{2}} - \log (0.3387)^3$

$\therefore \log m^n = n \log m$

$\log x = 3 \log 4308 + \frac{1}{2} \log 80.06 - 3 \log (0.3387)$

$\log x = 3(3.6342) + \frac{1}{2}(1.9034) - 3(-0.4701)$

$\log x = 10.9026 + 0.9517 + 1.4103$

$\log x = 13.2646$

$x = \text{antilog } 13.2646$

$x = 1.839077 \times 10^{13}$ Ans

$(-1 + 0.5298)$
 (-1.5298)

$0.3387 \cdot 3.387 = 1.147$

Ch = -1
Mantissa = 0.5298



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : 1

Find the values of the following by using logarithms :

$$(x) \frac{(43.68)^5 \times \sqrt{(0.057)^3}}{(3.048)^4}$$

Solution:

$$\text{Let } x = \frac{(43.68)^5 \times \sqrt{(0.057)^3}}{(3.048)^4}$$

Taking log on both sides:

$$\log x = \log \frac{(43.68)^5 \times (0.057)^{3 \times \frac{1}{2}}}{(3.048)^4}$$

$$\therefore \log mn = \log m + \log n$$

$$\therefore \log \frac{m}{n} = \log m - \log n$$

$$\log x = \log (43.68)^5 + \log (0.057)^{3/2} - \log (3.048)^4$$

$$\log m^n = n \log m$$

$$\log x = 5 \log (43.68) + \frac{3}{2} \log (0.057) - 4 \log (3.048)$$

$$\log x = 5 (1.640) + \frac{3}{2} (-1.244) - 4 (0.484)$$

$$\log x = 8.2 - 1.866 - 1.936$$

$$\log x = 6.334 - 1.936$$

$$\log x = 4.398$$

$$x = \text{Antilog } 4.398$$

$$x = 25003.45 \quad \text{Ans}$$

$$\begin{aligned} \text{Ch} &= -2 \\ 0.7559 \\ -2.7559 \\ -2 + 0.7559 \end{aligned}$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 2.6

QUES : 2

Find the numbers of digits in the following

i. 4^{12}

Solution:

$$\text{Let } x = 4^{12}$$

$$\log x = \log 4^{12}$$

$$\log x = 12 \log 4$$

$$\log x = 12(0.602)$$

$$\log x = 7.228$$

Now, the number of digits is $7+1=8$
the number of digit in 4^{12} is 8

ii. 7^{25}

Solution:

$$\text{Let } x = 7^{25}$$

$$\log x = \log 7^{25}$$

$$\log x = 25 \log 7$$

$$\log x = 25(0.845)$$

$$\log x = 21.125$$

$$\therefore \log m^n = n \log m$$

$$\log x = 21.12$$

$$\text{Characteristic} = 21+1$$

So, the number of digits in 7^{25} is 22

iii. 3^{30}

Solution:

$$\text{Let } x = 3^{30}$$

$$\log x = \log 3^{30}$$

$$\log x = 30 \log 3$$

$$\log x = 30(0.4771)$$

$$\log x = 14.313$$

$$\text{Characteristic} = 14+1$$

Now, the number of digits in 3^{30} is

15 Ans



MATHEMATICS (SINDH BOARD)

CLASS **9**

CHAPTER **2**

EXERCISE **2.6**

Q.2 Find the number of digits in the following:

i- 4^{12}

Solution:

Let $x = 4^{12}$

$\log x = \log 4^{12}$

$\log x = 12 \log 4$

$\log x = 12 (0.6021)$

$\log x = 7.224$

Characteristic = $7 + 1 = 8$

Now, the number of digits in 4^{12} is 8

$\therefore \log m^n = n \log m$

4×10^0
 0.6021

ii- 7^{25}

Solution:

Let $x = 7^{25}$

$\log x = \log 7^{25}$

$\log x = 25 \log 7$

$\log x = 25 (0.8450)$

$\log x = 21.127$

$\therefore \log m^n = n \log m$

Characteristic = $21 + 1$
 $= 22$

Now, the number of digits in 7^{25} is 22.

iii- 3^{30}

Solution:

Let $x = 3^{30}$

$\log x = \log 3^{30}$

$\log x = 30 \log 3$

$\log x = 30 (0.4771)$

$\log x = 14.31$

Characteristic = $14 + 1 = 15$

$\therefore \log m^n = n \log m$

Now, the number of digits in 3^{30} is

15. Ans



MATHEMATICS (SINDH BOARD)

CLASS

9TH

CHAPTER

1

EXERCISE

26

Q #2 If $z_1 = 2 - 5i$ and $z_2 = 2 + 3i$, verify that :

iv- 3^5

Solution:

Let $x = 3^5$

$$\log x = \log 3^5 = \log m^n = n \log m$$

$$\log x = 5 \log 3$$

$$\log x = 5(0.4771)$$

$$\log x = 2.385$$

$$\text{Characteristic} = 2 + 1 = 3$$

Now, the number of digits in 3^5 is 3.

v- 9^4

Solution:

Let $x = 9^4$

$$\log x = \log 9^4$$

$$\log x = 4 \log 9$$

$$\log x = 4(0.954)$$

$$\log x = 3.81$$

$$\text{Characteristic} = 3 + 1 = 4$$

Now, the number of digits in 9^4 is 4



MATHEMATICS (SINDH BOARD)

CLASS

9TH

CHAPTER

3

EXERCISE

3.1

Polynomials:

An algebraic expression in which the exponent is a positive integer or zero is called polynomial expression or polynomial.

JOIN ~~OR~~

An algebraic expression in which variable having powers only from set of whole numbers is called Polynomials.

$$\frac{5x+1}{x}$$

=

$$x^{\frac{1}{2}} + \frac{1}{x}$$

$x \rightarrow$ Polynomial

non-polynomial.

Irrational.



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : Example : 1

Examine whether the following are the polynomial or not?

i- $2x^2 - \frac{1}{\sqrt{x}}$

Solution:

$= 2x^2 - \frac{1}{x^{1/2}}$

It is not a polynomial because the second term does not have positive integral exponent.

ii- $6x^3 - 4x^2 - 5x$

Solution:

It is a polynomial because each term has positive integral exponent.

Example : 2: Examine whether the following are rational expressions or not?

i- $\frac{x^2 - 2x}{3x^2 + 1x}$

Solution:

It is a Rational expression.

ii- $6x^3 - \frac{1}{\sqrt{x+4}}$

Solution:

It is not a rational expression



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : Example : 1

Reduce the following rational expression to their lowest form:

$$i- \frac{(x^2 - x)(x^2 - 5x + 6)}{2x(x^2 - 3x + 2)}$$

Solution:

$$= \frac{x(x-1)(x^2 - 2x - 3x + 6)}{2x(x^2 - 2x - x + 2)}$$

$$= \frac{x(x-1)[x(x-2) - 3(x-2)]}{2x[x(x-2) - 1(x-2)]}$$

$$= \frac{x(x-1)(x-2)(x-3)}{2x(x-2)(x-1)}$$

$$= \frac{(x-3)}{2} \text{ Ans}$$

$$\begin{array}{r} 6x^2 \\ 3 \overline{) 2x^2 - 3x + 6} \\ \underline{2x^2} \\ -3x + 6 \\ \underline{-3x + 6} \\ 0 \end{array}$$

$x^2 \times 2 = 2x^2$



MATHEMATICS (SINDH BOARD)

CLASS :- 9

EXERCISE : 3.1

QUES : Example : 1

Reduce the following rational expression to their lowest form:

ii. $\frac{5(x^2 - 4)}{(3x + 6)(x - 3)}$

Solution:

$$= \frac{5(x^2 - 2^2)}{3(x + 2)(x - 3)}$$

$$= \frac{5(x + 2)(x - 2)}{3(x + 2)(x - 3)}$$

$$= \frac{5(x - 2)}{3(x - 3)}$$

$$\therefore (a^2 - b^2) = (a + b)(a - b)$$

JOIN FOR MORE!!!



MATHEMATICS (SINDH BOARD)

CLASS : **9**

EXERCISE : **3.1**

QUES : **Example # 1**

Simplify :

$$\frac{3}{x+1} + \frac{4x}{x^2-1}$$

Solution :

$$= \frac{3}{x+1} + \frac{4x}{x^2-1}$$

$$= \frac{3}{x+1} + \frac{4x}{(x+1)(x-1)}$$

$$= \frac{3(x-1) + 4x}{(x+1)(x-1)}$$

$$= \frac{3x-3+4x}{(x+1)(x-1)}$$

$$= \frac{7x-3}{(x+1)(x-1)}$$

$$= \frac{7x-3}{x^2-1}$$

Hence, Simplified in the lowest form =

$$a^2 - b^2 = (a+b)(a-b) \\ \therefore x^2 - 1^2 = (x+1)(x-1)$$



MATHEMATICS (SINDH BOARD)

CLASS : **9**

EXERCISE : **3.1**

QUES : **Example # 2**

Simplify $\frac{1}{x^2-1} - \frac{1}{x^3-1}$

Solution :

$$= \frac{1}{x^2-1} - \frac{1}{x^3-1}$$

$$= \frac{1}{(x+1)(x-1)} - \frac{1}{(x-1)(x^2+x+1)}$$

$$= \frac{(x^2+x+1) - (x+1)}{(x-1)(x+1)(x^2+x+1)}$$

$$= \frac{x^2 + \cancel{x} + \cancel{1} - \cancel{x} - \cancel{1}}{(x-1)(x+1)(x^2+x+1)}$$

$$= \frac{x^2}{(x+1)(x^3-1)}$$

$$\begin{aligned} a^2 - b^2 &= (a+b)(a-b) \\ \therefore x^2 - 1^2 &= (x+1)(x-1) \\ x^3 - 1^3 &= (x-1)(x^2+x+1) \\ a^3 - b^3 &= (a-b)(a^2+ab+b^2) \end{aligned}$$

Hence, Simplified in the lowest form:



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : Example # 3

Simplify : $\frac{x^2}{x^2+x-12} \cdot \frac{x^2-9}{2x^2}$

Solution:

$$= \frac{x^2}{x^2+x-12} \cdot \frac{x^2-9}{2x^2}$$

$$= \frac{x^2}{x^2+4x-3x-12} \cdot \frac{x^2-3^2}{2x^2}$$

$$= \frac{x^2}{x(x+4)-3(x+4)} \cdot \frac{(x+3)(x-3)}{2x^2}$$

$$= \frac{x^2}{(x+4)(x-3)} \cdot \frac{(x+3)(x-3)}{2x^2}$$

$$= \frac{(x+3)}{2(x+4)}$$

$$x^2x-12 = -12x^2$$

$$\begin{array}{r} 4 \overline{) 12} \\ \underline{8} \\ 4 \\ \underline{4} \\ 0 \end{array}$$

$$4x-3x = x$$

$$\therefore a^2-b^2=(a+b)(a-b)$$

Hence, Simplified in the
lowest form:



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : Example # 1

Simplify $\frac{3x-9y}{2x+10y} \div \frac{x^2-3xy}{4x+20y}$

Solution :

$$= \frac{3x-9y}{2x+10y} \div \frac{x^2-3xy}{4x+20y}$$

$$= \frac{3x-9y}{2x+10y} \times \frac{4x+20y}{x^2-3xy}$$

$$= \frac{3(\cancel{x-3y})}{\cancel{2}(x+5y)} \times \frac{\cancel{4}(\cancel{x+5y})}{x(\cancel{x-3y})}$$

$$= \frac{6}{x} \text{ Ans}$$

Hence, Simplified in the lowest form :



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MATHEMATICS (SINDH BOARD)

CLASS : 9 EXERCISE : 3.1 QUES : Example # 1

Find the value of $\frac{x^2 + yz}{x^3 + y^2 - 7yz^4}$ when $x = 3, y = 2$ and $z = -1$

Solution:

$$i - \frac{x^2 + yz}{x^3 + y^2 - 7yz^4}$$

$$= \frac{(3)^2 + (2)(-1)}{(3)^3 + (2)^2 - 7(2)(-1)^4}$$

$$3 \times 3 \times 3 = 27$$

$$(-1)^4 = +1$$

$$= \frac{9 - 2}{27 + 4 - 7(2)(1)}$$

$$= \frac{7}{27 + 4 - 14}$$

$$= \frac{7}{17} \text{ Ans}$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 1

Examine whether the following algebraic expressions are polynomials or not:

i- $2xy^2 - 3x^2 + 5y^2 - 6$

Solution:

Not Polynomial.

v- $\frac{2}{x+2}$

Solution:

Not Polynomial

ii- $3xy^{-2}$

Solution:

Not Polynomial.

iii- $6x^2 - 10x + x - \sqrt{45}$

Solution:

Polynomial

vi- $\frac{2}{x} + x^3 - 2$

Solution:

$2x^{-1} + x^3 - 2$

Not Polynomial

iv- $5\sqrt{x} - x + 5x^2$

Solution

$5x^{1/2} - x + 5x^2$

Not Polynomial



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 2

Examine whether the following expressions are rational or not :

i- $\frac{x^2 + 2x + 3}{x - 4}$

Solution:

Rational Expression:

iv- $\frac{\sqrt{x} - \sqrt{y}}{\sqrt{x} + \sqrt{y}}$

Solution:

Not-Rational.

ii- $\frac{x^2 + 5\sqrt{x} - 2x}{3x^2 + 5x + 4}$

Solution:

Not-Rational.

v- $\frac{7}{x+7}$

Solution

Rational.

iii- $\frac{13x^2 - 9x + 4}{x^2 + 5x + \sqrt{7}}$

Solution:

Rational.

vi- $5\sqrt{x} - x + 5x^2$

Solution:

$5x^{1/2} - x + 5x^2$

Not Rational.



MATHEMATICS (SINDH BOARD)

CLASS **9**

CHAPTER **3**

EXERCISE **3.1**

Q.3 Reduce the following into lowest form:

$$i. \frac{P^2 - 100}{P^2 + 10}$$

Solution:

$$= \frac{P^2 - 100}{P^2 + 10}$$

$$= 1 - \frac{110}{P^2 + 10}$$

Ans

$$\begin{array}{r} 1 \rightarrow Q \\ P^2 + 10 \overline{) P^2 - 100} \\ \underline{+ P^2 + 10} \\ -110 \rightarrow R \end{array}$$

$$1 - \frac{110}{P^2 + 10}$$

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MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 3

Reduce the following into the lowest form:

i. $\frac{p^2 - 100}{p^2 + 10}$
 Solution:
 $= 1 \frac{-110}{p^2 + 10}$

(1) → Quotient

$$\begin{array}{r} p^2 + 10 \overline{) p^2 - 100} \\ \underline{+ p^2 + 10} \\ -110 \end{array}$$

 → Rem

ii. $\frac{3ab - 3a^2}{3a^2 + 6ab + 3ab^2}$
 Solution:
 $= \frac{3a(b - a)}{3a(a + 2b + b^2)}$
 $= \frac{b - a}{a + 2b + b^2}$ Ans



iii. $\frac{(a-b)}{(a+b)} \times \frac{(a^2 + ab)}{2a^2 - 2b^2}$
 Solution:
 $= \frac{(a-b)}{(a+b)} \times \frac{a(a+b)}{2(a^2 - b^2)}$
 $= \frac{(a-b)}{(a+b)} \times \frac{a(a+b)}{2(a+b)(a-b)}$
 $= \frac{a}{2(a+b)}$ Ans



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 3

Reduce the following into their lowest form:

iv. $\frac{(x+y)^2 - z^2}{x+y+z}$

Solution:

$$= \frac{(x+y+z)(x+y-z)}{x+y+z}$$

$= (x+y-z)$ Ans

$$\therefore (a^2 - b^2) = (a+b)(a-b)$$

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v. $\frac{(m^2 - 6m)(3m + 15)}{2m - 12}$

Solution:

$$= \frac{m(m-6) \cdot 3(m+5)}{2(m-6)}$$

$= \frac{3m(m+5)}{2}$ Ans



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 3

Reduce the following into their lowest form:

vi- $\frac{4t^2 - 36t + 80}{(4t - t^2)(5 - t)}$

Solution:

$$= \frac{4(t^2 - 9t + 20)}{t(4 - t^2)(5 - t)}$$

$$= \frac{4(t^2 - 4t - 5t + 20)}{-t(t^2 - 4) \cdot -(t - 5)}$$

$$= \frac{4[t(t - 4) - 5(t - 4)]}{+t(t^2 - 4)(t - 5)}$$

$$= \frac{4(t - 4)(t - 5)}{t(t - 4)(t - 5)}$$

$$t^2 \times 20 = 20t^2$$

$$\begin{array}{r} 20 \\ 2 \overline{) 40} \\ 4 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 20 \\ 5 \overline{) 100} \\ 10 \\ \hline 0 \end{array}$$

$$-4t - 5t$$

vii- $\frac{x^2 - 2x - 3}{x^2 - x - 2}$

Solution:

$$= \frac{x^2 - 3x + x - 3}{x^2 - 2x + x - 2}$$

$$= \frac{x(x - 3) + 1(x - 3)}{x(x - 2) + 1(x - 2)}$$

$$= \frac{(x - 3)(x + 1)}{(x - 2)(x + 1)}$$

$$= \frac{(x - 3)}{(x - 2)} \quad \underline{\underline{\text{Ans}}}$$

$$\frac{4}{t} \quad \underline{\underline{\text{Ans}}}$$

$$x^2x - 3 = -3x^2$$

$$-3x + x$$

$$x^2x - 2 = 2x^2$$

$$-2x + x$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 3

Reduce the following into their lowest form:

viii- $\frac{4x^2 + 24x + 36}{3x^2 - 27}$

$3x^2 - 27$

Solution:

$$= \frac{4(x^2 + 6x + 9)}{3(x^2 - 9)}$$

$$= \frac{4(x^2 + 3x + 3x + 9)}{3(x^2 - 3^2)}$$

$$= \frac{4}{3} \cdot \frac{x(x+3) + 3(x+3)}{(x+3)(x-3)}$$

$$= \frac{4}{3} \cdot \frac{(x+3)(x+3)}{(x+3)(x-3)}$$

$$= \frac{4(x+3)}{3(x-3)} \text{ Ans}$$

$$x^2x+9 = 9x^2 \frac{3}{3} \frac{9}{3}$$

$$a^2 - b^2 = (a+b)(a-b)$$

ix- $\frac{(y+z)(y^2 - 2yz + z^2)}{y^2 + yz}$

Solution:

$$= \frac{(y+z)(y^2 - yz - yz + z^2)}{y(y+z)}$$

$$= \frac{y(y-z) - z(y-z)}{y}$$

$$= \frac{(y-z)(y-z)}{y} \text{ Ans}$$

$$= \frac{(y-z)^2}{y} \text{ Ans}$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 4

Simplify :

i- $\frac{4x-1}{2x-2} + \frac{4x+1}{2x+2}$

Solution :

$$= \frac{(4x-1)(2x+2) + (4x+1)(2x-2)}{(2x-2)(2x+2)}$$

$$= \frac{8x^2 + 8x - 2x - 2 + 8x^2 - 8x + 2x - 2}{4x^2 + 4x - 4x - 4}$$

$$= \frac{16x^2 - 4}{4x^2 - 4}$$

$$= \frac{4(4x^2 - 1)}{4(x^2 - 1)}$$

$$= \frac{4x^2 - 1}{(x^2 - 1)} \text{ Ans}$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 4

Simplify :

$$\text{ii- } \frac{1}{x+2} + \frac{2}{x+3}$$

Solution :

$$= \frac{(x+3) + 2(x+2)}{(x+2)(x+3)}$$

$$= \frac{x+3+2x+4}{(x+2)(x+3)}$$

$$= \frac{3x+7}{(x+2)(x+3)} \quad \text{Ans}$$

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MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 4

Simplify :

iii- $\frac{y^2 - 25}{y^2 - 5y} + \frac{y}{5y^2 - 5y}$

Solution:

$$= \frac{(y)^2 - (5)^2}{y(y-5)} + \frac{y}{5y(y-1)}$$

$$\because a^2 - b^2 = (a+b)(a-b)$$

$$= \frac{(y+5)(y-5)}{y(y-5)} + \frac{y}{5y(y-1)}$$

$$= \frac{y+5}{y} + \frac{y}{5y(y-1)}$$

$$= \frac{y+5}{y} + \frac{1}{5(y-1)}$$

$$= \frac{(y+5)5(y-1) + y}{5y(y-1)}$$

$$= \frac{(y+5)(5y-5) + y}{5y(y-1)}$$

$$= \frac{5y^2 - 5y + 25y - 25 + y}{5y(y-1)}$$

$$= \frac{5y^2 + 21y - 25}{5y(y-1)} \text{ Ans}$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 4

Simplify:

$$\text{iv. } \frac{xy}{xy+1} + \frac{xy+1}{xy-1}$$

Solution:

$$= \frac{xy(xy-1) + (xy+1)(xy+1)}{(xy+1)(xy-1)}$$

$$= \frac{x^2y^2 - xy + x^2y^2 + xy + xy + 1}{(xy+1)(xy-1)}$$

$$= \frac{2x^2y^2 + xy + 1}{(xy+1)(xy-1)}$$

$$= \frac{2(xy)^2 + xy + 1}{(xy+1)(xy-1)} \text{ Ans}$$

MORE!!!



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 31

QUES : 4

Simplify:

$$v - \frac{4}{z^2 - 4z - 5} + \frac{2}{4z^2 - 4}$$

Solution:

$$= \frac{4}{z^2 - 5z + z - 5} + \frac{2}{2(2z^2 - 1)}$$

$$= \frac{4}{z(z-5)+1(z-5)} + \frac{1}{2(z+1)(z-1)}$$

$$= \frac{4}{(z-5)(z+1)} + \frac{1}{2(z+1)(z-1)}$$

$$= \frac{8(z-1) + (z-5)}{2(z+1)(z-5)(z-1)}$$

$$= \frac{8z - 8 + z - 5}{2(z^2 - 1)(z-5)}$$

$$= \frac{9z - 13}{2(z^2 - 1)(z-5)} \xrightarrow{\text{Ans}}$$

$$z^2x - 5 = -5z^2$$

$$\begin{array}{r} 5 \overline{) 5} \\ 5 \\ \hline 0 \end{array}$$

L.C.M = Product of
common factor
× Product
of Uncom-
factor.

$$L.C.M = P.C.F \times P.U.C.F$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 4

Simplify :

vi- $\frac{1}{a+b} - \frac{1}{a-b} + \frac{2a}{a^2-b^2}$

Solution:

$\therefore a^2 - b^2 = (a+b)(a-b)$

$= \frac{1}{a+b} - \frac{1}{a-b} + \frac{2a}{(a+b)(a-b)}$

$= \frac{(a-b) - (a+b) + 2a}{(a+b)(a-b)}$

$= \frac{a-b-a-b+2a}{(a+b)(a-b)}$

$= \frac{2a-2b}{(a+b)(a-b)}$

$= \frac{2(a-b)}{(a+b)(a-b)}$

$= \frac{2}{a+b}$ **Ans**

L.C.M = Product of common factor
× Product of Uncommon factor.



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 4

Simplify:

$$\text{vii. } \frac{4y}{y^2-1} + \frac{y+1}{y-1} + \frac{y-1}{y+1}$$

Solution:

$$= \frac{4y}{(y)^2 - (1)^2} + \frac{y+1}{y-1} + \frac{y-1}{y+1} \quad \therefore (a^2 - b^2) = (a+b)(a-b)$$

$$= \frac{4y}{(y+1)(y-1)} + \frac{y+1}{y-1} + \frac{y-1}{y+1}$$

$$= \frac{4y + (y+1)(y+1) + (y-1)(y-1)}{(y+1)(y-1)}$$

$$y^2 \times 1 = y^2$$

$$= \frac{4y + y^2 + y + y + 1 + y^2 - y - y + 1}{(y+1)(y-1)}$$

$$= \frac{2y^2 + 4y + 2}{(y+1)(y-1)}$$

$$= \frac{2(y^2 + 2y + 1)}{(y+1)(y-1)}$$

$$= \frac{2(y^2 + y + y + 1)}{(y+1)(y-1)}$$

$$= \frac{2[y(y+1) + 1(y+1)]}{(y+1)(y-1)}$$

$$= \frac{2(y+1)(y+1)}{(y+1)(y-1)}$$

$$= \frac{2(y+1)}{(y-1)} \quad \text{Ans}$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 4

Simplify :

$$\text{viii} - \frac{1}{2x+y} + \frac{1}{2x-y} + \frac{1}{4x^2-y^2}$$

Solution :

$$= \frac{1}{2x+y} + \frac{1}{2x-y} + \frac{1}{(2x)^2 - (y)^2} \quad \because a^2 - b^2 = (a+b)(a-b)$$

$$= \frac{1}{2x+y} + \frac{1}{2x-y} + \frac{1}{(2x+y)(2x-y)}$$

$$= \frac{2x-y + 2x+y + 1}{(2x+y)(2x-y)}$$

$$= \frac{4x+1}{(2x+y)(2x-y)} \quad \underline{\text{Ans}}$$

FOR MORE!!!



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 4

Simplify:

$$\text{ix- } \frac{x-2}{x^2+6x+9} - \frac{x-2}{2x^2-18}$$

Solution:

$$= \frac{x-2}{x^2+3x+3x+9} - \frac{x-2}{2[(x)^2-(3)^2]}$$

$$= \frac{x-2}{x(x+3)+3(x+3)} - \frac{x-2}{2(x+3)(x-3)}$$

$$= \frac{x-2}{(x+3)(x+3)} - \frac{x-2}{2(x+3)(x-3)}$$

$$= \frac{2(x-2)(x-3) - (x-2)(x+3)}{2(x+3)(x+3)(x-3)}$$

$$= \frac{(2x-4)(x-3) - (x^2+3x-2x-6)}{2(x+3)^2(x-3)}$$

$$= \frac{2x^2-6x-4x+12 - (x^2+x-6)}{2(x+3)^2(x-3)}$$

$$= \frac{2x^2-10x+12 - x^2-x+6}{2(x+3)^2(x-3)}$$

$$= \frac{x^2-11x+18}{2(x+3)^2(x-3)} \quad \underline{\underline{\text{Ans}}}$$

$$x^2 \times 9 = 9x^2$$

$$\begin{array}{r} 3 \overline{) 9} \\ 3 \overline{) 3} \\ 1 \end{array}$$

$$\frac{2(x^2-9)}{2[(x)^2-(3)^2]}$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 4

Simplify :

$$x - \frac{1}{a-1} + \frac{1}{a-3} + \frac{1}{a+1} + \frac{1}{a+3}$$

Solution :

$$= \frac{(a-3)(a+1)(a+3) + (a-1)(a+1)(a+3) + (a-1)(a-3)(a+3) + (a-1)(a-3)(a+1)}{(a-1)(a-3)(a+1)(a+3)}$$

$$= \frac{(a^3 - 3a^2 - 3a + 3) + (a^3 - a^2 - 3a + 3) + (a^3 - 3a^2 - a + 3) + (a^3 - 3a^2 - a + 3)}{(a-1)(a-3)(a+1)(a+3)}$$

$$= \frac{(a^3 - 3a^2 - 3a + 3) + (a^3 - a^2 - 3a + 3) + (a^3 - 3a^2 - a + 3) + (a^3 - 3a^2 - a + 3)}{(a-1)(a-3)(a+1)(a+3)}$$

$$= \frac{(a^3 - 3a^2 - 3a + 3) + (a^3 - a^2 - 3a + 3) + (a^3 - 3a^2 - a + 3) + (a^3 - 3a^2 - a + 3)}{(a-1)(a-3)(a+1)(a+3)}$$

$$= \frac{(a^3 + 3a^3 - 2a^2 - 6a - 3a - 9) + (a^3 + 3a^2 - a - 3) + (a^3 + 3a^2 - 4a^2 - 12a + 3a + 9) + (a^3 + a^2 - 4a^2 - 4a + 3a + 3)}{(a-1)(a-3)(a+1)(a+3)}$$

$$= \frac{(a^3 + a^2 - 9a - 9) + (a^3 + 3a^2 - a - 3) + (a^3 - a^2 - 9a + 9) + (a^3 - 3a^2 - a + 3)}{(a-1)(a-3)(a+1)(a+3)}$$

$$= \frac{4a^3 - 20a}{(a-1)(a+1)(a-3)(a+3)}$$

$$= \frac{4a^3 - 20a}{(a^2 - 1)(a^2 - 9)}$$

$$= \frac{4a^3 - 20a}{(a^2 - 1)(a^2 - 9)} \quad \text{Ans}$$



MATHEMATICS (SINDH BOARD)

CLASS : 9

EXERCISE : 3.1

QUES : 5

Perform the indicated operations and simplify:

$$i - \left[\frac{x^2}{4y^2 - x^2} + 1 \right] \div \left[1 - \frac{x}{2y} \right]$$

Solution:

$$= \left(\frac{x^2 + 4y^2 - x^2}{4y^2 - x^2} \right) \div \left(\frac{2y - x}{2y} \right)$$

$$= \left(\frac{4y^2}{4y^2 - x^2} \right) \div \left(\frac{2y - x}{2y} \right)$$

$$= \frac{4y}{4y^2 - x^2} \times \frac{2y}{2y - x}$$

$$= \frac{8y^3}{(4y^2 - x^2)(2y - x)} \quad \underline{\underline{\text{Ans}}}$$



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MATHEMATICS (SINDH BOARD)

CLASS

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CHAPTER

3

EXERCISE

3.1

Q5: Perform the indicated operations and simplify:

ii- $\frac{x+3}{3y-2x} \cdot \frac{4x^2-9y^2}{xy+3y}$

Solution:

$\therefore a^2-b^2=(a+b)(a-b)$

$= \frac{x+3}{3y-2x} \cdot \frac{(2x)^2-(3y)^2}{y(x+3)}$

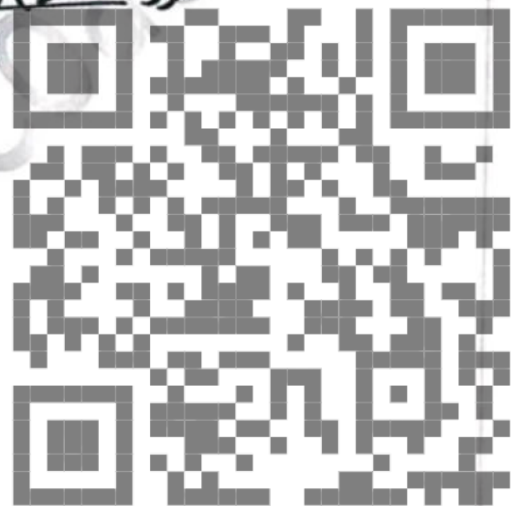
$= \frac{\cancel{x+3}}{3y-2x} \cdot \frac{(2x+3y)(2x-3y)}{y(\cancel{x+3})}$

$= \frac{1}{-(2x-3y)} \cdot \frac{(2x+3y)(2x-3y)}{y}$

$= \frac{2x+3y}{-y}$

Ans

MORE!!!



MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

3

EXERCISE

3.1

Q5 Perform the indicated operations and simplify:

$$\text{iii- } \left[\frac{x^2-1}{x^2+2x+1} \times \frac{x+1}{x-1} \right]$$

$$x^2 \times 1 = 1x^2$$

Solution:

$$= \left(\frac{x^2 - (1)^2}{x^2 + x + x + 1} \right) \times \left(\frac{(x+1)}{(x-1)} \right)$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= \frac{(x+1)(x-1)}{x(x+1) + 1(x+1)} \times \frac{(x+1)}{(x-1)}$$

$$= \frac{(x+1)}{(x+1)(x+1)} \times (x+1)$$

$$= 1 \text{ Ans}$$

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CLASS

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CHAPTER

3

EXERCISE

3.1

Q5 Perform the indicated operations and simplify:

$$\text{iv. } \frac{8(y+3)}{9} \times \frac{12(y+1)}{4(y+3)} \div \frac{8(y+1)}{5}$$

Solution:

$$= \frac{8(y+3)}{9} \times \frac{12(y+1)}{4(y+3)} \times \frac{5}{8(y+1)}$$

$$= \frac{(y+3)}{3} \times \frac{(y+1)}{(y+3)} \times \frac{5}{(y+1)}$$

$$= \frac{5}{3} \text{ Ans}$$

FOR MORE!!!



MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

3

EXERCISE

3.1

Q.5 Perform the indicated operations and simplify:

$$v - \frac{v^2 - 25}{v^2 - 3v} \div \frac{v^2 + 5v}{v^2 - 9}$$

Solution:

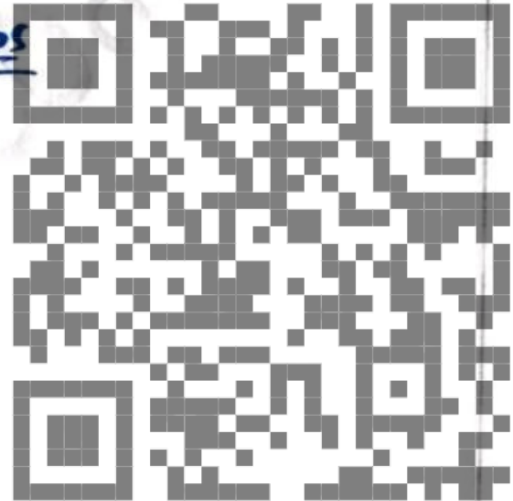
$$= \frac{(v)^2 - (5)^2}{v(v-3)} \div \frac{v(v+5)}{v^2 - (3)^2}$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= \frac{(v+5)(v-5)}{v(v-3)} \times \frac{(v+3)(v-3)}{v(v+5)}$$

$$= \frac{(v-5)(v+3)}{v^2} \quad \text{Ans}$$

MORE!!!



MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

3

EXERCISE

3.1

Q.5 Perform the indicated operation and simplify:

vi. $\frac{4}{z^2 - 4z - 5} \div \frac{2}{4z^2 - 4}$

Solution:

$$= \frac{4}{z^2 - 5z + z - 5} \div \frac{2}{(2z)^2 - (2)^2}$$

$$= \frac{4}{z(z-5)+1(z-5)} \div \frac{2}{(2z+2)(2z-2)}$$

$$= \frac{4}{(z-5)(z+1)} \times \frac{(2z+2)(2z-2)}{2}$$

$$= \frac{4}{(z-5)(z+1)} \times \frac{2(z+1) \cdot 2(z-1)}{2}$$

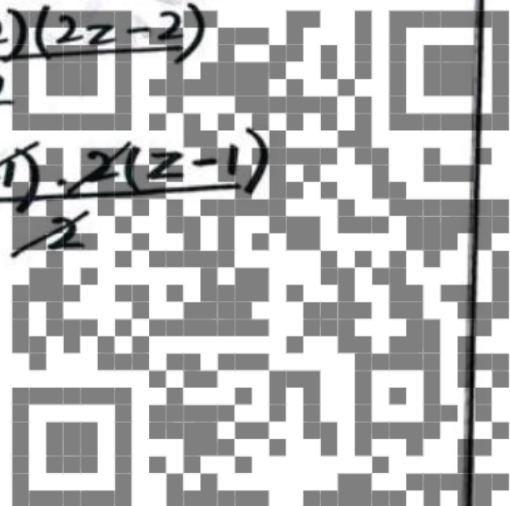
$$= \frac{8(z-1)}{(z-5)} \quad \text{Ans}$$

$$z^2x - 5 = -5z^2$$

$$\begin{array}{r} 5 \overline{) 5} \\ \underline{5} \\ 0 \end{array}$$

$$-5z + 1z$$

$$a^2 - b^2 = (a+b)(a-b)$$



MATHEMATICS (SINDH BOARD)

CLASS

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CHAPTER

3

EXERCISE

3.1

Q.6 Find the value of $t + \frac{1}{t}$, When $t = \frac{x-y}{x+y}$

Solution:

$$t = \frac{x-y}{x+y} \rightarrow (1)$$

$$\frac{1}{t} = \frac{x+y}{x-y} \rightarrow (2)$$

Now, adding equation (1) and (2)

$$t + \frac{1}{t} = \frac{x-y}{x+y} + \frac{x+y}{x-y}$$

$$t + \frac{1}{t} = \frac{(x-y)(x-y) + (x+y)(x+y)}{(x+y)(x-y)}$$

$$t + \frac{1}{t} = \frac{x^2 - xy - xy + y^2 + (x^2 + xy + xy + y^2)}{(x+y)(x-y)}$$

$$t + \frac{1}{t} = \frac{x^2 - xy - xy + y^2 + x^2 + xy + xy + y^2}{(x+y)(x-y)}$$

$$= \frac{2x^2 + 2y^2}{(x+y)(x-y)}$$

$$t + \frac{1}{t} = \frac{2(x^2 + y^2)}{(x+y)(x-y)}$$

Ans



MATHEMATICS (SINDH BOARD)

CLASS

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CHAPTER

3

EXERCISE

3.1

Q.7 Find the values of:

i. $\frac{5(x+4)}{3x^2\sqrt{y}+6}$ if $x = -4$, $y = 9$

Solution:

$$= \frac{5(-4+9)}{3(-4)^2\sqrt{9}+6}$$

$$-4 \times -4 = +16$$

$$\sqrt{9} = \sqrt{3 \times 3} = \sqrt{3^2}$$

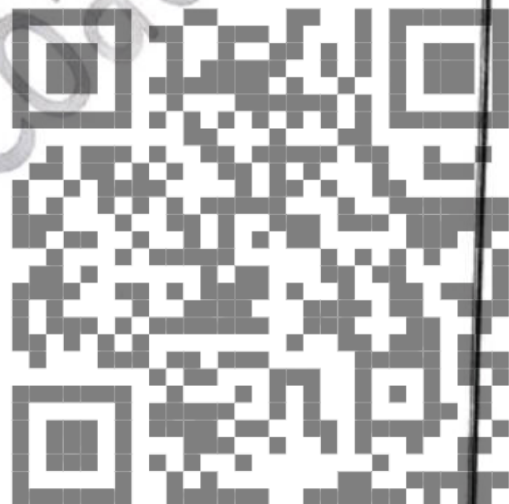
$$= \frac{5(5)}{3(16)\sqrt{3^2}+6}$$

$$= \frac{25}{3(16)(3)+6}$$

$$= \frac{25}{144+6}$$

$$= \frac{25}{150} = \frac{5}{30}$$

$$= \frac{1}{6} \text{ Ans}$$



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CHAPTER

3

EXERCISE

3.1

Q.7 Find the values of :

ii- $\frac{42ab^2c^3}{3a^2b+1}$, if $a=3$, $b=2$ and $c=1$

Solution:

$$= \frac{42(3)(2)^2(1)^3}{3(3)^2(2)+1}$$

$$= \frac{42(3)(4)(1)}{3(9)(2)+1}$$

$$= \frac{504}{54+1}$$

$$= \frac{504}{55} = 9 \frac{9}{55}$$

Ans



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$$\frac{10}{9} \quad \frac{1}{3} \quad 1 \frac{3}{7}$$



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CHAPTER

3

EXERCISE

3.1

Q.7 Find the values of :

iii. $\frac{(x+y)^3 - z^2}{x^2y^2 + z^2}$, if $x=2$, $y=-4$ and $z=3$

Solution

$$\begin{aligned} &= \frac{(2+(-4))^3 - (3)^2}{(2)^2(-4)^2 + (3)^2} \\ &= \frac{(2-4)^3 - 9}{4 \times 16 + 9} \\ &= \frac{(-2)^3 - 9}{64 + 9} \\ &= \frac{-8 - 9}{73} \\ &= \frac{-17}{73} \end{aligned}$$

Ans



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CHAPTER

3

EXERCISE

3.1

Q3 Find the values of:

iv. $\frac{3x^2y}{z} - \frac{bc}{x+1}$, if $x=2, y=-1, z=3, b=4, c=\frac{1}{3}$

Solution:

$$= \frac{3(2)^2(-1)}{(3)} - \frac{(4)(\frac{1}{3})}{2+1}$$

$$= \frac{3(4)(-1)}{3} - \frac{4/3}{3}$$

$$= -\frac{12}{3} - \frac{4}{3} \div 3$$

$$= -\frac{12}{3} - \frac{4}{3} \times \frac{1}{3}$$

$$= -\frac{12}{3} - \frac{4}{9}$$

$$= \frac{3(12) - 4}{9}$$

$$= \frac{-36 - 4}{9}$$

$$= -\frac{40}{9} \quad \underline{\text{Ans}}$$



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CLASS **9**

CHAPTER **3**

EXERCISE **3.1**

Q7 Find the values of :

$$v. \frac{(ab^2 - c)}{(a + cd^2)} \times \frac{(c + d)}{(a^2b - d)}, \text{ if } a=1, b=3, c=-3, d=2$$

Solution:

$$= \frac{(1)(3)^2 - (-3)}{[1 + (-3)(2)^2]} \times \frac{(-3 + 2)}{[(1)^2(3) - 2]}$$

$$= \frac{9 + 3}{1 + (-3)(4)} \times \frac{(-1)}{3 - 2}$$

$$= \frac{12}{1 - 12} \times \frac{-1}{1}$$

$$= \frac{12}{11}$$

$$= \frac{12}{11} \text{ Ans}$$



MATHEMATICS (SINDH BOARD)

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CHAPTER

3

EXERCISE

5

Q.3 : ... following ...

Formulas :

i- $(a+b)^2 + (a-b)^2 = 2(a^2 + b^2)$

ii- $(a+b)^2 - (a-b)^2 = 4ab$

iii- $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

Cubic Formulas :

i- $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$

ii- $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$

iii- $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

iv- $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

$(a+b)(a-b) = a^2 - b^2$



MATHEMATICS (SINDH BOARD)

CLASS

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CHAPTER

3

EXERCISE

3.2 Examples

Algebraic Formulas :

i. $(a+b)^2 + (a-b)^2 = 2(a^2 + b^2)$

Verification:

L.H.S:

$$\begin{aligned} &= (a+b)^2 + (a-b)^2 && \therefore (a+b)^2 = a^2 + 2ab + b^2 \\ &= (a^2 + 2ab + b^2 + a^2 - 2ab + b^2) && (a-b)^2 = a^2 - 2ab + b^2 \\ &= \underline{a^2} + b^2 + \underline{a^2} + b^2 \\ &= 2a^2 + 2b^2 \\ &= 2(a^2 + b^2) \quad \text{R.H.S:} \end{aligned}$$

ii. $(a+b)^2 - (a-b)^2 = 4ab$

Verification:

L.H.S:

$$\begin{aligned} &= (a+b)^2 - (a-b)^2 && \therefore (a+b)^2 = a^2 + 2ab + b^2 \\ &= a^2 + 2ab + b^2 - (a^2 - 2ab + b^2) && (a-b)^2 = a^2 - 2ab + b^2 \\ &= \underline{a^2} + \underline{2ab} + \underline{b^2} - \underline{a^2} + \underline{2ab} - \underline{b^2} \\ &= 4ab \quad \text{R.H.S:} \end{aligned}$$



MATHEMATICS (SINDH BOARD)

CLASS 9

CHAPTER 3

EXERCISE 3.2 Examples

Ex1 Find the values of i. a^2+b^2 and ii. ab ,

When $a+b=6$ and $a-b=4$

Solution:

i. $a^2+b^2 = ?$

$a+b = 6$

$a-b = 4$

Now, We know that:

$$(a+b)^2 + (a-b)^2 = 2(a^2+b^2)$$

$$\Rightarrow (6)^2 + (4)^2 = 2(a^2+b^2)$$

$$\Rightarrow 36 + 16 = 2(a^2+b^2)$$

$$\Rightarrow \frac{52}{2} = a^2+b^2$$

$$\Rightarrow \boxed{a^2+b^2 = 26}$$

ii. $ab = ?$

$a+b = 6$

$a-b = 4$

Now, we know that:

$$(a+b)^2 - (a-b)^2 = 4ab$$

$$\Rightarrow (6)^2 - (4)^2 = 4ab$$

$$\Rightarrow 36 - 16 = 4ab$$

$$\Rightarrow \frac{20}{4} = ab$$

$$\Rightarrow \boxed{ab = 5}$$

Thus, $a^2+b^2 = 26$
and $ab = 5$

Ans

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MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

3

EXERCISE

3.2 Formulae:

Algebraic Formula :

$$(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$$

Verification:

Taking L.H.S :

$$= (a+b+c)^2$$

$$= (a+b+c)(a+b+c)$$

$$= a(a+b+c) + b(a+b+c) + c(a+b+c)$$

$$= \underline{a^2} + \underline{ab} + \underline{ac} + \underline{ab} + \underline{b^2} + \underline{bc} + \underline{ac} + \underline{bc} + \underline{c^2}$$

$$= a^2 + b^2 + c^2 + 2ab + 2bc + 2ac \quad \text{Ans}$$

Example # 1: Find the value of $a^2 + b^2 + c^2$, when $a+b+c=7$ and $ab+bc+ca=15$:

Solution:

$$a^2 + b^2 + c^2 = ? , a+b+c=7 , ab+bc+ca=15$$

Now, we know that :-

$$(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca \rightarrow (1)$$

Now, substitute the values in eqn (1)

$$(7)^2 = a^2 + b^2 + c^2 + 2(ab+bc+ca)$$

$$\Rightarrow (7)^2 = a^2 + b^2 + c^2 + 2(15)$$

$$\Rightarrow 49 = a^2 + b^2 + c^2 + 30$$

$$\Rightarrow 49 - 30 = a^2 + b^2 + c^2$$

$$\Rightarrow \boxed{a^2 + b^2 + c^2 = 19} \quad \text{Ans}$$



MATHEMATICS (SINDH BOARD)

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CHAPTER

3

EXERCISE

3.2 Examples

Ex:2 Find the value of $(a+b+c)$, when $a^2+b^2+c^2=38$ and $ab+bc+ac=31$:

Solution:

$$a+b+c = ? , a^2+b^2+c^2=38 \text{ and } ab+bc+ac=31$$

Now, we know that:

$$\therefore (a+b+c)^2 = (a^2+b^2+c^2 + 2ab+2bc+2ca)$$

$$(a+b+c)^2 = (38) + 2(ab+bc+ca)$$

$$(a+b+c)^2 = 38 + 2(31)$$

$$(a+b+c)^2 = 38 + 62$$

$$(a+b+c)^2 = 100$$

$$\sqrt{(a+b+c)^2} = \sqrt{100}$$

$$a+b+c = \pm 10$$

Ans

Example #3: Find the value of $(ab+bc+ca)$, when $a+b+c=8$ and $a^2+b^2+c^2=20$

Solution:

$$ab+bc+ca = ? , a+b+c=8 \text{ and } a^2+b^2+c^2=20$$

Now, We know that:

$$(a+b+c)^2 = a^2+b^2+c^2 + 2ab+2bc+2ca \rightarrow (1)$$

Now, Substitute all the values in eqn (1)

$$\Rightarrow (8)^2 = (20) + 2(ab+bc+ca)$$

$$\Rightarrow 64 - 20 = 2(ab+bc+ca)$$

$$\Rightarrow \frac{44}{2} = ab+bc+ca$$

$$\Rightarrow ab+bc+ca = 22$$

Ans



MATHEMATICS (SINDH BOARD)

CLASS 9

CHAPTER 3

EXERCISE 3.2 Formulae:

Cubic Formulas:

i- $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$

Verification: $a^3 + b^3 + 3a^2b + 3ab^2$

L.H.S:

$$\begin{aligned} (a+b)^3 &= (a+b)(a+b)^2 & \therefore (a+b)^2 &= a^2 + 2ab + b^2 \\ &= (a+b)(a^2 + 2ab + b^2) \\ &= a^3 + 2a^2b + ab^2 + a^2b + 2ab^2 + b^3 \\ &= a^3 + b^3 + 3a^2b + 3ab^2 \\ &= a^3 + b^3 + 3ab(a+b) \end{aligned}$$

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ii- $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$

Verification:

L.H.S

$$\begin{aligned} (a-b)^3 &= (a-b)(a-b)^2 & \therefore (a-b)^2 &= a^2 - 2ab + b^2 \\ &= (a-b)(a^2 - 2ab + b^2) \\ &= a^3 - 2a^2b + ab^2 - a^2b + 2ab^2 - b^3 \\ &= a^3 - b^3 - 3a^2b + 3ab^2 \\ &= a^3 - b^3 - 3ab(a-b) \end{aligned}$$



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CHAPTER **3**

EXERCISE **3.2, Examples**

Ex:1 Find the value of $a^3 + b^3$, when $a+b=4$ & $ab=5$:

Solution:

$$a^3 + b^3 = ? , a+b=4 , ab=5$$

Now, we know that:

$$(a+b)^3 = a^3 + b^3 + 3ab(a+b)$$

$$\Rightarrow (4)^3 = a^3 + b^3 + 3(5)(4)$$

$$\Rightarrow 64 = a^3 + b^3 + 60$$

$$\Rightarrow 64 - 60 = a^3 + b^3$$

$$\Rightarrow \boxed{a^3 + b^3 = 4} \text{ Ans}$$

Example # 2: Find the value of ab , when $a^3 - b^3 = 5$ and $a-b=5$

Solution:

$$ab = ? , a^3 - b^3 = 5 , a-b=5$$

Now, we know that:

$$(a-b)^3 = a^3 - b^3 - 3ab(a-b)$$

Now, substitute the values of $a-b$ and $a^3 - b^3$ in above formula:

$$\Rightarrow (5)^3 = 5 - 3ab(5) \Rightarrow 125 = 5 - 15ab$$

$$\Rightarrow 125 = 5 - 15ab$$

$$\Rightarrow 125 - 5 = -15ab$$

$$\Rightarrow \frac{120}{-15} = ab$$

$$\boxed{ab = -8} \text{ Ans}$$



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EXERCISE

Examples^{1.6}

Example : 3 :

Find the value of $x^3 + \frac{1}{x^3}$, when

$$x + \frac{1}{x} = 3 :$$

Solution :

$$x + \frac{1}{x} = 3$$

Now Cubing on both sides:

$$\left(x + \frac{1}{x}\right)^3 = (3)^3$$

$$\Rightarrow (x)^3 + \left(\frac{1}{x}\right)^3 + 3\left(x\right)\left(\frac{1}{x}\right)\left(x + \frac{1}{x}\right) = 27$$

$$\Rightarrow x^3 + \frac{1}{x^3} + 3(3) = 27$$

$$\Rightarrow x^3 + \frac{1}{x^3} + 9 = 27$$

$$\Rightarrow x^3 + \frac{1}{x^3} = 27 - 9$$

$$\Rightarrow \boxed{x^3 + \frac{1}{x^3} = 18}$$



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CHAPTER 3

EXERCISE 3.2 Examples:

Ex3 Find the values of $x^3 + \frac{1}{x^3}$ when $x + \frac{1}{x} = 3$

Solution:

$$x^3 + \frac{1}{x^3} = ? \quad , \quad x + \frac{1}{x} = 3$$

$$a = x \\ b = \frac{1}{x}$$

we know that:-

$$(a+b)^3 = a^3 + b^3 + 3ab(a+b)$$

$$\Rightarrow \left(x + \frac{1}{x}\right)^3 = x^3 + \frac{1}{x^3} + 3x \cdot \frac{1}{x} \left(x + \frac{1}{x}\right)$$

$$\Rightarrow (3)^3 = x^3 + \frac{1}{x^3} + 3(3)$$

$$\Rightarrow 27 = x^3 + \frac{1}{x^3} + 9$$

$$\Rightarrow 27 - 9 = x^3 + \frac{1}{x^3}$$

$$x^3 + \frac{1}{x^3} = 18$$

Ans

Example #4: Find $8x^3 - \frac{1}{x^3}$ when $2x - \frac{1}{x} = 4$

Solution:

$$8x^3 - \frac{1}{x^3} = ? \quad 2x - \frac{1}{x} = 4$$

$$\therefore (a-b)^3 = a^3 - b^3 - 3ab(a-b)$$

$$2x - \frac{1}{x} = 4$$

Taking cube on both sides:

$$\left(2x - \frac{1}{x}\right)^3 = (4)^3$$

$$\Rightarrow (2x)^3 - \left(\frac{1}{x}\right)^3 - 3(2x)\left(\frac{1}{x}\right)\left(2x - \frac{1}{x}\right) = 64$$

$$\Rightarrow 8x^3 - \frac{1}{x^3} - 6(4) = 64$$

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EXERCISE

Example

$$\Rightarrow 8x^3 - \frac{1}{x^3} = 24 = 64$$

$$\Rightarrow 8x^3 - \frac{1}{x^3} = 64 + 24$$

$$\Rightarrow \boxed{8x^3 - \frac{1}{x^3} = 88} \text{ Ans}$$

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CHAPTER

3

EXERCISE

3.2 Formulas

Cubic Formulas:

i- $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

Verification:

$$\begin{aligned} \text{RHS} &:= (a+b)(a^2 - ab + b^2) \\ &= a^3 - \cancel{a^2b} + \cancel{ab^2} + a^2b - \cancel{ab^2} + b^3 \\ &= a^3 + b^3 \end{aligned}$$

ii- $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

Verification:

R.H.S:

$$\begin{aligned} &= (a-b)(a^2 + ab + b^2) \\ &= a^3 + \cancel{a^2b} + \cancel{ab^2} - a^2b - \cancel{ab^2} - b^3 \\ &= a^3 - b^3 \end{aligned}$$



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3.2 Examples:

Ex:1 Find the product of $\left(x + \frac{1}{x}\right)$ and $\left(x^2 + \frac{1}{x^2} - 1\right)$

Solution:

$$\left(x + \frac{1}{x}\right)\left(x^2 + \frac{1}{x^2} - 1\right)$$

$$\therefore (a+b)(a^2-ab+b^2) = a^3+b^3$$

Thus,

$$\left(x + \frac{1}{x}\right)\left(x^2 - 1 + \frac{1}{x^2}\right) = x^3 + \frac{1}{x^3}$$

$$\Rightarrow x^3 - x + \frac{x}{x^2} + \frac{x^2}{x} - \frac{1}{x} + \frac{1}{x^3}$$

$$\Rightarrow x^3 - \cancel{x} + \frac{1}{\cancel{x}} + \cancel{x} - \frac{1}{\cancel{x}} + \frac{1}{x^3}$$

$$\Rightarrow x^3 + \frac{1}{x^3}$$

Example # 2: Find the product of $\left(x - \frac{1}{x}\right)$ and $\left(x^2 + 1 + \frac{1}{x^2}\right)$

Solution:

$$= \left(x - \frac{1}{x}\right)\left(x^2 + 1 + \frac{1}{x^2}\right)$$

$$\therefore (a-b)(a^2+ab+b^2) = a^3-b^3$$

$$= \left(x - \frac{1}{x}\right)\left(x^2 + 1 + \frac{1}{x^2}\right) = x^3 - \frac{1}{x^3}$$



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3.2 Examples:

Ex3 Find the continued product:

i. $(x+y)(x^2-xy+y^2)(x-y)(x^2+xy+y^2)$

Solution:

$$(x+y)(x^2-xy+y^2)(x-y)(x^2+xy+y^2)$$

$$\therefore (a+b)(a^2-ab+b^2) = a^3+b^3$$

$$(a-b)(a^2+ab+b^2) = a^3-b^3$$

$$(x^3+y^3)(x^3-y^3)$$

$$\therefore (a+b)(a-b) = (a^2-b^2)$$

$$= (x^3)^2 - (y^3)^2$$

$$= \boxed{x^6 - y^6}$$

Ans



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CHAPTER 3

EXERCISE 3.2

3.2 Algebraic Formulas:

1. Find the value of $a-b$, when $a+b=9$ and $ab=20$:

Solution:

$a-b=?$, $a+b=9$ and $ab=20$

Now, we know that:-

$$(a+b)^2 + (a-b)^2 = 4ab$$

$$\Rightarrow (9)^2 + (a-b)^2 = 4(20)$$

$$\Rightarrow 81 + (a-b)^2 = 80$$

$$\Rightarrow 81 - 80 = (a-b)^2$$

$$\Rightarrow 1 = (a-b)^2$$

Taking roots on both sides:

$$\Rightarrow \sqrt{1} = \sqrt{(a-b)^2}$$

$$\Rightarrow a-b = \pm 1$$

2. Find the value of $a-b$, when $a+b=5$ and $ab=-6$

Solution:

$a-b=?$, $a+b=5$ and $ab=-6$

Now, we know that:-

$$(a+b)^2 + (a-b)^2 = 4ab$$

$$\Rightarrow (5)^2 + (a-b)^2 = 4(-6)$$

$$\Rightarrow 25 + (a-b)^2 = -24$$

$$\Rightarrow 25 - 24 = (a-b)^2$$

$$\Rightarrow \sqrt{(a-b)^2} = \sqrt{1}$$

$$\Rightarrow \boxed{a-b = 1} \text{ Ans}$$

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CHAPTER 3

EXERCISE 3.2

3. Find the value of a^2+b^2 and ab , when

$$a+b=8 \text{ and } a-b=6$$

Solution:

$$a^2+b^2=? , ab=? , a+b=8 , \text{ and } a-b=6$$

Now, we know that:

$$(a+b)^2 + (a-b)^2 = 2(a^2+b^2)$$

$$\Rightarrow (8)^2 + (6)^2 = 2(a^2+b^2)$$

$$\Rightarrow 64 + 36 = 2(a^2+b^2)$$

$$\Rightarrow \frac{100}{2} = (a^2+b^2)$$

$$\Rightarrow \boxed{a^2+b^2 = 50}$$

Now, we find ab ,

we know that:

$$(a+b)^2 - (a-b)^2 = 4ab$$

$$\Rightarrow (8)^2 - (6)^2 = 4ab$$

$$\Rightarrow 64 - 36 = 4ab$$

$$\Rightarrow \frac{28}{4} = ab$$

$$\Rightarrow \boxed{ab = 7}$$

Thus, $a^2+b^2 = 50$ and $ab = 7$



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4- Find the value of a^2+b^2 and ab , when

$$a+b=5 \text{ and } a-b=3$$

Solution:

$$a^2+b^2 = ? \quad ab = ? \quad , a+b=5 \text{ and } a-b=3$$

Now, we find a^2+b^2 :

we know that:

$$(a+b)^2 + (a-b)^2 = 2(a^2+b^2)$$

$$\Rightarrow (5)^2 + (3)^2 = 2(a^2+b^2)$$

$$\Rightarrow 25 + 9 = 2(a^2+b^2)$$

$$\Rightarrow \frac{34}{2} = a^2+b^2$$

$$\Rightarrow \boxed{a^2+b^2 = 17} \text{ Ans}$$

Now, we find ab :

we know that:

$$(a+b)^2 - (a-b)^2 = 4ab$$

$$\Rightarrow (5)^2 - (3)^2 = 4ab$$

$$\Rightarrow 25 - 9 = 4ab$$

$$\Rightarrow 16 = 4ab$$

$$\Rightarrow 4ab = 16$$

$$\Rightarrow ab = \frac{16}{4}$$

$$\Rightarrow \boxed{ab = 4}$$



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5. Find the value of $a^2+b^2+c^2$, when

$$a+b+c = 9 \text{ and } ab+bc+ac = 13$$

Solution:

$$a^2+b^2+c^2 = ? , a+b+c = 9 , ab+bc+ac = 13$$

Now, we know that:

$$(a+b+c)^2 = a^2+b^2+c^2+2ab+2bc+2ca$$

By substituting the values of $a+b+c = 9$
and $ab+bc+ac = 13$ in above formula:

$$\Rightarrow (9)^2 = a^2+b^2+c^2+2(13)$$

$$\Rightarrow 81 = a^2+b^2+c^2+26$$

$$\Rightarrow 81-26 = a^2+b^2+c^2$$

$$\Rightarrow \underline{a^2+b^2+c^2 = 55}$$

Ans



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3.2

6. Find the value of $a^2+b^2+c^2$, when

$$a+b+c = \frac{1}{3} \text{ and } ab+bc+ac = -\frac{2}{9}$$

Solution:

$$a^2+b^2+c^2 = ? , a+b+c = \frac{1}{3} , ab+bc+ac = -\frac{2}{9}$$

We know that:

$$(a+b+c)^2 = a^2+b^2+c^2 + 2(ab+bc+ac)$$

$$\Rightarrow \left(\frac{1}{3}\right)^2 = a^2+b^2+c^2 + 2\left(-\frac{2}{9}\right)$$

$$\Rightarrow \frac{1}{9} = a^2+b^2+c^2 - \frac{4}{9}$$

$$\Rightarrow a^2+b^2+c^2 = \frac{1}{9} + \frac{4}{9}$$

$$\Rightarrow a^2+b^2+c^2 = \frac{1+4}{9}$$

$$\Rightarrow a^2+b^2+c^2 = \frac{5}{9}$$

Ans



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3.2

7. Find the value of $a+b+c$, when $a^2+b^2+c^2=29$ and $ab+bc+ac=10$:

Solution:

$a+b+c = ?$, $a^2+b^2+c^2=29$ and $ab+bc+ac=10$

Now, we know that:

$$(a+b+c)^2 = a^2+b^2+c^2 + 2(ab+bc+ca)$$

Now, substituting the values in above formula:

$$\Rightarrow (a+b+c)^2 = 29 + 2(10)$$

$$\Rightarrow (a+b+c)^2 = 29 + 20$$

$$\Rightarrow (a+b+c)^2 = 49$$

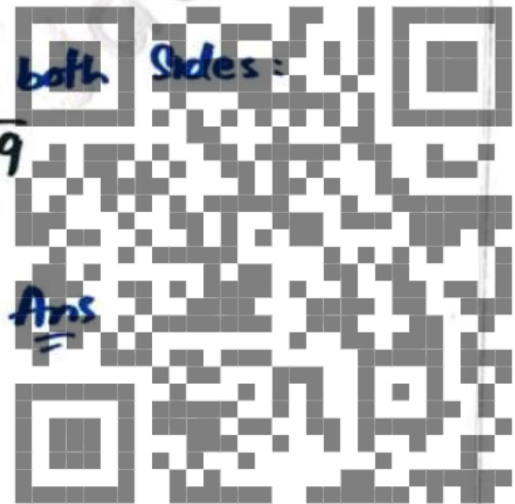
Taking root on both sides:

$$\Rightarrow \sqrt{(a+b+c)^2} = \sqrt{49}$$

$$\Rightarrow a+b+c = \sqrt{7^2}$$

$$\Rightarrow \boxed{a+b+c = 7}$$

Ans



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3.2

8. Find the value of $a+b+c$, when

$$a^2+b^2+c^2 = 0.9 \text{ and } ab+bc+ac = 0.8$$

Solution:

$$a+b+c = ? \quad a^2+b^2+c^2 = 0.9 \text{ and } ab+bc+ac = 0.8$$

Now, we know that:

$$(a+b+c)^2 = a^2+b^2+c^2 + 2(ab+bc+ca)$$

Now, substituting the values in above formula:

$$\Rightarrow (a+b+c)^2 = 0.9 + 2(0.8)$$

$$\Rightarrow (a+b+c)^2 = 0.9 + 1.6$$

$$\Rightarrow (a+b+c)^2 = 2.5$$

Taking square on

$$\Rightarrow \sqrt{(a+b+c)^2} = \sqrt{2.5}$$

$$\Rightarrow \boxed{a+b+c = \sqrt{2.5}}$$

both Sides:

Ans



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EXERCISE

3.2

9- Find the value of $ab+bc+ac$, when

$$a+b+c=10 \text{ and } a^2+b^2+c^2=20$$

Solution:

$$ab+bc+ac = ? \quad a+b+c=10 \text{ and } a^2+b^2+c^2=20$$

Now, we know that:

$$(a+b+c)^2 = a^2+b^2+c^2 + 2(ab+bc+ca)$$

Now, substituting all the values in above formula:

$$\Rightarrow (10)^2 = 20 + 2(ab+bc+ca)$$

$$\Rightarrow 100 = 20 + 2(ab+bc+ca)$$

$$\Rightarrow 100 - 20 = 2(ab+bc+ca)$$

$$\Rightarrow 80 = 2(ab+bc+ca)$$

$$\Rightarrow \frac{80}{2} = ab+bc+ca$$

$$\Rightarrow \boxed{ab+bc+ca = 40} \quad \text{Ans}$$



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EXERCISE

3.2

10. Find the value of $a^3 + b^3$, when $a + b = 4$

and $ab = 3$:

Solution:

$$a^3 + b^3 = ? , a + b = 4 \text{ and } ab = 3$$

Now, we know that:

$$(a + b)^3 = a^3 + b^3 + 3ab(a + b)$$

Now, substitute all the values in above formula:

$$\Rightarrow (4)^3 = a^3 + b^3 + 3(3)(4) \quad 4 \times 4 \times 4$$

$$\Rightarrow 64 = a^3 + b^3 + 36$$

$$\Rightarrow 64 - 36 = a^3 + b^3$$

$$\Rightarrow \boxed{a^3 + b^3 = 28} \quad \text{Ans}$$

FOR MORE!!!



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CHAPTER 3

EXERCISE 3.2

11. Find the value of ab , when $a^3 - b^3 = 5$

and $a - b = 5$

Solution:

$$ab = ? \quad a^3 - b^3 = 5, \quad a - b = 5$$

Now, we know that:

$$(a - b)^3 = a^3 - b^3 - 3ab(a - b)$$

$$\Rightarrow (5)^3 = 5 - 3ab(5)$$

$5 \times 5 \times 5$

$$\Rightarrow 125 = 5 - 15ab$$

$$\Rightarrow 125 - 5 = -15ab$$

$$\Rightarrow 120 = -15ab$$

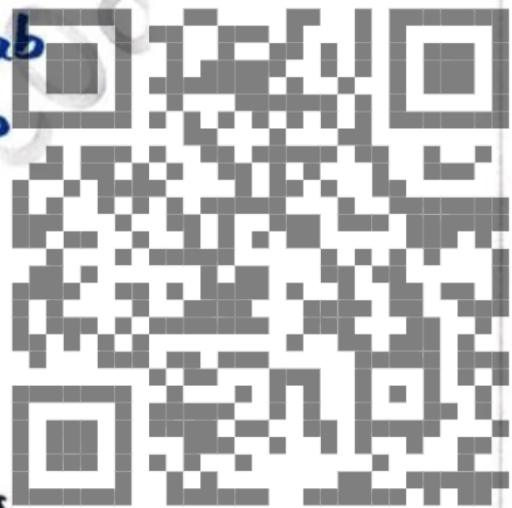
$$\Rightarrow \frac{120}{-15} = -ab$$

$$\Rightarrow -ab = -8$$

$$\Rightarrow -(-ab) = -8$$

$$\Rightarrow \boxed{ab = -8} \quad \text{Ans}$$

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EXERCISE 3.2

12. Find the value of ab , when $a^3 - b^3 = 16$

and $a - b = 4$

Solution:

$ab = ?$, $a^3 - b^3 = 16$ and $a - b = 4$

Now, we know that:

$$(a - b)^3 = a^3 - b^3 - 3ab(a - b)$$

Now, substitute all the values in eqn above formula:

$$\Rightarrow (4)^3 = 16 - 3ab(4)$$

$$\Rightarrow 64 = 16 - 12ab$$

$$\Rightarrow 64 - 16 = -12ab$$

$$\Rightarrow 48 = -12ab$$

$$\Rightarrow -12ab = 48$$

$$\Rightarrow -ab = \frac{48}{12}$$

$$\Rightarrow -(-ab) = -4$$

$$\Rightarrow \boxed{+ab = -4} \text{ Ans}$$



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3.2

13. Find the value of $a^3 - b^3$, when $a - b = 5$ and $ab = 7$

Solution:

$$a^3 - b^3 = ?, \quad a - b = 5 \quad \text{and} \quad ab = 7$$

Now, we know that:

$$(a - b)^3 = a^3 - b^3 - 3ab(a - b)$$

Now, substituting the value of $a - b = 5$ and $ab = 7$ in above formula:

$$\Rightarrow (5)^3 = a^3 - b^3 - 3(7)(5)$$

$$\Rightarrow 125 = a^3 - b^3 - 105$$

$$\Rightarrow 125 + 105 = a^3 - b^3$$

$$\Rightarrow \boxed{a^3 - b^3 = 230} \quad \text{Ans}$$



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3.2

Q14: Find the value of $125x^3 + y^3$ when $5x + y = 13$ and

$$xy = 10$$

Solution:

$$125x^3 + y^3 = ? , 5x + y = 13 , \text{ and } xy = 10$$

$$\Rightarrow 5x + y = 13$$

Taking cube on both sides:

$$\Rightarrow (5x + y)^3 = (13)^3$$

$$= (a + b)^3 = a^3 + b^3 + 3ab(a + b)$$

$$\Rightarrow (5x)^3 + (y)^3 + 3(5x)(y)(5x + y) = 2197$$

$$\Rightarrow 125x^3 + y^3 + 15xy(5x + y) = 2197$$

$$\Rightarrow 125x^3 + y^3 + 15(10)(13) = 2197$$

$$\Rightarrow 125x^3 + y^3 + 1950 = 2197$$

$$\Rightarrow 125x^3 + y^3 = 2197 - 1950$$

$$\Rightarrow \boxed{125x^3 + y^3 = 247} \text{ Ans}$$



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Q15: Find the value of $216a^3 - 343b^3$, when

$$6a - 7b = 11 \text{ and } ab = 8$$

Solution:

$$216a^3 - 343b^3 = ? , 6a - 7b = 11 , ab = 8$$

$$\Rightarrow 6a - 7b = 11$$

Taking cube on both sides:

$$\Rightarrow (6a - 7b)^3 = (11)^3$$

$$\Rightarrow (6a)^3 - (7b)^3 - 3(6a)(7b)(6a - 7b) = 1331$$

$$\Rightarrow 216a^3 - 343b^3 - 126ab(6a - 7b) = 1331$$

$$\Rightarrow 216a^3 - 343b^3 - 126(8)(11) = 1331$$

$$\Rightarrow 216a^3 - 343b^3 - 11088 = 1331$$

$$\Rightarrow 216a^3 - 343b^3 = 1331 + 11088$$

$$\Rightarrow 216a^3 - 343b^3 = 12419 \quad \text{Ans}$$



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EXERCISE

3.2

Q16 Find the value of $x^3 + \frac{1}{x^3}$, when $x + \frac{1}{x} = 7$

Solution:

$$x^3 + \frac{1}{x^3} = ? , \quad x + \frac{1}{x} = 7$$

$$x + \frac{1}{x} = 7$$

Taking cube on both sides:

$$\left(x + \frac{1}{x}\right)^3 = (7)^3$$

$$\therefore (a+b)^3 = a^3 + b^3 + 3ab(a+b)$$

$$\Rightarrow \left(x\right)^3 + \left(\frac{1}{x}\right)^3 + 3\left(x\right)\left(\frac{1}{x}\right)\left(x + \frac{1}{x}\right) = 343$$

$$\Rightarrow x^3 + \frac{1}{x^3} + 3\left(x + \frac{1}{x}\right) = 343$$

$$\Rightarrow x^3 + \frac{1}{x^3} + 3(7) = 343$$

$$\Rightarrow x^3 + \frac{1}{x^3} + 21 = 343$$

$$\Rightarrow x^3 + \frac{1}{x^3} = 343 - 21$$

$$\Rightarrow \boxed{x^3 + \frac{1}{x^3} = 322} \quad \underline{\underline{\text{Ans}}}$$



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EXERCISE

3.2

Q17 Find the values of $x^3 - \frac{1}{x^3}$, when $x - \frac{1}{x} = 11$

Solution:

$$x^3 - \frac{1}{x^3} = ? , \quad x - \frac{1}{x} = 11$$

$$x - \frac{1}{x} = 11$$

Taking cube on both sides:

$$\Rightarrow \left(x - \frac{1}{x}\right)^3 = (11)^3$$

$$= (a-b)^3 = a^3 - b^3 - 3ab(a-b)$$

$$\Rightarrow \left(x\right)^3 - \left(\frac{1}{x}\right)^3 - 3\left(x\right)\left(\frac{1}{x}\right)\left(x - \frac{1}{x}\right) = 1331$$

$$\Rightarrow x^3 - \frac{1}{x^3} - 3\left(x - \frac{1}{x}\right) = 1331$$

$$\Rightarrow x^3 - \frac{1}{x^3} - 3(11) = 1331$$

$$\Rightarrow x^3 - \frac{1}{x^3} - 33 = 1331$$

$$\Rightarrow x^3 - \frac{1}{x^3} = 1331 + 33$$

$$\Rightarrow \boxed{x^3 - \frac{1}{x^3} = 1364} \quad \underline{\underline{\text{Ans}}}$$



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CHAPTER

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EXERCISE

3.2

Q18: Find the continued product by using the relevant formulas:

i. $(2x^2 + 3y^2)(4x^4 - 6x^2y^2 + 9y^4)$

Solution:

$$= (2x^2 + 3y^2)[(2x^2)^2 - (2x^2)(3y^2) + (3y^2)^2]$$

$$\therefore (a+b)(a^2 - ab + b^2) = (a^3 + b^3)$$

$$= (2x^2)^3 + (3y^2)^3$$

$$= 8x^6 + 27y^6 \quad \underline{\underline{\text{Ans}}}$$

ii. $(x+y)(x-y)(x^2+y^2)(x^4+y^4)$

Solution:

$$\Rightarrow (x^2 - y^2)(x^2 + y^2)(x^4 + y^4)$$

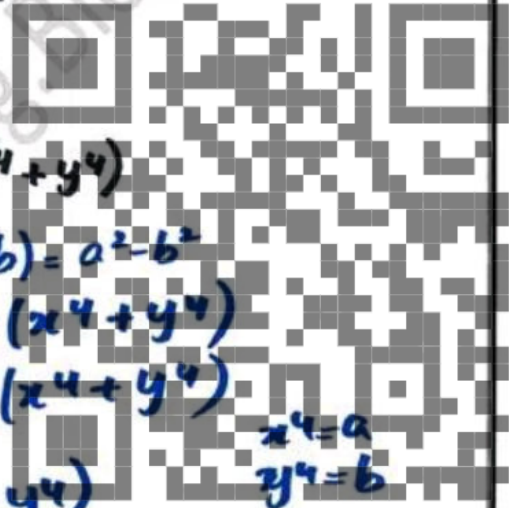
$$\Rightarrow (x^2 - y^2)(x^2 + y^2)(x^4 + y^4)$$

$$\Rightarrow (x^2)^2 - (y^2)^2 (x^4 + y^4)$$

$$\Rightarrow (x^4 - y^4)(x^4 + y^4) \quad \therefore (a+b)(a-b) = a^2 - b^2$$

$$\Rightarrow (x^4)^2 - (y^4)^2 = \boxed{x^8 - y^8} \quad \underline{\underline{\text{Ans}}}$$

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EXERCISE

3.2

Q.18 Find the continued product by using relevant formulas:

$$\text{iii. } (x-y)(x+y)(x^2+y^2)(x^2+xy+y^2)(x^2-xy+y^2)(x^4+x^2y^2+y^4)$$

Solution:

$$\Rightarrow (x-y)(x^2+xy+y^2)(x+y)(x^2-xy+y^2)(x^2+y^2)(x^4+x^2y^2+y^4)$$

$$\therefore (a+b)(a^2-ab+b^2) = (a^3+b^3)$$

$$(a-b)(a^2+ab+b^2) = a^3-b^3$$

$$\Rightarrow (x^3-y^3)(x^3+y^3)(x^2+y^2)[(x^2)^2+(x^2)(y^2)+(y^2)^2]$$

$$\Rightarrow (x^3-y^3)(x^3+y^3)[(x^2)^3+(y^2)^3]$$

$$\Rightarrow (x^3-y^3)(x^3+y^3)(x^6+y^6)$$

$$\Rightarrow [(x^3)^2-(y^3)^2](x^6+y^6)$$

$$\Rightarrow (x^6-y^6)(x^6+y^6)$$

$$\Rightarrow (x^6)^2-(y^6)^2$$

$$\Rightarrow \boxed{x^{12}-y^{12}} \quad \underline{\underline{\text{Ans}}}$$

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3.2

Q18: find the continued product by using relevant formulas

$$\text{iii- } (x-y)(x+y)(x^2+y^2)(x^2+xy+y^2)(x^2-xy+y^2)(x^4+x^2y^2+y^4)$$

Solution:

$$\therefore (a-b)(a+b) = a^2 - b^2$$

$$\Rightarrow (x^2 - y^2)(x^2 + y^2)(x^2 + xy + y^2)(x^2 - xy + y^2)(x^4 + x^2y^2 + y^4)$$

⇒

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$$\text{iv- } (2x+3y)(2x-3y)(4x^2+9y^2)(16x^4+81y^4)$$

Solution:

$$\Rightarrow [(2x)^2 - (3y)^2](4x^2 + 9y^2)(16x^4 + 81y^4)$$

$$= (4x^2 - 9y^2)(4x^2 + 9y^2)(16x^4 + 81y^4)$$

$$= [(4x^2)^2 - (9y^2)^2](16x^4 + 81y^4)$$

$$= (16x^4 - 81y^4)(16x^4 + 81y^4)$$

$$= (16x^4)^2 - (81y^4)^2$$

$$= \boxed{256x^8 - 6561y^8} \quad \text{Ans}$$

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3.2

Q17: Find Product of :

$$i. \left(\frac{3b}{2} + \frac{2}{3b} \right) \left(\frac{9b^2}{4} + \frac{4}{9b^2} - 1 \right)$$

Solution:

$$\Rightarrow \left(\frac{3b}{2} + \frac{2}{3b} \right) \left(\left(\frac{3b}{2} \right)^2 - \left(\frac{2}{3b} \right) \left(\frac{2}{3b} \right) + \left(\frac{2}{3b} \right)^2 \right)$$

$$\Rightarrow \left(\frac{3b}{2} \right)^3 + \left(\frac{2}{3b} \right)^3 \quad \because (a+b)(a^2-ab+b^2) = a^3+b^3$$

$$\Rightarrow \boxed{\frac{27b^3}{8} + \frac{8}{27b^3}} \quad \underline{\text{Ans}}$$

$$ii. \left(\frac{7y^2}{9} + \frac{9}{7y^2} \right) \left(\frac{49y^4}{81} + \frac{81}{49y^4} - 1 \right)$$

Solution:

$$= \left(\frac{7y^2}{9} + \frac{9}{7y^2} \right) \left[\left(\frac{7y^2}{9} \right)^2 - \left(\frac{7y^2}{9} \right) \left(\frac{9}{7y^2} \right) + \left(\frac{9}{7y^2} \right)^2 \right]$$

$$= \left(\frac{7y^2}{9} \right)^3 + \left(\frac{9}{7y^2} \right)^3 \quad \because (a+b)(a^2-ab+b^2) = a^3+b^3$$

$$= \boxed{\frac{343y^6}{729} + \frac{729}{343y^6}} \quad \underline{\text{Ans}}$$

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3.2

Q19: Find the product of:

$$\text{iii- } \left(\frac{x^4}{12} - \frac{12}{x^4} \right) \left(\frac{x^8}{144} + \frac{144}{x^8} + 1 \right)$$

Solution:

$$= \left(\frac{x^4}{12} - \frac{12}{x^4} \right) \left[\left(\frac{x^4}{12} \right)^2 + \left(\frac{x^4}{12} \right) \left(\frac{12}{x^4} \right) + \left(\frac{12}{x^4} \right)^2 \right]$$

$$\therefore (a-b)(a^2+ab+b^2) = a^3 - b^3$$

$$= \left(\frac{x^4}{12} \right)^3 - \left(\frac{12}{x^4} \right)^3$$

$$= \boxed{\frac{x^{12}}{1728} - \frac{1728}{x^{12}}}$$

$$\text{iv- } \left(c^2 - \frac{1}{c^2} \right) \left(c^4 + \frac{1}{c^4} + 1 \right)$$

Solution:

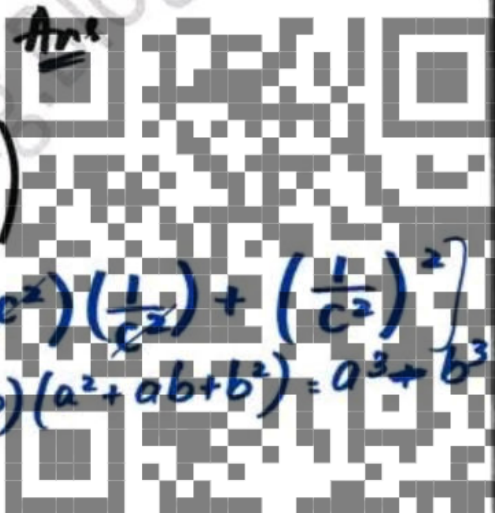
$$= \left(c^2 - \frac{1}{c^2} \right) \left[\left(c^2 \right)^2 + \left(c^2 \right) \left(\frac{1}{c^2} \right) + \left(\frac{1}{c^2} \right)^2 \right]$$

$$\therefore (a-b)(a^2+ab+b^2) = a^3 - b^3$$

$$= \left(c^2 \right)^3 - \left(\frac{1}{c^2} \right)^3$$

$$= \boxed{c^6 - \frac{1}{c^6}} \quad \text{Ans}$$

Ans



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3.3 Examples:

1. Simplify : $\sqrt{343} - 3\sqrt{7} - 2\sqrt{7}$ (Addition & Subtraction of Surds)

Solution:

$$\begin{aligned} &= \sqrt{343} - 3\sqrt{7} - 2\sqrt{7} \\ &= \sqrt{7 \times 7 \times 7} - 3\sqrt{7} - 2\sqrt{7} \\ &= \sqrt{7^2 \times 7} - 3\sqrt{7} - 2\sqrt{7} \\ &= 7\sqrt{7} - 3\sqrt{7} - 2\sqrt{7} \\ &= (7 - 3 - 2)\sqrt{7} \\ &= 2\sqrt{7} \text{ Ans} \end{aligned}$$

$$\begin{array}{r} 7 \overline{) 343} \\ 7 \overline{) 49} \\ 7 \overline{) 7} \\ 1 \end{array}$$

$$\sqrt{7 \times 7 \times 7}$$

$$3\sqrt{7 \times 7 \times 7}$$

$$2\sqrt{7}$$

2. Simplify : $\sqrt{32} + 5\sqrt{2} + \sqrt{128} + 7\sqrt{2}$

Solution:

$$\begin{aligned} &= \sqrt{2 \times 2 \times 2 \times 2 \times 2} + 5\sqrt{2} + \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2} + 7\sqrt{2} \\ &= \sqrt{2^2 \times 2^2 \times 2} + 5\sqrt{2} + \sqrt{2^2 \times 2^2 \times 2^2 \times 2} + 7\sqrt{2} \\ &= 2 \times 2\sqrt{2} + 5\sqrt{2} + 4 \times 2\sqrt{2} + 7\sqrt{2} \\ &= 4\sqrt{2} + 5\sqrt{2} + 8\sqrt{2} + 7\sqrt{2} \\ &= (4 + 5 + 8 + 7)\sqrt{2} \\ &= 24\sqrt{2} \text{ Ans} \end{aligned}$$

$$\begin{array}{r} 2 \overline{) 16} \\ 2 \overline{) 16} \\ 2 \overline{) 16} \\ 2 \overline{) 16} \\ 2 \overline{) 16} \end{array}$$



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33 Examples:

ii- Multiplication & Division of Surds :

Examples : 1: Simplify $\sqrt{125} \times \sqrt{48}$

Solution:

$$= \sqrt{125} \times \sqrt{48}$$

$$= \sqrt{5 \times 5 \times 5} \times \sqrt{2 \times 2 \times 2 \times 2 \times 3}$$

$$= \sqrt{5^2 \times 5} \times \sqrt{2^4 \times 2^2 \times 3}$$

$$= 5\sqrt{5} \times 2 \times 2\sqrt{3}$$

$$= 5\sqrt{5} \times 4\sqrt{3}$$

$$= 5 \times 4 \sqrt{5 \times 3}$$

$$= 20\sqrt{15} \text{ Ans}$$

$$\begin{array}{r} 5 \overline{) 125} \\ 5 \overline{) 25} \\ 5 \overline{) 5} \\ 1 \\ 2 \overline{) 48} \\ 2 \overline{) 24} \\ 2 \overline{) 12} \\ 2 \overline{) 6} \\ 3 \\ 1 \end{array}$$

Examples : 2: Simplify : $\frac{\sqrt{162}}{\sqrt{144}}$

Solution:

$$= \sqrt{2 \times 3 \times 3 \times 3 \times 3}$$

$$= \sqrt{2 \times 2 \times 2 \times 2 \times 3 \times 3}$$

$$= \sqrt{2 \times 3^2 \times 3^2}$$

$$= \sqrt{2^2 \times 2^2 \times 3^2}$$

$$= \frac{3 \times 3 \sqrt{2}}{2 \times 2 \times 3}$$

$$= \frac{3\sqrt{2}}{4} \text{ Ans}$$



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33

Q.1 Simplify:

i. $\sqrt[4]{81x^{-8}z^4}$

Solution:

$$= \sqrt[4]{81x^{-8}z^4}$$

$$= (3 \times 3 \times 3 \times 3 \times x^{-8} \times z^4)^{1/4}$$

$$= (3^4 x^{-8} z^4)^{1/4}$$

$$= (3^4)^{1/4} \cdot (x^{-8})^{1/4} \cdot (z^4)^{1/4}$$

$$= 3x^{-2}z$$

$$= \frac{3z}{x^2} \text{ Ans}$$

ii. $\sqrt[3]{256a^6b^{12}c^9}$

Solution:

$$= \sqrt[3]{256a^6b^{12}c^9}$$

$$= \sqrt[3]{2^3 \times 2^3 \times 2^2 a^6 b^{12} c^9}$$

$$= (2^3 \times 2^3 \times 2^2 a^6 b^{12} c^9)^{1/3}$$

$$= (2^3)^{1/3} \times (2^3)^{1/3} \times (2^2)^{1/3} \times (a^6)^{1/3} (b^{12})^{1/3} (c^9)^{1/3}$$

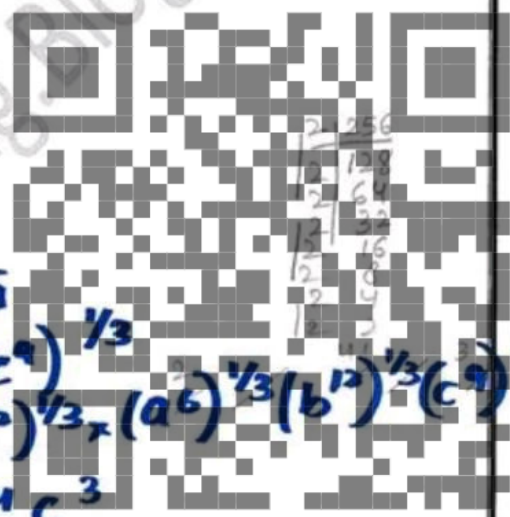
$$= 2 \times 2 \times 2^{2/3} \times a^2 b^4 c^3$$

$$= 4 \sqrt[3]{2^2} a^2 b^4 c^3$$

$$= 4 \sqrt[3]{4} a^2 b^4 c^3 \text{ Ans}$$

$$\begin{array}{r} 3 \overline{) 81} \\ 27 \\ \underline{3} \\ 9 \\ \underline{3} \\ 3 \\ \underline{3} \\ 0 \end{array}$$

$$(3^4)^{1/4} = 3^{4/4} = 3^1 = 3$$



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33

Problems:

Q1: Simplify:

iii. $\sqrt[7]{128}$

Solution:

$$= \sqrt[7]{128}$$

$$= \sqrt[7]{2^7}$$

$$= (2^7)^{1/7}$$

$$= 2 \text{ Ans}$$

$$\begin{array}{r} 2 \overline{) 128} \\ 2 \overline{) 64} \\ 2 \overline{) 32} \\ 2 \overline{) 16} \\ 2 \overline{) 8} \\ 2 \overline{) 4} \\ 2 \overline{) 2} \end{array}$$

iv. $\sqrt{7776}$

$$= \sqrt{7776}$$

$$= \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3}$$

$$= \sqrt{2^4 \times 3^4}$$

$$= 2 \times 2 \times 3 \times 3 \sqrt{6}$$

$$= 36 \sqrt{6} \text{ Ans}$$

vi. $\sqrt{21} \times \sqrt{28}$

$$\sqrt{121}$$

Solution

$$= \sqrt{3 \times 7} \times \sqrt{2 \times 2 \times 7}$$

$$\sqrt{11 \times 11}$$

$$\begin{array}{r} 2 \overline{) 7776} \\ 2 \overline{) 3888} \\ 2 \overline{) 1944} \\ 2 \overline{) 972} \\ 2 \overline{) 486} \\ 2 \overline{) 243} \\ 2 \overline{) 121.5} \\ 2 \overline{) 60.75} \\ 2 \overline{) 30.375} \\ 2 \overline{) 15.1875} \end{array}$$

v. $\sqrt[3]{(125)^2 \times 8}$

Solution:

$$= \sqrt[3]{125^2 \times 2^3}$$

$$2 \times 32$$

$$= \left[(5^2)^3 \right]^{1/3} \times (2^3)^{1/3}$$

$$2 \times 32$$

$$= \frac{5^2 \times 2}{2 \times 32}$$

$$= \frac{25}{32} \text{ Ans}$$

$$\begin{array}{r} 2 \overline{) 8} \\ 2 \overline{) 4} \\ 2 \overline{) 2} \\ 2 \overline{) 1} \end{array}$$

$$= \sqrt{3 \times 7 \times 7 \times 2 \times 2}$$

$$\sqrt{11^2}$$

$$= \sqrt{3 \times 7^2 \times 2^2}$$

$$\sqrt{11^2}$$

$$= 7 \times 2 \sqrt{3}$$

$$= \frac{14 \sqrt{3}}{11} \text{ Ans}$$



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EXERCISE

3.3

Q1: Simplify :

$$\text{vii- } \sqrt{\frac{(216)^{2/3} \times (125)^{1/2}}{(0.04)^{-3/2}}}$$

Solution:

$$= \sqrt{\frac{(216)^{2/3} \times (125)^{1/2}}{(0.04)^{-3/2}}}$$

$$= \left(\frac{(216)^{2/3} \times (125)^{1/2}}{\left(\frac{4}{100} \right)^{-3/2}} \right)^{1/2}$$

$$= \left(\frac{(2 \times 2 \times 2 \times 3 \times 3 \times 3)^{2/3} \times (5 \times 5 \times 5)^{1/2}}{\left(\frac{2 \times 2}{2 \times 2 \times 5 \times 5} \right)^{-3/2}} \right)^{1/2}$$

$$= \left(\frac{(2^3 \times 3^3)^{2/3} \times (5^3)^{1/2}}{\left(\frac{2^2 \times 5^2}{2^2} \right)^{3/2}} \right)^{1/2}$$

$$= \left(\frac{(2^3)^{2/3} \times (3^3)^{2/3} \times 5^{3/2}}{(2^2)^{3/2} \times (5^2)^{3/2}} \right)^{1/2}$$

$$= \frac{2^{2/2} \times 3^{2/2} \times 5^{3/4}}{2^{3/2} \times 5^{3/2}}$$

$$= \frac{2 \times 3 \times 5^{3/4}}{5^{3/2}}$$

$$\frac{0.04}{100} = \frac{4}{100}$$

$$\begin{array}{r} 2 \overline{) 216} \\ 2 \\ \underline{208} \\ 8 \\ 6 \\ \underline{60} \\ 0 \end{array}$$

$$\begin{array}{r} 5 \overline{) 125} \\ 5 \\ \underline{50} \\ 75 \\ \underline{75} \\ 0 \end{array}$$

$$\begin{array}{r} 2 \overline{) 4} \\ 2 \\ \underline{2} \\ 0 \end{array}$$

$$\begin{array}{r} 2 \overline{) 100} \\ 2 \\ \underline{20} \\ 80 \\ \underline{80} \\ 0 \end{array}$$

$$\begin{aligned} &= \frac{6 \times 5^{3/4}}{5^{3/2}} \\ &= 6 \times 5^{\frac{3}{4} - \frac{3}{2}} \\ &= 6 \times 5^{-3/4} \\ &= \frac{6}{5^{3/4}} \end{aligned}$$

$$= \sqrt[4]{5^3} = 1.7944 \text{ Ans}$$



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3.3

Q1: Simplify:

$$\text{viii} - \frac{\sqrt[4]{4} \times \sqrt[3]{27} \times (\sqrt{60})}{\sqrt{180} \times \sqrt[3]{0.25} \times \sqrt[4]{9}}$$

Solution:

$$= \frac{\sqrt[4]{4} \times \sqrt[3]{27} \times \sqrt{60}}{\sqrt{180} \times \sqrt[3]{\frac{1}{4}} \times \sqrt[4]{9}}$$

$$= \frac{(2^2)^{1/4} \times (3^3)^{1/3} \times (2^2 \times 3 \times 5)^{1/2}}{(2^2 \times 3^2 \times 5)^{1/2} \times (\frac{1}{2^2})^{1/3} \times (3^2)^{1/4}}$$

$$= \frac{2^{1/2} \times 3 \times (2^2)^{1/2} \times (3)^{1/2} \times (5)^{1/2}}{(2^2)^{1/2} \times (3^2)^{1/2} \times (5)^{1/2} \times \frac{1}{2^{2/3}} \times 3^{1/2}}$$

$$= \frac{2^{1/2} \times 3 \times 2 \times 3^{1/2} \times 5^{1/2}}{2 \times 3 \times 5^{1/2} \times 2^{-2/3} \times 3^{1/2}}$$

$$= \frac{2^{1/2+1} \times 3^{1+1/2} \times 5^{1/2}}{2^{1-2/3} \times 3^{1+1/2} \times 5^{1/2}}$$

$$= \frac{2^{3/2} \times 3^{3/2}}{2^{1/3} \times 3^{3/2}}$$

$$= 2^{\frac{3}{2}-\frac{1}{3}}$$

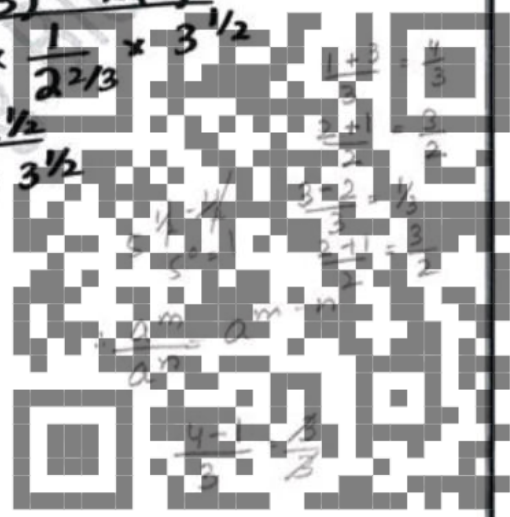
$$= 2^1 \text{ Ans}$$

$$\frac{0.25}{100} = \frac{25}{10000}$$

$$2^2 = 4, 3^3 = 27$$

$$\begin{array}{r} 2 \overline{) 60} \\ 2 \overline{) 30} \\ 3 \overline{) 15} \\ 5 \end{array} \quad \begin{array}{r} 2 \overline{) 180} \\ 2 \overline{) 90} \\ 3 \overline{) 45} \\ 5 \end{array}$$

$$a^m \times a^n = a^{m+n}$$



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EXERCISE

3.3

Q2: Find the conjugate of :

i. $(8 - 4\sqrt{3})$

Solution:

$$= 8 + 4\sqrt{3}$$

iv. $(2 - \sqrt{3})$

Solution:

$$= 2 + \sqrt{3}$$

ii. $(6\sqrt{6} + 2\sqrt{3})$

Solution:

$$= 6\sqrt{6} - 2\sqrt{3}$$

iii. $(8\sqrt{12} + \sqrt{8})$

Solution

$$= 8\sqrt{12} - \sqrt{8}$$



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3.3 Q# 3

Q3: Simplify:

i. $6\sqrt{3} + 4\sqrt{2} + 7\sqrt{128}$

Solution:

$$= 6\sqrt{3} + 4\sqrt{2} + 7\sqrt{2^8 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}$$

$$= 6\sqrt{3} + 4\sqrt{2} + 7\sqrt{2^2 \times 2^2 \times 2^2 \times 2}$$

$$= 6\sqrt{3} + 4\sqrt{2} + 7 \times 2 \times 2 \times 2 \sqrt{2}$$

$$= 6\sqrt{3} + 4\sqrt{2} + 56\sqrt{2}$$

$$= 6\sqrt{3} + (4+56)\sqrt{2}$$

$$= 6\sqrt{3} + 60\sqrt{2}$$

$$\begin{array}{r} 2 \overline{) 128} \\ 2 \overline{) 64} \\ 2 \overline{) 32} \\ 2 \overline{) 16} \\ 2 \overline{) 8} \\ 2 \overline{) 4} \\ 2 \overline{) 2} \\ 2 \overline{) 1} \end{array}$$

ii. $\frac{\sqrt{2}}{10} + \sqrt{8}$

Solution:

$$= \frac{\sqrt{2}}{10} + \sqrt{2 \times 2 \times 2}$$

$$= \frac{\sqrt{2}}{10} + \sqrt{2^2 \times 2}$$

$$= \frac{\sqrt{2}}{10} + 2\sqrt{2} \text{ Ans}$$

$$\begin{array}{r} 2 \overline{) 8} \\ 2 \overline{) 4} \\ 2 \overline{) 2} \end{array}$$

iii. $(13+15\sqrt{3}) + (7-6\sqrt{3})$

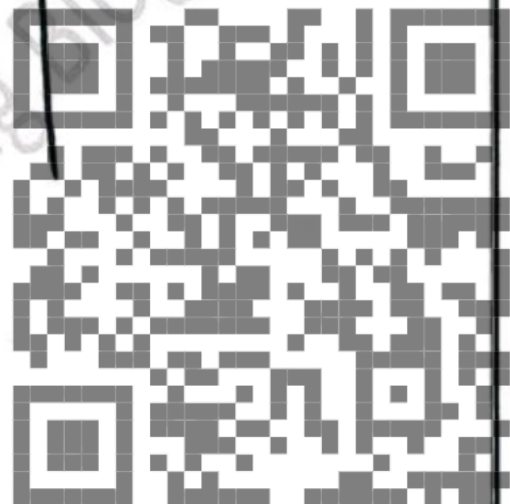
Solution:

$$= 13 + 15\sqrt{3} + 7 - 6\sqrt{3}$$

$$= 13 + 7 + 15\sqrt{3} - 6\sqrt{3}$$

$$= 20 + (15-6)\sqrt{3}$$

$$= 20 + 9\sqrt{3} \text{ Ans}$$



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EXERCISE

3.3 Q#3

Q:3 Simplify:

iv- $\sqrt{250} + \sqrt{490} + 3\sqrt{10}$

Solution:

$$\begin{aligned} &= \sqrt{2 \times 5 \times 5 \times 5} + \sqrt{2 \times 5 \times 7 \times 7} + 3\sqrt{10} \\ &= \sqrt{10 \times 5^2} + \sqrt{10 \times 7^2} + 3\sqrt{10} \\ &= 5\sqrt{10} + 7\sqrt{10} + 3\sqrt{10} \\ &= (5+7+3)\sqrt{10} = 15\sqrt{10} \text{ Ans} \end{aligned}$$

$$\begin{array}{r} 2 \overline{)250} \\ \underline{125} \\ 125 \\ \underline{25} \\ 25 \\ \underline{25} \\ 0 \end{array} \quad \begin{array}{r} 2 \overline{)490} \\ \underline{245} \\ 45 \\ \underline{49} \\ 49 \\ \underline{49} \\ 0 \end{array}$$

v- $\sqrt{245} + \sqrt{625} - \sqrt{45}$

Solution:

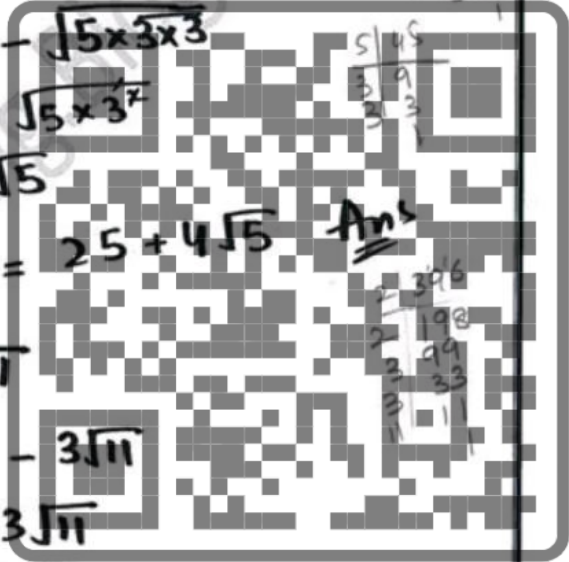
$$\begin{aligned} &= \sqrt{5 \times 7 \times 7} + \sqrt{5 \times 5 \times 5 \times 5} - \sqrt{5 \times 3 \times 3} \\ &= \sqrt{5 \times 7^2} + \sqrt{5^2 \times 5^2} - \sqrt{5 \times 3^2} \\ &= 7\sqrt{5} + (5 \times 5) - 3\sqrt{5} \\ &= 25 + (7-3)\sqrt{5} = 25 + 4\sqrt{5} \text{ Ans} \end{aligned}$$

$$\begin{array}{r} 5 \overline{)245} \\ \underline{7} \\ 7 \\ \underline{7} \\ 0 \end{array} \quad \begin{array}{r} 5 \overline{)625} \\ \underline{5} \\ 125 \\ \underline{125} \\ 0 \end{array}$$

vi- $10\sqrt{11} - \sqrt{396} - 3\sqrt{11}$

Solution:

$$\begin{aligned} &= 10\sqrt{11} - \sqrt{2 \times 2 \times 3 \times 3 \times 11} - 3\sqrt{11} \\ &= 10\sqrt{11} - \sqrt{2^2 \times 3^2 \times 11} - 3\sqrt{11} \\ &= 10\sqrt{11} - 2 \times 3\sqrt{11} - 3\sqrt{11} \\ &= 10\sqrt{11} - 6\sqrt{11} - 3\sqrt{11} \\ &= (10-6-3)\sqrt{11} = \sqrt{11} \text{ Ans} \end{aligned}$$



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EXERCISE 3.3 Q#3

Q3: Simplify:

vii. $\sqrt{17} (10\sqrt{17} - 2\sqrt{17})$

Solution:

$$= \sqrt{17} [10 - 2 (\sqrt{17})]$$

$$= \sqrt{17} (8\sqrt{17})$$

$$= 8(\sqrt{17})^2$$

$$= 136 \text{ Ans}$$

viii. $\frac{3}{2} (\sqrt{18} + \sqrt{32} - \sqrt{50})$

Solution:

$$= \frac{3}{2} (\sqrt{2 \times 3 \times 3} + \sqrt{2 \times 2 \times 2 \times 2 \times 2} - \sqrt{2 \times 5 \times 5})$$

$$= \frac{3}{2} (\sqrt{2 \times 3^2} + \sqrt{2^2 \times 2^2 \times 2} - \sqrt{2 \times 5^2})$$

$$= \frac{3}{2} (3\sqrt{2} + (2 \times 2) \sqrt{2} - 5\sqrt{2})$$

ix. $\left(\frac{\sqrt{2}}{\sqrt{3}} + \frac{1}{\sqrt{3}}\right) \left(\frac{\sqrt{2}}{\sqrt{3}} - \frac{1}{\sqrt{3}}\right)$

Solution:

$$= \left(\frac{\sqrt{2}}{\sqrt{3}}\right)^2 - \left(\frac{1}{\sqrt{3}}\right)^2$$

$$= \frac{2}{3} - \frac{1}{3}$$

$$= \frac{2-1}{3} = \frac{1}{3} \text{ Ans}$$

$$\begin{array}{r} 2 \overline{) 18} \\ 3 \overline{) 9} \\ 3 \overline{) 3} \\ 3 \overline{) 1} \end{array} \quad \begin{array}{r} 2 \overline{) 32} \\ 2 \overline{) 16} \\ 2 \overline{) 8} \\ 2 \overline{) 4} \end{array}$$

$$\begin{array}{r} 2 \overline{) 50} \\ 5 \overline{) 25} \\ 5 \overline{) 5} \end{array}$$

$$= \frac{3}{2} (3\sqrt{2} + 4\sqrt{2} - 5\sqrt{2})$$

$$= \frac{3}{2} [3+4-5 (\sqrt{2})]$$

$$= \frac{3}{2} (2\sqrt{2})$$

$$= 3\sqrt{2} \text{ Ans}$$



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CHAPTER

3

EXERCISE

3.3 Q#3

Q3: Simplify:

x. $(\sqrt{13} + \sqrt{11})(\sqrt{13} - \sqrt{11})$

$$\therefore (a+b)(a-b) = (a^2 - b^2)$$

Solution:

$$(\sqrt{13})^2 - (\sqrt{11})^2$$

$$= 13 - 11$$

$$= 2 \quad \underline{\text{Ans}}$$

xi. $(3\sqrt{6} - 4\sqrt{5})^2$

Solution:

$$= (3\sqrt{6})^2 - 2(3\sqrt{6})(4\sqrt{5}) + (4\sqrt{5})^2$$

$$= (9 \times 6) - 24\sqrt{6 \times 5} + (16 \times 5)$$

$$= 54 - 24\sqrt{30} + 80$$

$$= 134 - 24\sqrt{30} \quad \underline{\text{Ans}}$$

xii. $(2\sqrt{3} + 3\sqrt{2})^2$

Solution:

$$= (2\sqrt{3})^2 + 2(2\sqrt{3})(3\sqrt{2}) + (3\sqrt{2})^2$$

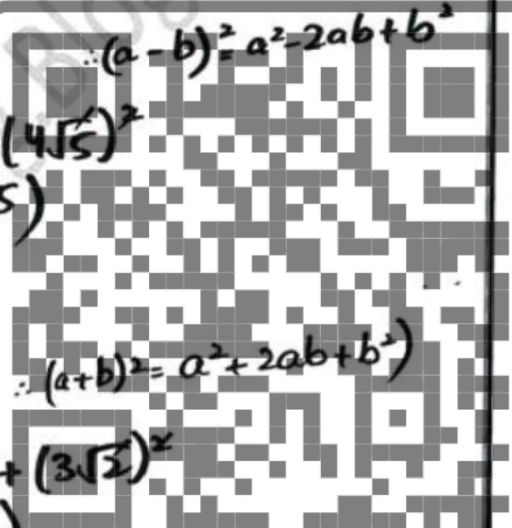
$$= (4 \times 3) + 12\sqrt{3 \times 2} + (9 \times 2)$$

$$= 12 + 12\sqrt{6} + 18$$

$$= 30 + 12\sqrt{6} \quad \underline{\text{Ans}}$$

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3

EXERCISE

3.3 Q#4

Q4: Simplify:

i. $\sqrt{32} - \sqrt{8}$

Solution:

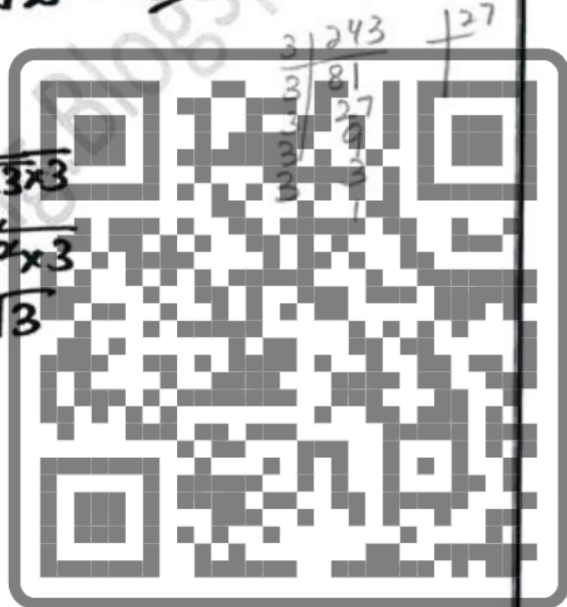
$$\begin{aligned} &= \sqrt{2 \times 2 \times 2 \times 2 \times 2} - \sqrt{2 \times 2 \times 2} \\ &= \sqrt{2^4 \times 2^1} - \sqrt{2^3 \times 2^1} \\ &= 2 \times 2 \sqrt{2} - 2 \sqrt{2} \\ &= 4\sqrt{2} - 2\sqrt{2} \\ &= (4-2)\sqrt{2} = 2\sqrt{2} \text{ Ans} \end{aligned}$$

$$\begin{array}{r} 2 \overline{) 32} \\ 2 \overline{) 16} \\ 2 \overline{) 8} \\ 2 \overline{) 4} \\ 2 \overline{) 2} \\ 2 \overline{) 2} \\ 2 \overline{) 2} \\ 2 \overline{) 2} \end{array} \quad \begin{array}{r} 2 \overline{) 8} \\ 2 \overline{) 4} \\ 2 \overline{) 2} \\ 2 \overline{) 2} \\ 2 \overline{) 2} \\ 2 \overline{) 2} \\ 2 \overline{) 2} \\ 2 \overline{) 2} \end{array}$$

ii. $8\sqrt{243} - 2\sqrt{27}$

Solution:

$$\begin{aligned} &= 8\sqrt{3 \times 3 \times 3 \times 3 \times 3} - 2\sqrt{3 \times 3 \times 3} \\ &= 8\sqrt{3^4 \times 3^1} - 2\sqrt{3^3 \times 3^1} \\ &= 8 \times 3 \times 3 \sqrt{3} - 2 \times 3 \sqrt{3} \\ &= 72\sqrt{3} - 6\sqrt{3} \\ &= (72-6)\sqrt{3} \\ &= 66\sqrt{3} \text{ Ans} \end{aligned}$$



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3

EXERCISE

3.3 Q#4

Q4: Simplify:

$$\text{iii} - \frac{3}{2} \sqrt{18} - \frac{3}{8} \sqrt{32} - \frac{6}{4} \sqrt{50}$$

Solution:

$$= \frac{3}{2} \sqrt{2 \times 3 \times 3} - \frac{3}{8} \sqrt{2 \times 2 \times 2 \times 2 \times 2} - \frac{6}{4} \sqrt{2 \times 5 \times 5}$$

$$= \frac{3}{2} \sqrt{3^2 \times 2} - \frac{3}{8} \sqrt{2^4 \times 2} - \frac{6}{4} \sqrt{5^2 \times 2}$$

$$= \frac{3}{2} \times 3 \sqrt{2} - \frac{3}{8} \times 2 \times 2 \sqrt{2} - \frac{6}{4} \times 5 \sqrt{2}$$

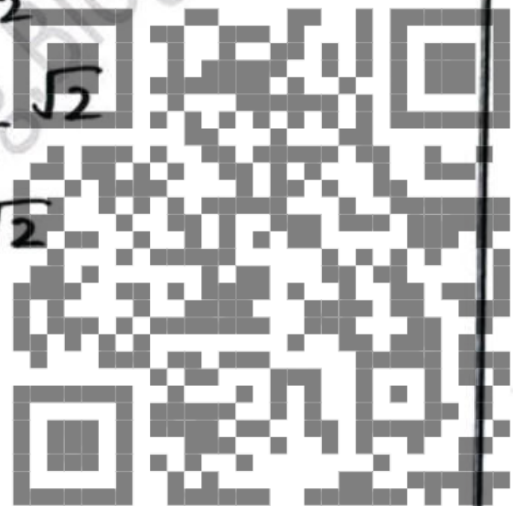
$$= \frac{9}{2} \sqrt{2} - \frac{3}{2} \sqrt{2} - \frac{30}{4} \sqrt{2}$$

$$= \frac{9}{2} \sqrt{2} - \frac{3}{2} \sqrt{2} - \frac{15}{2} \sqrt{2}$$

$$= \left(\frac{9}{2} - \frac{3}{2} - \frac{15}{2} \right) \sqrt{2}$$

$$= \left(\frac{9 - 3 - 15}{2} \right) \sqrt{2}$$

$$= -\frac{9\sqrt{2}}{2} \text{ Ans}$$



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3

EXERCISE

3.3 Q#4

Q4: Simplify :

iv- $10\sqrt{289}$

Solution:

$$\begin{array}{r} 17 \overline{) 289} \\ 17 \overline{) 17} \\ 1 \end{array}$$

$$= 10\sqrt{17 \times 17}$$

$$= 10\sqrt{17^2}$$

$$= 10 \times 17$$

$$= 170 \text{ Ans}$$

v- $3\sqrt{2} + \sqrt{8}$

Solution:

$$= 3\sqrt{2} + \sqrt{2 \times 2 \times 2}$$

$$= 3\sqrt{2} + \sqrt{2^2 \times 2}$$

$$= 3\sqrt{2} + 2\sqrt{2}$$

$$= (3+2)\sqrt{2}$$

$$= 5\sqrt{2} \text{ Ans}$$

vi- $(3\sqrt{27} - 5\sqrt{3}) + (\sqrt{3} + \sqrt{27})$

Solution:

$$= 3\sqrt{27} - 5\sqrt{3} + \sqrt{3} + \sqrt{27}$$

$$= 3\sqrt{3 \times 3 \times 3} - 5\sqrt{3} + \sqrt{3} + \sqrt{3 \times 3 \times 3}$$

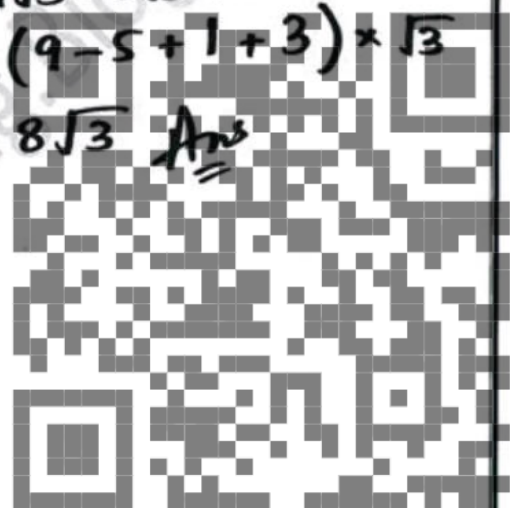
$$= 3\sqrt{3^2 \times 3} - 5\sqrt{3} + \sqrt{3} + \sqrt{3^2 \times 3}$$

$$= 3 \times 3\sqrt{3} - 5\sqrt{3} + \sqrt{3} + 3\sqrt{3}$$

$$= 9\sqrt{3} - 5\sqrt{3} + \sqrt{3} + 3\sqrt{3}$$

$$= (9 - 5 + 1 + 3) \times \sqrt{3}$$

$$= 8\sqrt{3} \text{ Ans}$$



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CHAPTER 3

EXERCISE

Examples 3.4

Example: 01

Rationalize : $\frac{1}{5+2\sqrt{3}}$

Solution :

$$= \frac{1}{5+2\sqrt{3}}$$

Multiplying and dividing by its conjugate:-
 $(5-2\sqrt{3})$

$$= \frac{1}{5+2\sqrt{3}} \times \frac{5-2\sqrt{3}}{5-2\sqrt{3}}$$

$$= \frac{5-2\sqrt{3}}{(5)^2 - (2\sqrt{3})^2}$$

$$= \frac{5-2\sqrt{3}}{25 - 4 \times 3}$$

$$= \frac{5-2\sqrt{3}}{25-12}$$

$$= \frac{5-2\sqrt{3}}{13}$$

$$= \frac{5}{13} - \frac{2\sqrt{3}}{13} \quad \underline{\underline{\text{Ans}}}$$

$$\therefore (a+b)(a-b) = a^2 - b^2$$



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EXERCISE

Examples : 3.4

Example : 2

Rationalize : $\frac{5}{\sqrt{3}+\sqrt{2}}$

Solution :

$$= \frac{5}{\sqrt{3}+\sqrt{2}}$$

Multiplying and dividing by its conjugates:

$$= \frac{5}{\sqrt{3}+\sqrt{2}} \times \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}-\sqrt{2}}$$

$$= \frac{5(\sqrt{3}-\sqrt{2})}{(\sqrt{3})^2 - (\sqrt{2})^2}$$

$$= \frac{5(\sqrt{3}-\sqrt{2})}{3-2}$$

$$= 5(\sqrt{3}-\sqrt{2}) \quad \text{Ans}$$

$$\therefore (a+b)(a-b) = a^2 - b^2$$



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3

EXERCISE

3.4

Q:1 Find the conjugate of the following :

i- $\sqrt{6} - 2$

Solution:

= $\sqrt{6} + 2$

v- $5\sqrt{10} + \sqrt{3}$

Solution:

= $5\sqrt{10} - \sqrt{3}$

ii- $10 + \sqrt{10}$

Solution:

= $10 - \sqrt{10}$

vi- $4\sqrt{5} - \sqrt{11}$

Solution:

= $4\sqrt{5} + \sqrt{11}$

iii- $3 - 2\sqrt{2}$

Solution:

= $3 + 2\sqrt{2}$

vii- $\sqrt{11} + \sqrt{7}$

Solution:

= $\sqrt{11} - \sqrt{7}$

iv- $3\sqrt{2} + 2\sqrt{3}$

Solution:

= $3\sqrt{2} - 2\sqrt{3}$

viii- $9 - 3\sqrt{7}$

Solution:

= $9 + 3\sqrt{7}$

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3

EXERCISE

3.4

Q:2 Rationalize the denominator of the following:

i. $\frac{1}{\sqrt{2}+10}$

Solution:

$$= \frac{1}{\sqrt{2}+10}$$

Multiplying and dividing by its conjugates:

$$= \frac{1}{\sqrt{2}+10} \times \frac{\sqrt{2}-10}{\sqrt{2}-10}$$

$$= \frac{\sqrt{2}-10}{(\sqrt{2})^2 - (10)^2} \quad \because (a+b)(a-b) = a^2 - b^2$$

$$= \frac{\sqrt{2}-10}{2-100}$$

$$= \frac{\sqrt{2}-10}{-98}$$

$$= \frac{-(\sqrt{2}-10)}{98}$$

$$= \frac{10-\sqrt{2}}{98} \quad \text{Ans}$$

ii. $\frac{1}{3+2\sqrt{5}}$

Solution:

$$= \frac{1}{3+2\sqrt{5}}$$

Multiplying & dividing by its conjugates:

$$= \frac{1}{3+2\sqrt{5}} \times \frac{3-2\sqrt{5}}{3-2\sqrt{5}}$$

$$= \frac{3-2\sqrt{5}}{(3)^2 - (2\sqrt{5})^2} \quad \because (a+b)(a-b) = a^2 - b^2$$

$$= \frac{3-2\sqrt{5}}{9-4 \times 5}$$

$$= \frac{3-2\sqrt{5}}{9-20}$$

$$= \frac{3-2\sqrt{5}}{-11}$$

$$= \frac{-(3-2\sqrt{5})}{11}$$

$$= \frac{2\sqrt{5}-3}{11} \quad \text{Ans}$$



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3

EXERCISE

3.4

Q2: Rationalize the denominator of the following:

iii - $\frac{1}{4\sqrt{3}-3\sqrt{6}}$

Solution:

$$= \frac{1}{4\sqrt{3}-3\sqrt{6}}$$

Multiplying and dividing by its conjugates:

$$= \frac{1}{4\sqrt{3}-3\sqrt{6}} \times \frac{4\sqrt{3}+3\sqrt{6}}{4\sqrt{3}+3\sqrt{6}}$$

$$= \frac{4\sqrt{3}+3\sqrt{6}}{(4\sqrt{3})^2 - (3\sqrt{6})^2} \quad \because (a+b)(a-b) = a^2 - b^2$$

$$= \frac{4\sqrt{3}+3\sqrt{6}}{(16 \times 3) - (9 \times 6)}$$

$$= \frac{4\sqrt{3}+3\sqrt{6}}{48-54}$$

$$= \frac{4\sqrt{3}+3\sqrt{6}}{-6}$$

$$= \frac{-4\sqrt{3}-3\sqrt{6}}{6}$$

iv - $\frac{16}{\sqrt{12}+\sqrt{11}}$

Solution:

Multiplying & dividing by its conjugates:

$$= \frac{16}{\sqrt{12}+\sqrt{11}} \times \frac{\sqrt{12}-\sqrt{11}}{\sqrt{12}-\sqrt{11}}$$

$$= \frac{16(\sqrt{12}-\sqrt{11})}{(\sqrt{12})^2 - (\sqrt{11})^2} \quad \because (a+b)(a-b) = a^2 - b^2$$

$$= \frac{16(\sqrt{12}-\sqrt{11})}{12-11}$$

$$= 16(\sqrt{12}-\sqrt{11})$$

$$= 16(\sqrt{2^2 \times 3} - \sqrt{11})$$

$$= 16(2\sqrt{3} - \sqrt{11}) \text{ Ans}$$



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EXERCISE

3.4

Q:2 Rationalize the denominator of the following:

v. $\frac{9 - \sqrt{2}}{9 + \sqrt{2}}$

Solution:

$$= \frac{9 - \sqrt{2}}{9 + \sqrt{2}}$$

Multiplying & dividing by its conjugates:

$$= \frac{9 - \sqrt{2}}{9 + \sqrt{2}} \times \frac{9 - \sqrt{2}}{9 - \sqrt{2}}$$

$$= \frac{(9 - \sqrt{2})^2}{(9)^2 - (\sqrt{2})^2} \quad \because (a+b)(a-b) = a^2 - b^2$$

$$= \frac{(9)^2 - 2(9)(\sqrt{2}) + (\sqrt{2})^2}{81 - 2}$$

$$= \frac{81 - 18\sqrt{2} + 2}{79}$$

$$= \frac{83 - 18\sqrt{2}}{79} \quad \text{Ans}$$

vi. $\frac{\sqrt{13} + 3}{\sqrt{13} - 3}$

Solution:

$$\frac{\sqrt{13} + 3}{\sqrt{13} - 3}$$

Multiplying and dividing by its conjugates:

$$= \frac{\sqrt{13} + 3}{\sqrt{13} - 3} \times \frac{\sqrt{13} + 3}{\sqrt{13} + 3}$$

$$= \frac{(\sqrt{13} + 3)^2}{(\sqrt{13})^2 - (3)^2} \quad \because (a+b)(a-b) = a^2 - b^2$$

$$= \frac{(\sqrt{13})^2 + 2(\sqrt{13})(3) + (3)^2}{13 - 9}$$

$$= \frac{13 + 6\sqrt{13} + 9}{4}$$

$$= \frac{22 + 6\sqrt{13}}{4}$$

$$= \frac{2(11 + 3\sqrt{13})}{4}$$

$$= \frac{11 + 3\sqrt{13}}{2}$$



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EXERCISE

3.4

Q2: Rationalize the denominator of the following :

vii. $\frac{15}{7-2\sqrt{5}}$

Solution:

$$= \frac{15}{7-2\sqrt{5}}$$

Multiplying and dividing by its conjugates:

$$= \frac{15}{7-2\sqrt{5}} \times \frac{7+2\sqrt{5}}{7+2\sqrt{5}}$$

$$= \frac{15(7+2\sqrt{5})}{(7)^2 - (2\sqrt{5})^2} \quad \therefore (a+b)(a-b) = (a^2 - b^2)$$

$$= \frac{15(7+2\sqrt{5})}{49 - 4 \times 5}$$

$$= \frac{15(7+2\sqrt{5})}{49 - 20}$$

$$= \frac{15(7+2\sqrt{5})}{29} \text{ Ans}$$

viii. $\frac{11-\sqrt{2}}{\sqrt{2}+11}$

Solution:

$$= \frac{11-\sqrt{2}}{\sqrt{2}+11}$$

Multiplying and dividing by its conjugates:

$$= \frac{11-\sqrt{2}}{\sqrt{2}+11} \times \frac{\sqrt{2}-11}{\sqrt{2}-11}$$

$$= \frac{(11-\sqrt{2})(\sqrt{2}-11)}{(\sqrt{2})^2 - (11)^2}$$

$$= \frac{11\sqrt{2} - 121 - (\sqrt{2})^2 + 11\sqrt{2}}{2 - 121}$$

$$= \frac{22\sqrt{2} - 121 - 2}{-119}$$

$$= \frac{-(22\sqrt{2} - 123)}{119}$$

$$= \frac{-22\sqrt{2} + 123}{119}$$

$$= \frac{123 - 22\sqrt{2}}{119} \text{ Ans}$$



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EXERCISE

3.4

Q2: Rationalize the denominator of the following :

ix. $\frac{1}{\sqrt{17}+4}$

Solution

$$\frac{1}{\sqrt{17}+4}$$

Multiplying and dividing by its conjugates:

$$= \frac{1}{\sqrt{17}+4} \times \frac{\sqrt{17}-4}{\sqrt{17}-4}$$

$$= \frac{\sqrt{17}-4}{(\sqrt{17})^2 - (4)^2} \quad \because (a+b)(a-b) = a^2 - b^2$$

$$= \frac{\sqrt{17}-4}{17-16}$$

$$= \sqrt{17}-4 \quad \underline{\text{Ans}}$$

x. $\frac{1}{\sqrt{17}-4}$

Solution:

$$= \frac{1}{\sqrt{17}-4}$$

Multiplying and dividing by its conjugates:

$$= \frac{1}{\sqrt{17}-4} \times \frac{\sqrt{17}+4}{\sqrt{17}+4}$$

$$= \frac{\sqrt{17}+4}{(\sqrt{17})^2 - (4)^2}$$

$$= \frac{\sqrt{17}+4}{17-16}$$

$$= \sqrt{17}+4 \quad \underline{\text{Ans}}$$



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CHAPTER

3

EXERCISE

3.4

Q3: i. If $x = 8 - 3\sqrt{7}$, find $\left(x + \frac{1}{x}\right)^2$

Solution:

$$\Rightarrow x = 8 - 3\sqrt{7} \rightarrow \textcircled{1}$$

$$\Rightarrow \frac{1}{x} = \frac{1}{8 - 3\sqrt{7}}$$

Multiplying and dividing by its conjugate:

$$\Rightarrow \frac{1}{x} = \frac{1}{8 - 3\sqrt{7}} \times \frac{8 + 3\sqrt{7}}{8 + 3\sqrt{7}}$$

$$\therefore (a-b)(a+b) = a^2 - b^2$$

$$\Rightarrow \frac{1}{x} = \frac{8 + 3\sqrt{7}}{(8)^2 - (3\sqrt{7})^2}$$

$$\Rightarrow \frac{1}{x} = \frac{8 + 3\sqrt{7}}{64 - 9 \times 7}$$

$$\Rightarrow \frac{1}{x} = \frac{8 + 3\sqrt{7}}{64 - 63}$$

$$\Rightarrow \frac{1}{x} = 8 + 3\sqrt{7} \rightarrow \textcircled{2}$$

Add equation $\textcircled{1}$ and $\textcircled{2}$

$$\Rightarrow x + \frac{1}{x} = 8 - 3\sqrt{7} + 8 + 3\sqrt{7}$$

$$\Rightarrow x + \frac{1}{x} = 16$$

Taking square on both sides:

$$\Rightarrow \left(x + \frac{1}{x}\right)^2 = (16)^2$$

$$\Rightarrow \boxed{\left(x + \frac{1}{x}\right)^2 = 256} \quad \underline{\text{Ans}}$$

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CHAPTER

3

EXERCISE

3.4

Q3: ii- If $\frac{1}{x} = 2\sqrt{28} - 11$, find x :

Solution:

$$\Rightarrow \frac{1}{x} = 2\sqrt{28} - 11$$

$$\Rightarrow x = \frac{1}{2\sqrt{28} - 11}$$

Multiplying and dividing by its conjugates:

$$\Rightarrow x = \frac{1}{2\sqrt{28} - 11} \times \frac{2\sqrt{28} + 11}{2\sqrt{28} + 11}$$

$$\Rightarrow x = \frac{2\sqrt{28} + 11}{(2\sqrt{28})^2 - (11)^2}$$

$$\Rightarrow x = \frac{2\sqrt{28} + 11}{4 \times 28 - 121}$$

$$\Rightarrow x = \frac{2\sqrt{28} + 11}{112 - 121}$$

$$\Rightarrow x = \frac{2\sqrt{28} + 11}{-9}$$

$$\Rightarrow \boxed{x = -\frac{2\sqrt{28} + 11}{9}}$$

Ans



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3

EXERCISE

3.4

Q3: iii- If $x = 3 - 2\sqrt{2}$

find: $x + \frac{1}{x}$, $x - \frac{1}{x}$, $x^2 + \frac{1}{x^2}$, and $x^4 + \frac{1}{x^4}$

Solution:

$$\Rightarrow x = 3 - 2\sqrt{2} \rightarrow \textcircled{1}$$

$$\Rightarrow \frac{1}{x} = \frac{1}{3 - 2\sqrt{2}}$$

Multiplying and dividing by its conjugates:

$$\Rightarrow \frac{1}{x} = \frac{1}{3 - 2\sqrt{2}} \times \frac{3 + 2\sqrt{2}}{3 + 2\sqrt{2}}$$

$$\Rightarrow \frac{1}{x} = \frac{3 + 2\sqrt{2}}{(3)^2 - (2\sqrt{2})^2}$$

$$\Rightarrow \frac{1}{x} = \frac{3 + 2\sqrt{2}}{9 - 4 \times 2}$$

$$\Rightarrow \frac{1}{x} = \frac{3 + 2\sqrt{2}}{9 - 8}$$

$$\Rightarrow \frac{1}{x} = 3 + 2\sqrt{2} \rightarrow \textcircled{2}$$

Add equation $\textcircled{1}$ and $\textcircled{2}$

$$\Rightarrow x + \frac{1}{x} = 3 - 2\sqrt{2} + 3 + 2\sqrt{2}$$

$$\Rightarrow \boxed{x + \frac{1}{x} = 6} \quad \text{Ans} \rightarrow \textcircled{3}$$



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EXERCISE

3.4

Q:3 iii- If $x = 3 - 2\sqrt{2}$

find: $x + \frac{1}{x}$, $x - \frac{1}{x}$, $x^2 + \frac{1}{x^2}$ and $x^4 + \frac{1}{x^4}$

Now, subtraction eqn (1) and (2)

$$\Rightarrow x - \frac{1}{x} = 3 - 2\sqrt{2} - (3 + 2\sqrt{2})$$

$$\Rightarrow x - \frac{1}{x} = \cancel{3} - 2\sqrt{2} - \cancel{3} - 2\sqrt{2}$$

$$\Rightarrow \boxed{x - \frac{1}{x} = -4\sqrt{2}}$$

Now, find $x^2 + \frac{1}{x^2}$

To find $x^2 + \frac{1}{x^2}$, we squaring eqn (3)
on both sides:

$$\Rightarrow \left(x + \frac{1}{x}\right)^2 = (6)^2$$

$$\Rightarrow \left(x\right)^2 + 2\left(x\right)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2 = 36$$

$$\Rightarrow x^2 + 2 + \frac{1}{x^2} = 36$$

$$\Rightarrow x^2 + \frac{1}{x^2} = 36 - 2$$

$$\Rightarrow \boxed{x^2 + \frac{1}{x^2} = 34} \rightarrow (4)$$

$$(a+b)^2 = a^2 + 2ab + b^2$$



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EXERCISE

3.4

Q:3 iii. find, If $x = 3 - 2\sqrt{2}$

find $x + \frac{1}{x}$, $x - \frac{1}{x}$, $x^2 + \frac{1}{x^2}$, $x^4 + \frac{1}{x^4}$

To, find $x^4 + \frac{1}{x^4}$, Squaring eqn (4) on both sides:

$$(4) \Rightarrow \left(x^2 + \frac{1}{x^2}\right)^2 = (34)^2 \quad (a+b)^2 = a^2 + 2ab + b^2$$

$$\Rightarrow (x^2)^2 + 2(x^2)\left(\frac{1}{x^2}\right) + \left(\frac{1}{x^2}\right)^2 = 1156$$

$$\Rightarrow x^4 + 2 + \frac{1}{x^4} = 1156$$

$$\Rightarrow x^4 + \frac{1}{x^4} = 1156 - 2$$

$$\Rightarrow \boxed{x^4 + \frac{1}{x^4} = 1154}$$

Now, find $x^2 - \frac{1}{x^2}$:

$$(a^2 - b^2) = (a+b)(a-b)$$

$$\Rightarrow x^2 - \frac{1}{x^2} = \left(x + \frac{1}{x}\right)\left(x - \frac{1}{x}\right)$$

$$\Rightarrow x^2 - \frac{1}{x^2} = (6)(-4\sqrt{2})$$

$$\Rightarrow \boxed{x^2 - \frac{1}{x^2} = -24\sqrt{2}} \quad \underline{\text{Ans}}$$

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EXERCISE

3.4

Q4: Simplify:

$$i. \frac{\sqrt{x+3} + \sqrt{x-3}}{\sqrt{x+3} - \sqrt{x-3}}$$

Solution:

$$= \frac{\sqrt{x+3} + \sqrt{x-3}}{\sqrt{x+3} - \sqrt{x-3}}$$

Multiplying and dividing by its conjugates:

$$= \frac{\sqrt{x+3} + \sqrt{x-3}}{\sqrt{x+3} - \sqrt{x-3}} \times \frac{\sqrt{x+3} + \sqrt{x-3}}{\sqrt{x+3} + \sqrt{x-3}}$$

$$= \frac{(\sqrt{x+3} + \sqrt{x-3})^2}{(\sqrt{x+3})^2 - (\sqrt{x-3})^2}$$

$$= \frac{(\sqrt{x+3} + \sqrt{x-3})^2}{x+3 - (x-3)}$$

$$= \frac{(\sqrt{x+3} + \sqrt{x-3})^2}{x+3 - x + 3}$$

$$= \frac{(\sqrt{x+3} + \sqrt{x-3})^2}{6}$$



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EXERCISE

3.4

Q4: Simplify :

$$\text{ii. } \frac{\sqrt{y^2+5} - y}{\sqrt{y^2+5} + y}$$

Solution:

$$= \frac{\sqrt{y^2+5} - y}{\sqrt{y^2+5} + y}$$

Multiplying and dividing by its conjugates:

$$= \frac{\sqrt{y^2+5} - y}{\sqrt{y^2+5} + y} \times \frac{\sqrt{y^2+5} - y}{\sqrt{y^2+5} - y}$$

$$= \frac{(\sqrt{y^2+5} - y)^2}{(\sqrt{y^2+5})^2 - (y)^2}$$

$$= \frac{(\sqrt{y^2+5} - y)^2}{y^2+5 - y^2}$$

$$= \frac{(\sqrt{y^2+5} - y)^2}{5}$$

$$\begin{aligned} (a-b)(a+b) &= (a-b)^2 \\ &= (a+b)(a-b) = a^2 - b^2 \end{aligned}$$



MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

3

EXERCISE

3.4

Q4: Simplify:

iii. $\frac{10}{6 - \sqrt{y^2 + 36}}$

Solution:

$$= \frac{10}{6 - \sqrt{y^2 + 36}}$$

Multiply and dividing by its conjugates:-

$$= \frac{10}{6 - \sqrt{y^2 + 36}} \times \frac{6 + \sqrt{y^2 + 36}}{6 + \sqrt{y^2 + 36}}$$

$$= \frac{10(6 + \sqrt{y^2 + 36})}{(6)^2 - (\sqrt{y^2 + 36})^2}$$

$$= \frac{10(6 + \sqrt{y^2 + 36})}{36 - (y^2 + 36)}$$

$$= \frac{10(6 + \sqrt{y^2 + 36})}{36 - y^2 - 36}$$

$$= \boxed{-\frac{10(6 + \sqrt{y^2 + 36})}{y^2}}$$

$$(a-b)(a+b) = a^2 - b^2$$

Ans



MATHEMATICS (SINDH BOARD)

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CHAPTER

3

EXERCISE

3.4

Q4: Simplify:

iv. $\frac{5}{6 + \sqrt{y^2 + 36}}$

Solution:

$$= \frac{5}{6 + \sqrt{y^2 + 36}}$$

Multiplying and dividing by its conjugates

$$= \frac{5}{6 + \sqrt{y^2 + 36}} \times \frac{6 - \sqrt{y^2 + 36}}{6 - \sqrt{y^2 + 36}}$$

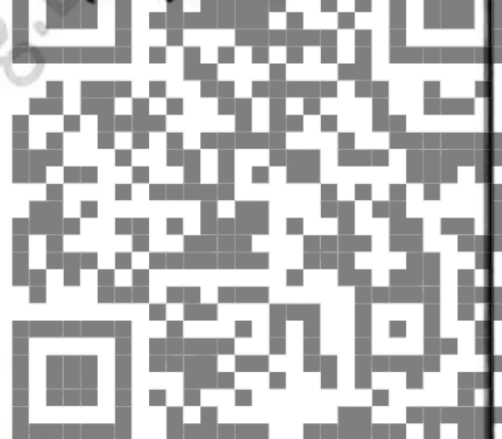
$$= \frac{5(6 - \sqrt{y^2 + 36})}{(6)^2 - (\sqrt{y^2 + 36})^2}$$

$$= \frac{5(6 - \sqrt{y^2 + 36})}{36 - (y^2 + 36)}$$

$$= \frac{5(6 - \sqrt{y^2 + 36})}{36 - y^2 - 36}$$

$$= \boxed{-\frac{5(6 - \sqrt{y^2 + 36})}{y^2}}$$

$$\therefore (a+b)(a-b) = a^2 - b^2$$



MATHEMATICS (SINDH BOARD)

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3

EXERCISE

3.4

Q4: Simplify:

$$v. \frac{15}{3-2\sqrt{2}} - \frac{5}{3+2\sqrt{2}}$$

Solution:

$$= \frac{15(3+2\sqrt{2}) - [5(3-2\sqrt{2})]}{(3-2\sqrt{2})(3+2\sqrt{2})}$$

$$= \frac{45 + 30\sqrt{2} - (15 - 10\sqrt{2})}{(3)^2 - (2\sqrt{2})^2} \quad \because (a+b)(a-b) = a^2 - b^2$$

$$= \frac{45 + 30\sqrt{2} - 15 + 10\sqrt{2}}{9 - (4 \times 2)}$$

$$= \frac{30 + 40\sqrt{2}}{9 - 8}$$

$$= \boxed{30 + 40\sqrt{2}} \text{ Ans}$$



MATHEMATICS (SINDH BOARD)

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CHAPTER

3

EXERCISE

3.4

Q4: Simplify :

$$\text{vi. } \frac{6}{12+\sqrt{6}} - \frac{3}{12-\sqrt{6}}$$

Solution:

$$= \frac{6}{12+\sqrt{6}} - \frac{3}{12-\sqrt{6}}$$

$$= \frac{6(12-\sqrt{6}) - [3(12+\sqrt{6})]}{(12+\sqrt{6})(12-\sqrt{6})}$$

$$= \frac{72 - 6\sqrt{6} - (36 + 3\sqrt{6})}{(12)^2 - (\sqrt{6})^2}$$

$$= \frac{72 - 6\sqrt{6} - 36 - 3\sqrt{6}}{144 - 6}$$

$$= \frac{36 - 9\sqrt{6}}{138}$$

$$= \frac{3(12 - 3\sqrt{6})}{138}$$

$$= \frac{3(4 - \sqrt{6})}{46}$$

Ans



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MATHEMATICS (FEDERAL BOARD)

CLASS : **9**

EXERCISE : **4.1**

QUES : **Examples:**

i. Factors Of the type : $ka + kb + kc$

Example 1:

Factorize : $10a + 15b - 20c$

Solution:

$$\begin{aligned} &= 10a + 15b - 20c \\ &= 5(2a + 3b - 4c) \end{aligned}$$

$$\begin{array}{r} 2 \overline{) 10} \quad 3 \overline{) 15} \\ \underline{5} \quad \underline{5} \\ 5 \quad 5 \\ \underline{5} \quad \underline{5} \\ 1 \quad 1 \end{array}$$

Example 2:

Find the factors of $\frac{4}{9}x - \frac{8}{12}x - \frac{16}{15}xy$

Solution:

$$= \frac{4}{3} \left(\frac{1}{3}x - \frac{2}{4}x - \frac{4}{5}xy \right)$$

$$\begin{array}{r} 2 \overline{) 4} \quad 3 \overline{) 9} \\ \underline{2} \quad \underline{3} \\ 2 \quad 3 \\ \underline{2} \quad \underline{3} \\ 1 \quad 1 \end{array}$$

FOR MORE!!!



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.1

QUES : Examples:

ii. Factors of the type : $ac + ad + bc + bd$:

Example : 1

Find the factors of $3a - ac - 3c + c^2$

Solution:

$$\begin{aligned} &= 3a - ac - 3c + c^2 \\ &= a(3 - c) - c(3 - c) \\ &= (3 - c)(a - c) \end{aligned}$$

JOIN

Example : 2

Find the factors of $9y^2z + 3xyz - 9xy^2 - 3x^2y$

Solution:

$$\begin{aligned} &= 9y^2z + 3xyz - 9xy^2 - 3x^2y \\ &= 3y(3yz + xz - 3xy - x^2) \\ &= 3y[z(3y + x) - x(3y + x)] \\ &= 3y[(3y + x)(z - x)] \end{aligned}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9 EXERCISE : 4.1 QUES : Examples

iii. Factors of the type : $a^2 \pm 2ab + b^2$:

$$a^2 + 2ab + b^2 = (a + b)^2$$

$$a^2 - 2ab + b^2 = (a - b)^2$$

Example : 1

Factorize $16a^2 + 40ab + 25b^2$

Solution :

$$= (4a)^2 + 2(4a)(5b) + (5b)^2$$

$$= (4a + 5b)^2 \quad \underline{\text{Ans}} \quad \because (a^2 + 2ab + b^2) = (a + b)^2$$

Example : 2

Factorize $4p^2 - 28pq + 49q^2$

Solution :

$$= 4p^2 - 28pq + 49q^2$$

$$= (2p)^2 - 2(2p)(7q) + (7q)^2$$

$$\therefore a^2 - 2ab + b^2 = (a - b)^2$$

$$= (2p - 7q)^2 \quad \underline{\text{Ans}}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : **9** EXERCISE : **4.1** QUES : **Examples**

iv. Factors of the type: $a^2 - b^2$

$$a^2 - b^2 = (a+b)(a-b)$$

Example 1:

Factorize: $4x^2 - 1$

$$= (2x)^2 - (1)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= (2x+1)(2x-1)$$

Example 2:

Factorize: $96y^2 - 6z^2$

$$= 96y^2 - 6z^2$$

$$= 6(16y^2 - z^2)$$

$$= 6[(4y)^2 - (z)^2]$$

$$= 6(4y+z)(4y-z)$$

Example 3:

Factorize $9r^4 - (6s - t^2)^2$

$$= (3r^2)^2 - (6s - t^2)^2$$

$$= (3r^2 + 6s - t^2)(3r^2 - 6s + t^2)$$

$$= (3r^2 + 6s - t^2)(3r^2 - 6s + t^2)$$

$$9r^4 - (6s - t^2)^2$$

$$= 9r^4 - p^2$$

$$= (3r^2)^2 - (p)^2$$

$$= (3r^2 - p)(3r^2 + p)$$

$$= (3r^2 - (6s - t^2))(3r^2 + 6s - t^2)$$

$$= (3r^2 - 6s + t^2)(3r^2 + 6s - t^2)$$



MATHEMATICS (FEDERAL BOARD)

CLASS : **9** EXERCISE : **4.1** QUES : **Examples :**

V. Factors of the type : $(a^2 \pm 2ab + b^2) - c^2$

Example 1 :

Factorize $x^2 + 4xy^2 + 4y^4 - 4z^2$

Solution :

$$= (x)^2 + 2(x)(2y^2) + (2y^2)^2 - 4z^2$$

$$\therefore (a^2 + 2ab + b^2) = (a+b)^2$$

$$= (x + 2y^2)^2 - 4z^2$$

$$= (x + 2y^2)^2 - (2z)^2$$

$$\therefore (a^2 - b^2) = (a+b)(a-b)$$

$$= (x + 2y^2 + 2z)(x + 2y^2 - 2z)$$

Example 2 :

Factorize $9p^2 - 6pq + q^2 - 9r^2$

Solution :

$$= 9p^2 - 6pq + q^2 - 9r^2$$

$$= (3p)^2 - 2(3p)(q) + (q)^2 - 9r^2$$

$$\therefore (a^2 - 2ab + b^2) = (a-b)^2$$

$$= (3p - q)^2 - (3r)^2$$

$$\therefore (a^2 - b^2) = (a+b)(a-b)$$

$$= (3p - q + 3r)(3p - q - 3r) \quad \underline{\underline{Ans}}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9 EXERCISE : 4.1 QUES : Examples:

vi. Factors of the type : $(\sqrt{a})^2 - (\sqrt{b})^2$

Example : 1

Factorize $(\sqrt{xy})^2 - (\sqrt{z})^2$

Solution:

$$= (\sqrt{xy} + \sqrt{z})(\sqrt{xy} - \sqrt{z})$$

$$a^2 - b^2 = (a+b)(a-b)$$

$$a = \sqrt{xy}$$

$$b = \sqrt{z}$$

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MATHEMATICS (FEDERAL BOARD)

CLASS : **9**

EXERCISE : **4.1**

QUES : **1**

Factorize the following:

i. $4x + 16y + 24z$

Solution:

$$= 4(x + 4y + 6z)$$

$$\begin{aligned} 4 \times 1 &= 4 \\ 4 \times 4 &= 16 \\ 4 \times 6 &= 24 \end{aligned}$$

ii. $x^2 + 3x^2y + 4x^2y^2z$

Solution:

$$= x^2(1 + 3y + 4y^2z)$$

iii. $3pqr + 6prt + 3pqs$

Solution:

$$= 3pq(r + 2t + s)$$

iv. $9qrs(s^2 + t^2) + 18qr^2t^2(s^2 + t^2)$

Solution:

$$= 9qrs(s^2 + t^2)(1 + 2qr)$$

v. $\frac{z^2x}{16} - \frac{x^2z^2}{8} + \frac{x^2z^3}{12}$

Solution:

$$= \frac{xz^2}{4} \left(\frac{1}{4} - \frac{x}{2} + \frac{xz}{3} \right)$$

vi. $a(x-y) - a^2b(x-y) + a^2b^2(x-y)$

Solution:

$$= a(x-y)(1 - ab + ab^2)$$

Ans



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.1

QUES : 2

Factorize the following:

i. $7x + xz + 7z + z^2$

Solution:

$$\begin{aligned} &= 7x + xz + 7z + z^2 \\ &= x(7+z) + z(7+z) \\ &= (7+z)(x+z) \quad \underline{\text{Ans}} \end{aligned}$$

ii. $9a^2b + 18ab^2 - 6ac - 12bc$

Solution:

$$\begin{aligned} &= 9a^2b + 18ab^2 - 6ac - 12bc \\ &= 3(3a^2b + 6ab^2 - 2ac - 4bc) \\ &= 3[3ab(a+2b) - 2c(a+2b)] \\ &= 3(a+2b)(3ab-2c) \quad \underline{\text{Ans}} \\ &= (a+2b)(9ab-6c) \end{aligned}$$

iii. $6t - 12p + 4tq - 8pq$

Solution:

$$\begin{aligned} &= 6(t-2p) + 4q(t-2p) \\ &= (t-2p)(6+4q) \quad \underline{\text{Ans}} \end{aligned}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9 EXERCISE : 4.1 QUES : 2

Factorize the following:

iv- $r^2 + 9rs - 7rs - 63s^2$

Solution:

$$\begin{aligned} &= r^2 + 9rs - 7rs - 63s^2 \\ &= r(r + 9s) - 7s(r + 9s) \\ &= (r + 9s)(r - 7s) \end{aligned}$$

v- $\frac{y^2}{4} - \frac{4^2z}{4} - \frac{z^2t}{9} + \frac{z^2tz}{9}$

Solution:

$$= \frac{1}{4} (y^2 - 4^2z) - \frac{z^2t}{9} (1 - z) \quad \underline{\underline{Ans}}$$

vi- $\frac{10xy}{11} + \frac{5xz}{11} - \frac{14yz}{11} - \frac{7xy}{11}$

Solution:

$$= \frac{5x}{11} (2y + z) - \frac{7y}{11} (2z + x) \quad \underline{\underline{Ans}}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.1

QUES : 3

Find the factors of:
i. $4a^2 + 12ab + 9b^2$

Solution:

$$= 4a^2 + 12ab + 9b^2$$

$$= (2a)^2 + 2(2a)(3b) + (3b)^2$$

$$\therefore a^2 + 2ab + b^2 = (a+b)^2$$

$$= (2a + 3b)^2$$

JOIN

ii. $36x^4 + 12x^2 + 1$

Solution:

$$= 36x^4 + 12x^2 + 1$$

$$= (6x^2)^2 + 2(6x^2)(1) + (1)^2$$

$$\therefore a^2 + 2ab + b^2 = (a+b)^2$$

$$= (6x^2 + 1)^2 \text{ Ans}$$

iii. $x^2 + 1 + \frac{1}{4x^2}$

Solution:

$$= (x)^2 + 2(x)\left(\frac{1}{2x}\right) + \left(\frac{1}{2x}\right)^2$$

$$\therefore a^2 + 2ab + b^2 = (a+b)^2$$

$$= \left(x + \frac{1}{2x}\right)^2 \text{ Ans}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9 EXERCISE : 4.1 QUES : 3

Find the factors of:

iv. $81y^2 + 144yz + 64z^2$

Solution:

$$\begin{aligned} &= (9y)^2 + 2(9y)(8z) + (8z)^2 \\ &\quad \therefore a^2 + 2ab + b^2 = (a+b)^2 \\ &= (9y + 8z)^2 \end{aligned}$$

v. $625 + 50a^2b + a^4b^2$

Solution:

$$\begin{aligned} &= 625 + 50a^2b + a^4b^2 \\ &= (25)^2 + 2(25)(a^2b) + (a^2b)^2 \\ &\quad \therefore a^2 + 2ab + b^2 = (a+b)^2 \\ &= (25 + a^2b)^2 \end{aligned}$$

Ans

vi. $a^2 + 0.4a + 0.04$

Solution:

$$\begin{aligned} &= (a)^2 + 2(a)(0.2) + (0.2)^2 \\ &\quad \therefore a^2 + 2ab + b^2 = (a+b)^2 \\ &= (a + 0.2)^2 \end{aligned}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.1

QUES : 4

Factorize:

i. $b^4 - 4b^2c^2 + 4c^4$

Solution:

$$= (b^2)^2 - 2(b^2)(2c^2) + (2c^2)^2$$

$$= (b^2 - 2c^2)^2 \quad \because a^2 - 2ab + b^2 = (a-b)^2$$

ii. $\frac{9}{4}x^4 - 2 + \frac{4}{9x^4}$

Solution:

$$= \left(\frac{3}{2}x^2\right)^2 - 2\left(\frac{3}{2}x^2\right)\left(\frac{2}{3x^2}\right) + \left(\frac{2}{3x^2}\right)^2$$

$$= \left(\frac{3}{2}x^2 - \frac{2}{3x^2}\right)^2 \quad \because a^2 - 2ab + b^2 = (a-b)^2$$

iii. $2a^3b^3 - 16a^2b^4 + 32ab^5$

Solution:

$$= 2ab^3(a^2 - 8ab + 16b^2)$$

$$= 2ab^3[(a)^2 - 2(a)(4b) + (4b)^2]$$

$$= 2ab^3(a - 4b)^2 \quad \because a^2 - 2ab + b^2 = (a-b)^2$$

Ans



MATHEMATICS (FEDERAL BOARD)

CLASS : **9**

EXERCISE : **4.1**

QUES : **4**

Factorize:

iv. $9(p+q)^2 - 6(p+q)r^2 + r^4$

Solution:

$$= [3(p+q)]^2 - 2(3(p+q))(r^2) + (r^2)^2$$

$$= [3(p+q) - r^2]^2 \quad \text{Ans}$$

v. $x^2y^2 - 0.1xy + 0.0025$

Solution:

$$= (xy)^2 - 2(xy)(0.05) + (0.05)^2$$

$$= (xy - 0.05)^2$$

vi. $(a-b)^2 - 18(a-b) + 81$

Solution:

$$= (a-b)^2 - 2(a-b)(9) + (9)^2$$

$$= [(a-b) - 9]^2 \quad \text{Ans}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.1

QUES : 5

Factorize :

i. $4a^2 - 9b^2$

Solution:

$$= 4a^2 - 9b^2$$

$$= (2a)^2 - (3b)^2$$

$$= (2a + 3b)(2a - 3b)$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

ii. $16x^2 - 25y^2$

Solution:

$$= 16x^2 - 25y^2$$

$$= (4x)^2 - (5y)^2$$

$$= (4x + 5y)(4x - 5y)$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

iii. $100x^2z^2 - y^4$

Solution:

$$= 100x^2z^2 - y^4$$

$$= (10xz)^2 - (y^2)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= (10xz + y^2)(10xz - y^2)$$

Ans



MATHEMATICS (FEDERAL BOARD)

CLASS : **9**

EXERCISE : **4.1**

QUES : **5**

Factorize :

iv- $\frac{1}{100}x^4 - 100y^4$

Solution:

$$= \frac{1}{100}x^4 - 100y^4$$

$$= \left(\frac{1}{10}x^2\right)^2 - (10y^2)^2 \quad \therefore a^2 - b^2 = (a+b)(a-b)$$

$$= \left(\frac{1}{10}x^2 + 10y^2\right) \left(\frac{1}{10}x^2 - 10y^2\right) \quad \text{Ans}$$

v- $\frac{64}{81}f^2 - \frac{81}{64}g^4$

Solution:

$$= \left(\frac{8}{9}f\right)^2 - \left(\frac{9}{8}g^2\right)^2 \quad \therefore a^2 - b^2 = (a+b)(a-b)$$

$$= \left(\frac{8}{9}f + \frac{9}{8}g^2\right) \left(\frac{8}{9}f - \frac{9}{8}g^2\right)$$

vi- $\frac{x^4}{121} - 121y^2$

Solution:

$$= \left(\frac{x^2}{11}\right)^2 - (11y)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= \left(\frac{x^2}{11} + 11y\right) \left(\frac{x^2}{11} - 11y\right) \quad \text{Ans}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.1

QUES : 6

Find the factors of:

i- $(2x+z)^2 - (2x-z)^2$

Solution:

$$= (2x+z)^2 - (2x-z)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= [(2x+z) + (2x-z)][(2x+z) - (2x-z)]$$

$$\begin{aligned}\therefore 2x+z &= a \\ 2x-z &= b\end{aligned}$$

JOIN

FOR

ii- $(4a-9b)^2 - (2a-5b)^2$

Solution:

$$= (4a-9b)^2 - (2a-5b)^2$$

$$\begin{aligned}4a-9b &= a \\ 2a-5b &= b\end{aligned}$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= [(4a-9b) + (2a-5b)][(4a-9b) - (2a-5b)]$$



MATHEMATICS (FEDERAL BOARD)

CLASS : **9** EXERCISE : **4.1** QUES : **6**

Find the factors of :

iii. $169x^4 - (3t+4)^2$

Solution:

$169 = 13^2$

$$= 169x^4 - (3t+4)^2$$

$$= (13x^2)^2 - (3t+4)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= (13x^2 + (3t+4)) [13x^2 - (3t+4)]$$

iv. $(9x^2 - 4y^2)^2 - (4x^2 - y^2)^2$

Solution:

$$= (9x^2 - 4y^2)^2 - (4x^2 - y^2)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= [(9x^2 - 4y^2) + (4x^2 - y^2)] [(9x^2 - 4y^2) - (4x^2 - y^2)]$$

$a = 9x^2 - 4y^2$
 $b = 4x^2 - y^2$

Continue
Part vi:-

$$= \left[\left(3x + \frac{1}{3x} \right) + \left(2y - \frac{1}{2y} \right) \right] \left[\left(3x + \frac{1}{3x} \right) - \left(2y - \frac{1}{2y} \right) \right]$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.1

QUES : 6

Find the factors of:

v. $\left[a^2 + 2 + \frac{1}{a^2}\right] - \left[b^2 - 2 + \frac{1}{b^2}\right]$

Solution:

$$= \left[a^2 + 2 + \frac{1}{a^2}\right] - \left[b^2 - 2 + \frac{1}{b^2}\right]$$

$$= \left[(a)^2 + 2(a)\left(\frac{1}{a}\right) + \left(\frac{1}{a}\right)^2\right] - \left[(b)^2 - 2(b)\left(\frac{1}{b}\right) + \left(\frac{1}{b}\right)^2\right]$$

$$= (a^2 + 2ab + b^2 = (a+b)^2) - (a^2 - 2ab + b^2 = (a-b)^2)$$

$$= \left(a + \frac{1}{a}\right)^2 - \left(b - \frac{1}{b}\right)^2$$

$$= \left[\left(a + \frac{1}{a}\right) + \left(b - \frac{1}{b}\right)\right] \left[\left(a + \frac{1}{a}\right) - \left(b - \frac{1}{b}\right)\right]$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

vi. $9x^2 + \frac{1}{9x^2} - 4y^2 - \frac{1}{4y^2} + 2$

Solution:

$$= 9x^2 + \frac{1}{9x^2} - 4y^2 - \frac{1}{4y^2} + 2 + 2$$

$$= 9x^2 + 2 + \frac{1}{9x^2} - 4y^2 + 2 - \frac{1}{4y^2}$$

$$= \left(9x^2 + 2 + \frac{1}{9x^2}\right) - \left(4y^2 - 2 + \frac{1}{4y^2}\right)$$

$$= \left[(3x)^2 + 2(3x)\left(\frac{1}{3x}\right) + \left(\frac{1}{3x}\right)^2\right] - \left[(2y)^2 - 2(2y)\left(\frac{1}{2y}\right) + \left(\frac{1}{2y}\right)^2\right]$$

$$\therefore (a^2 + 2ab + b^2 = (a+b)^2, a^2 - 2ab + b^2 = (a-b)^2)$$

$$= \left(3x + \frac{1}{3x}\right)^2 - \left(2y - \frac{1}{2y}\right)^2$$

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MATHEMATICS (FEDERAL BOARD)

CLASS : 9 EXERCISE : 4.1 QUES : 7

Find the factors of:

i- $(x^2 + 2xy + y^2) - 9z^4$

Solution:

$$= (x^2 + 2xy + y^2) - 9z^4$$

$$= [(x)^2 + 2(x)(y) + (y)^2] - (3z^2)^2 \because a^2 + 2ab + b^2 = (a+b)^2$$

$$= (x+y)^2 - (3z^2)^2 \because a^2 - b^2 = (a+b)(a-b)$$

$$= [(x+y) + (3z^2)][(x+y) - (3z^2)] \text{ Ans}$$

ii- $(4a^2 + 8ab^2 + 4b^4) - 9c^2$

Solution:

$$= (4a^2 + 8ab^2 + 4b^4) - 9c^2$$

$$= [(2a)^2 + 2(2a)(2b^2) + (2b^2)^2] - 9c^2 \because (a^2 + 2ab + b^2) = (a+b)^2$$

$$= [(2a + 2b^2)^2 - 9c^2$$

$$= (2a + 2b^2)^2 - (3c)^2 \because (a^2 - b^2) = (a+b)(a-b)$$

$$= [(2a + 2b^2) + (3c)][(2a + 2b^2) - 3c]$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9 EXERCISE : 4.1 QUES : 7

Find the factors of:

iii. $16a^4 - (c^4 - 2c^2d + d^2)$

Solution:

$$= 16a^4 - [(c^2)^2 - 2(c^2)(d) + (d)^2]$$

$$\therefore a^2 - 2ab + b^2 = (a-b)^2$$

$$= 16a^4 - (c^2 - d)^2$$

$$= (4a^2)^2 - (c^2 - d)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= [4a^2 + (c^2 - d)][(4a^2) - (c^2 - d)]$$

iv. $4(x^2 + 2xy^2 + y^4) - 9y^6$

Solution:

$$= (4x^2 + 8xy^2 + 4y^4) - 9y^6$$

$$= [(2x)^2 + 2(2x)(2y^2) + (2y^2)^2] - 9y^6$$

$$\therefore a^2 + 2ab + b^2 = (a+b)^2$$

$$= (2x + 2y^2)^2 - (3y^3)^2$$

$$= [(2x + 2y^2) + 3y^3][(2x + 2y^2) - 3y^3]$$

Ans



MATHEMATICS (FEDERAL BOARD)

CLASS : 9 EXERCISE : 4.1 QUES : 7

Find the factors of:

v. $x^2 - y^2 - 4x - 2y + 3$

Solution:

$$= x^2 - 4x - y^2 - 2y + 3 + 1 - 1$$

$$= x^2 - 4x + 4 - y^2 - 2y - 1$$

$$= x^2 - 4x + 4 - (y^2 + 2y + 1)$$

$$= [(x)^2 - 2(x)(2) + (2)^2] - [(y)^2 + 2(y)(1) + (1)^2]$$

$$= (x-2)^2 - (y+1)^2$$

$$= [(x-2) + (y+1)][(x-2) - (y+1)]$$

vi. $4x^2 - y^2 - 2y - 1$

Solution:

$$= 4x^2 - (y^2 + 2y + 1)$$

$$= (2x)^2 - [(y)^2 + 2(y)(1) + (1)^2]$$

$$= (2x)^2 - (y+1)^2$$

$$= [2x + (y+1)][2x - (y+1)]$$

Ans



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.1

QUES : 8

Factorize:

i- $(\sqrt{ab})^2 - (\sqrt{c})^2$

Solution:

$$= (\sqrt{ab})^2 - (\sqrt{c})^2$$

$$= (\sqrt{ab} + \sqrt{c})(\sqrt{ab} - \sqrt{c})$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

JOIN

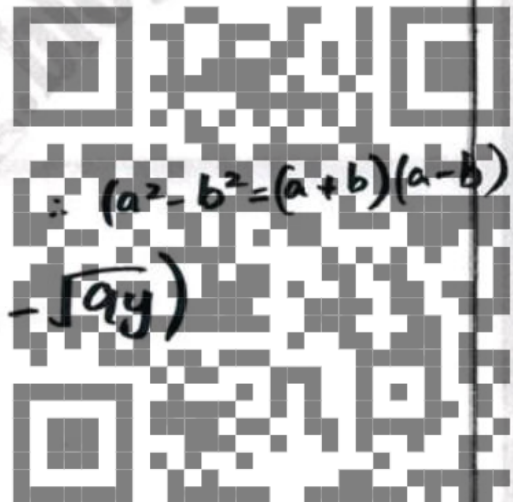
FOR

ii- $(\sqrt{4x})^2 - (\sqrt{9y})^2$

Solution:

$$= (\sqrt{4x})^2 - (\sqrt{9y})^2$$

$$= (\sqrt{4x} + \sqrt{9y})(\sqrt{4x} - \sqrt{9y})$$



$$\therefore a^2 - b^2 = (a+b)(a-b)$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.1

QUES : 8

Factorize:

iii- $(\sqrt{yz})^2 - \left(\frac{1}{\sqrt{yz}}\right)^2$

Solution:

$$= (\sqrt{yz})^2 - \left(\frac{1}{\sqrt{yz}}\right)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= \left(\sqrt{yz} + \frac{1}{\sqrt{yz}}\right) \left(\sqrt{yz} - \frac{1}{\sqrt{yz}}\right)$$

JOIN

FOR

iv- $xzt - \frac{1}{t}$

Solution:

$$= (xzt)^2 - \left(\sqrt{\frac{1}{t}}\right)^2$$

$$= (a^2 - b^2 = (a+b)(a-b))$$

$$= \left(\sqrt{xzt} + \sqrt{\frac{1}{t}}\right) \left(\sqrt{xzt} - \sqrt{\frac{1}{t}}\right)$$

Ans



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.2

QUES : Examples :

Example 1: TYPE I:

Factorization: $a^4 + a^2b^2 + b^4$

Solution:

$$\begin{aligned}
 &= a^4 + a^2b^2 + b^4 \\
 &= a^4 + a^2b^2 + b^4 + a^2b^2 - a^2b^2 \\
 &= a^4 + 2a^2b^2 + b^4 - a^2b^2 \\
 &= [(a^2)^2 + 2(a^2)(b^2) + (b^2)^2] - a^2b^2 \\
 &= (a^2 + b^2)^2 - a^2b^2 \\
 &= (a^2 + b^2)^2 - (ab)^2 \\
 &= (a^2 + b^2 + ab)(a^2 + b^2 - ab) \\
 &= (a^2 + ab + b^2)(a^2 - ab + b^2)
 \end{aligned}$$

$(a^2)^2 + 2(a^2)(b^2) + (b^2)^2$
 $a^4 + 2a^2b^2 + b^4$
 $\therefore a^2 + 2ab + b^2 = (a+b)^2$
 $\therefore a^2 - b^2 = (a+b)(a-b)$

Example 2:

Factorize $a^4 + 4b^4$

Solution:

$$\begin{aligned}
 &= a^4 + 4b^4 \\
 &= (a^4 + 4b^4 + 4a^2b^2) - 4a^2b^2 \\
 &= [(a^2)^2 + 2(a^2)(2b^2) + (2b^2)^2] - 4a^2b^2 \\
 &= (a^2 + 2b^2)^2 - 4a^2b^2 \\
 &= (a^2 + 2b^2)^2 - (2ab)^2 \\
 &= (a^2 + 2b^2 + 2ab)(a^2 + 2b^2 - 2ab) \\
 &= (a^2 + 2ab + 2b^2)(a^2 - 2ab + 2b^2)
 \end{aligned}$$

$(a^2)^2 + 2(a^2)(2b^2) + (2b^2)^2$
 $a^4 + 4a^2b^2 + 4b^4$
 $\therefore a^2 + 2ab + b^2 = (a+b)^2$
 $\therefore a^2 - b^2 = (a+b)(a-b)$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.2

QUES : Examples :

Example 3 :

Factorize : $x^8 + x^4 + 1$

Solution :

$$= x^8 + x^4 + 1$$

$$= (x^8 + x^4 + 1 + x^4 - x^4)$$

$$\begin{aligned} (x^4)^2 + 2(x^4)(1) + (1)^2 \\ x^8 + 2x^4 + 1 \end{aligned}$$

$$= (x^8 + 2x^4 + 1) - x^4$$

$$= [(x^4)^2 + 2(x^4)(1) + (1)^2] - x^4$$

$$= (x^4 + 1)^2 - x^4$$

$$= (x^4 + 1)^2 - (x^2)^2$$

$$= (x^4 + 1 + x^2)(x^4 + 1 - x^2)$$

$$= (x^4 + x^2 + 1)(x^4 - x^2 + 1) \quad \underline{\underline{\text{Ans}}}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.2

QUES : Examples

TYPE II : middle Term break:

Example 1:

Factorize $y^2 + 7y + 12$

Solution:

$$= y^2 + 7y + 12$$

$$= y^2 + 3y + 4y + 12$$

$$= y(y+3) + 4(y+3)$$

$$= (y+3)(y+4) \text{ Ans}$$

$$y^2 \times 12 = (12)y^2$$

2	12
4	6
3	3
	1

Example 2:

Factorize $x^2 + 13xy - 30y^2$

Solution:

$$= x^2 + 13xy - 30y^2$$

$$= x^2 + 15xy - 2xy - 30y^2$$

$$= x(x + 15y) - 2y(x + 15y)$$

$$= (x + 15y)(x - 2y)$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.2

QUES : Examples:

TYPE III : $ax^2 + bx + c$ $a \neq 0$

Example 1:

Factorize $10x^2 - 19xy + 6y^2$

Solution:

$$\begin{aligned} &= 10x^2 - 19xy + 6y^2 \\ &= 10x^2 - 15xy - 4xy + 6y^2 \\ &= 5x(2x - 3y) - 2y(2x - 3y) \\ &= (2x - 3y)(5x - 2y) \end{aligned}$$

$$10x^2 \times 6y^2 = 60x^2y^2$$

4	2	60
	2	30
15	3	15
	5	5
		1

Example 2:

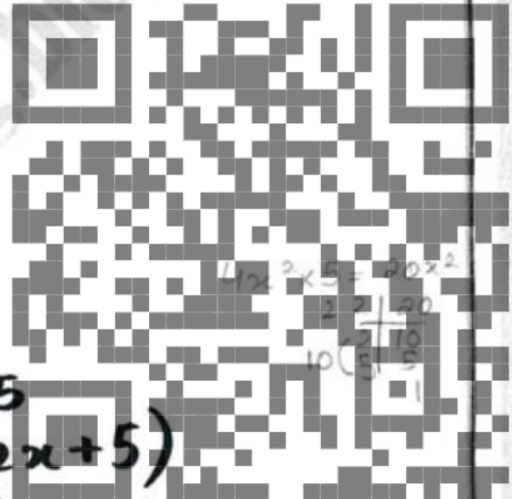
Factorize $4x^2 + 12x + 5$

Solution:

$$\begin{aligned} &= 4x^2 + 12x + 5 \\ &= 4x^2 + 10x + 2x + 5 \\ &= 2x(2x + 5) + 1(2x + 5) \\ &= (2x + 5)(2x + 1) \end{aligned}$$

$$4x^2 \times 5 = 20x^2$$

2	2	20
	2	10
10	5	5
		1



MATHEMATICS (FEDERAL BOARD)

CLASS : 9 EXERCISE : 4.2 QUES : 1

1. Factorize the following:

i. $a^4 + a^2x^2 + x^4$

Solution:

$$= (a^4 + \underline{a^2x^2} + x^4 + \underline{a^2x^2} - a^2x^2)$$

$$= (a^4 + 2a^2x^2 + x^4) - a^2x^2$$

$$= (a^2)^2 + 2(a^2)(x^2) + (x^2)^2 - a^2x^2$$

$$= (a^2 + x^2)^2 - a^2x^2$$

$$= (a^2 + x^2)^2 - (ax)^2$$

$$= (a^2 + x^2 + ax)(a^2 + x^2 - ax)$$

$$= (a^2 + ax + x^2)(a^2 - ax + x^2) \quad \text{Ans}$$

$$a^2 + 2ab + b^2 = (a+b)^2$$

$$(a^2)^2 + 2(a^2)(x^2) + (x^2)^2 = 2a^2x^2$$

$$\therefore a^2 + 2ab + b^2 = (a+b)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

ii. $b^4 + b^2 + 1$

Solution:

$$= b^4 + b^2 + 1 + b^2 - b^2$$

$$= (b^4 + 2b^2 + 1) - b^2$$

$$= [(b^2)^2 + 2(b^2)(1) + (1)^2] - b^2$$

$$= (b^2 + 1)^2 - b^2$$

$$= (b^2 + 1)^2 - (b)^2$$

$$= (b^2 + 1 + b)(b^2 + 1 - b)$$

$$= (b^2 + b + 1)(b^2 - b + 1) \quad \text{Ans}$$

$$(a^2 + 2ab + b^2) = (a+b)^2$$

$$= (b^2)^2 + 2(b^2)(1) + (1)^2$$

$$= b^4 + 2b^2 + 1$$

$$\therefore a^2 + 2ab + b^2 = (a+b)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.2

QUES : 1

1. Factorize the following:

iii. $a^8 + a^4x^4 + x^8$

Solution:

$$= a^8 + a^4x^4 + x^8 + a^4x^4 - a^4x^4$$

$$= (a^8 + 2a^4x^4 + x^8) - a^4x^4$$

$$= (a^4)^2 + 2(a^4)(x^4) + (x^4)^2 - a^4x^4$$

$$= (a^4 + x^4)^2 - a^4x^4$$

$$= (a^4 + x^4)^2 - (a^2x^2)^2$$

$$= (a^4 + x^4 + a^2x^2)(a^4 + x^4 - a^2x^2)$$

$$= (a^4 + a^2x^2 + x^4)(a^4 - a^2x^2 + x^4)$$

$$(a^4)^2 + 2(a^4)(x^4) + (x^4)^2 + 2a^4x^4$$

$$\therefore a^2 + 2ab + b^2 = (a+b)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

iv. $z^8 + z^4 + 1$

Solution:

$$= z^8 + z^4 + 1 + z^4 - z^4$$

$$= (z^8 + 2z^4 + 1) - z^4$$

$$= (z^4)^2 + 2(z^4)(1) + (1)^2 - z^4$$

$$= (z^4 + 1)^2 - (z^4)$$

$$= (z^4 + 1)^2 - (z^2)^2$$

$$= (z^4 + 1 + z^2)(z^4 + 1 - z^2)$$

$$= (z^4 + z^2 + 1)(z^4 - z^2 + 1) \quad \underline{\text{Ans}}$$

$$(z^4)^2 + 2(z^4)(1) + (1)^2 - z^4$$

$$\therefore a^2 + 2ab + b^2 = (a+b)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.2

QUES : 2

2. Factorize :

i. $42x^2 - 8x - 2$

Solution:

$$\begin{aligned} &= 2(21x^2 - 4x - 1) \\ &= 2(21x^2 - 7x + 3x - 1) \\ &= 2[7x(3x - 1) + 1(3x - 1)] \\ &= 2[(3x - 1)(7x + 1)] \end{aligned}$$

$$\begin{array}{r} 21x^2 - 1 = -21x^2 \\ 3 \overline{) 21} \\ 7 \overline{) 7} \\ 1 \end{array}$$

ii. $21z^2 - 4z - 1$

Solution:

$$\begin{aligned} &= 21z^2 - 4z - 1 \\ &= 21z^2 - 7z + 3z - 1 \\ &= 7z(3z - 1) + 1(3z - 1) \\ &= (3z - 1)(7z + 1) \end{aligned}$$

$$\begin{array}{r} 21z^2 - 1 = -21z^2 \\ 3 \overline{) 21} \\ 7 \overline{) 7} \\ 1 \end{array}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.2

QUES : 2

Factorize :

iii. $9y^2 + 21yz^4 - 8z^4$

Solution:

$$\begin{aligned} &= y^2 + 21yz^4 \\ &= y(y + 21z^4) \end{aligned}$$

JOIN
FOR

iv.

$24a^2 - 18a + 27$

Solution:

$$\begin{aligned} &= 3(8a^2 - 6a + 9) \\ &= 3(8a^2 - 6a - 9) \\ &= 3(8a^2 - 12a + 6a - 9) \\ &= 3[4a(2a - 3) + 3(2a - 3)] \\ &= 3(2a - 3)(4a + 3) \end{aligned}$$



MATHEMATICS (FEDERAL BOARD)

CLASS : 9

EXERCISE : 4.2

QUES : 3

Factorize :

i- $x^4 + 4y^2$

Solution:

$$\begin{aligned} &= x^4 + 4y^2 + 4x^2y - 4x^2y \\ &= (x^4 + 4x^2y + 4y^2) - 4x^2y \\ &= (x^2)^2 + 2(x^2)(2y) + (2y)^2 - 4x^2y \\ &= (x^2 + 2y)^2 - 4x^2y \end{aligned}$$

$x^4 + 4y^2$
 $(x^2)^2 + (2y)^2$
 $(x^2)^2 + 2(x^2)(2y) + (2y)^2$
 $\therefore a^2 + 2ab + b^2 = (a+b)^2$

Ans

ii- $36x^4z^4 + 9y^4$

Solution:

$$= 9(4x^4z^4 + y^4)$$

Ans



MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

4

EXERCISE

4.2

Q3 Factorize :

iii. $4t^4 + 625$

Solution:

$$\begin{aligned}
 &= (2t^2)^2 + (25)^2 + 100t^2 - 100t^2 \\
 &= (2t^2)^2 + 2(2t^2)(25) + (25)^2 - 100t^2 \\
 &= (2t^2 + 25)^2 - 100t^2 \\
 &= (2t^2 + 25)^2 - (10t)^2 \quad \therefore a^2 - b^2 = (a+b)(a-b) \\
 &= (2t^2 + 25 + 10t)(2t^2 + 25 - 10t) \\
 &= (2t^2 + 10t + 25)(2t^2 - 10t + 25)
 \end{aligned}$$

iv. $4t^4 + 1$

Solution:

$$\begin{aligned}
 &= (2t^2)^2 + (1)^2 + 4t^2 - 4t^2 \\
 &= [(2t^2)^2 + 2(2t^2)(1) + (1)^2] - 4t^2 \\
 &= (2t^2 + 1)^2 - 4t^2 \\
 &= (2t^2 + 1)^2 - (2t)^2 \quad \therefore a^2 - b^2 = (a+b)(a-b) \\
 &= (2t^2 + 1 - 2t)(2t^2 + 1 + 2t) \\
 &= (2t^2 - 2t + 1)(2t^2 + 2t + 1)
 \end{aligned}$$

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MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

4

EXERCISE

4.2

Q4: Resolve into factors:

i. $x^2 + 3x - 10$

Solution:

$$= x^2 + 5x - 2x - 10$$

$$= x(x+5) - 2(x+5)$$

$$= (x+5)(x-2)$$

$$x^2x - 10 = -10x^2$$

$$\begin{array}{r} 2 \quad 10 \\ - \quad 5 \\ \hline 5 \end{array}$$

JOIN

FOR

ii. $a^2b^2 - 3ab - 10$

Solution:

$$= a^2b^2 - 3ab - 10$$

$$= a^2b^2 - 5ab + 2ab - 10$$

$$= ab(ab - 5) + 2(ab - 5)$$

$$= (ab - 5)(ab + 2)$$



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MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

4

EXERCISE

4.2

Q4: Resolve into factors :

iii- $y^2 + 7y - 98$

Solution:

$$= y^2 + 7y - 98$$

$$= y^2 + 14y - 7y - 98$$

$$= y(y + 14) - 7(y + 14)$$

$$= (y + 14)(y - 7)$$

$$y^2x - 98 = -98y^2$$

$$+14 \left(\begin{array}{r} 2 \\ 7 \end{array} \middle| \begin{array}{r} 98 \\ 49 \\ 7 \\ 1 \end{array} \right)$$

iv- $x^2y^2z^2 + 2xyz - 24$

Solution:

$$= x^2y^2z^2 + 2xyz - 24$$

$$= x^2y^2z^2 + 6xyz - 4xyz - 24$$

$$= xyz(xyz + 6) - 4(xyz + 6)$$

$$= (xyz + 6)(xyz - 4)$$



MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

4

EXERCISE

4.2

Q5: Resolve into factors:

i. $121x^4 + 11x^2 + 2 \rightarrow$ No factors

Solution:

$$= 121x^4 + 11x^2 + 2$$

$$= 121x^4 + 11x^2 - 2$$

$$= 121x^4 + 22x^2 - 11x^2 - 2$$

$$= 11x^2(11x^2 + 2) - 1(11x^2 + 2)$$

$$= (11x^2 + 2)(11x^2 - 1)$$

$$121x^4 \times 2 = 242x^4$$

$$\begin{array}{r} +22 \\ 11 \end{array} \begin{array}{r} 242 \\ 121 \\ 11 \\ 1 \end{array}$$

$$\ominus 242$$

JOIN
FOR

ii. $42z^4 + 50z^2 + 8$

Solution:

$$= 2(21z^4 + 25z^2 + 4)$$

$$= 2(21z^4 + 25z^2 + 4)$$

$$= 2(21z^4 + 21z^2 + 4z^2 + 4)$$

$$= 2[21z^2(z^2 + 1) + 4(z^2 + 1)]$$

$$= 2(z^2 + 1)(21z^2 + 4)$$

$$= 2(21z^2 + 4)(z^2 + 1)$$

$$21z^4 \times 4 = 84z^4$$

$$\begin{array}{r} 4 \\ 21 \end{array} \begin{array}{r} 84 \\ 42 \\ 21 \\ 7 \\ 1 \end{array}$$



MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

4

EXERCISE

4.2

Q5: Resolve into factors:

iii. $4x^2 + 12x + 5$

Solution:

$$= 4x^2 + 12x + 5$$

$$= 4x^2 + 10x + 2x + 5$$

$$= 2x(2x + 5) + 1(2x + 5)$$

$$= \cancel{2x}(2x + 5)(2x + 1)$$

$$= (2x + 1)(2x + 5)$$

$$4x^2 \times 5 = 20x^2$$

$$+ 2 \quad 2 \quad 20$$

$$+ 10 \quad 2 \quad 10$$

$$5 \quad 5 \quad 1$$

iv. $3x^2 - 38xy - 13y^2$

Solution:

$$= 3x^2 - 39xy + xy - 13y^2$$

$$= 3x(x - 13y) + y(x - 13y)$$

$$= (x - 13y)(3x + y)$$

$$= (3x + y)(x - 13y)$$

Ans



MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

4

EXERCISE

4.2

Q6: Resolve into factors:

i- $81x^4 + 36x^2y^2 + 16y^4$

Solution:

$$= 81x^4 + 36x^2y^2 + 16y^4 + 36x^2y^2 - 36x^2y^2 + 36x^2y^2 - 36x^2y^2$$

$$= 81x^4 + 72x^2y^2 + 16y^4 - 36x^2y^2$$

$$= (9x^2)^2 + 2(9x^2)(4y^2) + (4y^2)^2 - 36x^2y^2$$

$$= (a+b)^2 - (a-b)^2 = (a+b)(a-b)$$

$$= (9x^2 + 4y^2)^2 - 36x^2y^2$$

$$= (9x^2 + 4y^2)^2 - (6xy)^2$$

$$= (a^2 - b^2) = (a+b)(a-b)$$

$$= (9x^2 + 4y^2 + 6xy)(9x^2 + 4y^2 - 6xy)$$

$$= (9x^2 + 6xy + 4y^2)(9x^2 - 6xy + 4y^2)$$

ii- $x^4 + x^2 + 25$

Solution:

$$= (x^4 + x^2 + 25)$$

$$= x^4 + x^2 + 25 + 9x^2 + 9x^2 - 9x^2$$

$$= x^4 + 10x^2 + 25 - 9x^2$$

$$= (x^2)^2 + 2(x^2)(5) + (5)^2 - 9x^2$$

$$= (a^2 + 2ab + b^2) - (a-b)^2 = (a+b)^2 - (a-b)^2 = (a+b)(a-b)$$

$$= (x^2 + 5)^2 - 9x^2$$

$$= (x^2 + 5)^2 - (3x)^2$$

$$= (x^2 + 5 + 3x)(x^2 + 5 - 3x)$$

$$= (x^2 + 3x + 5)(x^2 - 3x + 5) \quad \text{Ans}$$

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MATHEMATICS (SINDH BOARD)

CLASS

9

CHAPTER

4

EXERCISE

4.2

Q6: Resolve into factors:

iii- $y^4 - 7y^2 - 8$

Solution:

$$\begin{aligned} &= y^4 - 7y^2 - 8 \\ &= y^4 - 8y^2 + y^2 - 8 \\ &= y^2(y^2 - 8) + 1(y^2 - 8) \\ &= (y^2 - 8)(y^2 + 1) \\ &= (y^2 + 1)(y^2 - 8) \end{aligned}$$

$$y^4x - 8 = -8y^4$$

$$\begin{array}{r} 2 8 \\ -8 2 4 \\ +1 2 2 1 \end{array}$$

iv- $16a^4 - 97a^2b^2 + 81b^4$

Solution:

$$\begin{aligned} &= 16a^4 - 97a^2b^2 + 81b^4 \\ &= 16a^4 - 81a^2b^2 - 16a^2b^2 + 81b^4 - 81b^4 \\ &= a^2(16a^2 - 81b^2) - b^2(16a^2 - 81b^2) \\ &= (16a^2 - 81b^2)(a^2 - b^2) \\ &= [(4a)^2 - (9b)^2] [(a)^2 - (b)^2] \\ &= (4a + 9b)(4a - 9b)(a + b)(a - b) \text{ Ans} \end{aligned}$$

$$= a^2b^2(a+b)(a-b)$$

$$16a^4 \times 81b^4 = 296a^4b^4$$

$$\begin{array}{r} 2 296 \\ -16 648 \\ +1 324 81 \\ 27 9 3 1 \end{array}$$



Class : 9

Exercise : 4.3

Examples :

TYPE IV**Example : 1****Factorize** : $(x^2 + 5x + 4)(x^2 + 5x + 6) - 120$ **Solution :**

$$= (x^2 + 5x + 4)(x^2 + 5x + 6) - 120$$

Let $x^2 + 5x = t$, then we have,

$$= (t + 4)(t + 6) - 120$$

$$= t^2 + 6t + 4t + 24 - 120$$

$$= t^2 + 10t - 96$$

$$= t^2 + 16t - 6t - 96 \quad (\text{By factorizing})$$

$$= t(t + 16) - 6(t + 16)$$

$$= (t + 16)(t - 6)$$

$$= (t - 6)(t + 16)$$

$$= (x^2 + 5x - 6)(x^2 + 5x + 16)$$

$$= (x^2 + 2x + 3x - 6)$$

$$= (x^2 + 6x - x - 6)(x^2 + 5x + 16)$$

$$= [x(x + 6) - 1(x + 6)](x^2 + 5x + 16)$$

$$= (x + 6)(x - 1)(x^2 + 5x + 16)$$

$$= (x - 1)(x + 6)(x^2 + 5x + 16) \quad \text{Ans}$$

$$t^2 + 10t - 96 = -96t^2$$

2	96
2	48
2	24
2	12
2	6
3	3

$$\therefore t = x^2 + 5x$$

$$x^2 + 5x - 6 = 6x^2$$

2	6
3	3

$$x^2 + 5x - 6 = 16x^2$$

2	16
2	8
2	4
2	2



Class : 9

Exercise : 4.3

Examples :

Example : 2

Factorize $(x+1)(x+2)(x+3)(x+4) - 15$

Solution:

$$= (x+1)(x+2)(x+3)(x+4) - 15$$

$$= (x+1)(x+4)(x+2)(x+3) - 15$$

$$= (x^2 + 4x + x + 4)(x^2 + 3x + 2x + 6) - 15$$

$$= (x^2 + 5x + 4)(x^2 + 5x + 6) - 15$$

$$\text{Let } x^2 + 5x = t$$

$$= (t+4)(t+6) - 15$$

$$= t^2 + 6t + 4t + 24 - 15$$

$$= t^2 + 10t + 9$$

$$= t^2 + 9t + t + 9 \quad (\text{By factorizing})$$

$$= t(t+9) + 1(t+9)$$

$$= (t+9)(t+1)$$

$$= (t+1)(t+9)$$

$$= (x^2 + 5x + 1)(x^2 + 5x + 9)$$



Class : 9

Exercise : 4.3

Examples :

Example : 3

Factorize : $(x+2)(x-2)(x-3)(x+3) + (-2x^2)$

Solution :

$$= (x+2)(x-2)(x-3)(x+3) + (-2x^2)$$

$$\therefore (a+b)(a-b) = a^2 - b$$

$$= (x^2 - 2^2)(x^2 - 3^2) - 2x^2$$

$$= (x^2 - 4)(x^2 - 9) - 2x^2$$

$$= x^4 - 9x^2 - 4x^2 + 36 - 2x^2$$

$$= x^4 - 15x^2 + 36$$

$$= x^4 - 12x^2 - 3x^2 + 36$$

$$= x^2(x^2 - 12) - 3(x^2 - 12)$$

$$= (x^2 - 12)(x^2 - 3)$$

$$= [(x)^2 - (\sqrt{12})^2] [(x)^2 - (\sqrt{3})^2]$$

$$= (x + \sqrt{12})(x - \sqrt{12})(x + \sqrt{3})(x - \sqrt{3})$$

MORE!!!



Class: 9

Exercise : 4.3

Question : 1

Q:1 Factorize the following:

i. $(x^2 - 4x - 5)(x^2 - 4x - 12) - 144$

Solution:

$$= (x^2 - 4x - 5)(x^2 - 4x - 12) - 144$$

$$\text{Let } x^2 - 4x = t$$

$$= (t - 5)(t - 12) - 144$$

$$= t^2 - 12t - 5t + 60 - 144$$

$$= t^2 - 17t - 84$$

$$= t^2 - 21t + 4t - 84 \quad (\text{By factorizing})$$

$$= t(t - 21) + 4(t - 21)$$

$$= (t - 21)(t + 4)$$

$$= (t + 4)(t - 21)$$

$$= (x^2 - 4x + 4)(x^2 - 4x - 21)$$

$$\begin{array}{r} t^2 - 84 = -84t^2 \\ +4 \quad \begin{array}{r} 2 \mid 84 \\ \underline{42} \\ 21 \\ 7 \mid 21 \\ \underline{21} \\ 0 \end{array} \end{array}$$

FOR MORE!!!



Class : 9

Exercise : 4.3

Question : 1

Q1: Factorize the following:

ii. $(x^2 + 5x + 6)(x^2 + 5x + 4) - 3$

Solution:

$$= (x^2 + 5x + 6)(x^2 + 5x + 4) - 3$$

$$\text{Let } t = (x^2 + 5x)$$

$$= (t + 6)(t + 4) - 3$$

$$= t^2 + 4t + 6t + 24 - 3$$

$$= t^2 + 10t + 21$$

$$= t^2 + 7t + 3t + 21 \text{ (By factorizing)}$$

$$= t(t + 7) + 3(t + 7)$$

$$= (t + 7)(t + 3)$$

$$= (t + 3)(t + 7)$$

$$= (x^2 + 5x + 3)(x^2 + 5x + 7) \text{ Ans}$$

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Class : 9

Exercise : 4.3

Question : 1

Q1: Factorize the following:

iii. $(x^2 - 2x + 3)(x^2 - 2x + 4) - 42$

Solution:

$$= (x^2 - 2x + 3)(x^2 - 2x + 4) - 42$$

$$\text{Let } x^2 - 2x = t$$

$$= (t + 3)(t + 4) - 42$$

$$= t^2 + 4t + 3t + 12 - 42$$

$$= t^2 + 7t - 30$$

$$= t^2 + 10t - 3t - 30$$

$$= t(t + 10) - 3(t + 10)$$

$$= (t + 10)(t - 3)$$

$$= (t - 3)(t + 10)$$

$$= (x^2 - 2x - 3)(x^2 - 2x + 10) \quad \text{Ans}$$

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$$t^2 + 7t - 30 = +30t^2$$
$$+10-3 \left(\begin{array}{r} 2 \mid 30 \\ 3 \mid 15 \\ 5 \mid 5 \\ 5 \mid 1 \end{array} \right)$$



Class : 9

Exercise : 4.3

Question : 1

Q1: Factorize the following:

iv. $(x^2 - 8x + 4)(x^2 - 8x - 4) + 15$

Solution:

$$= (x^2 - 8x + 4)(x^2 - 8x - 4) + 15$$

$$\text{Let } t = x^2 - 8x$$

$$= (t + 4)(t - 4) + 15$$

$$= t^2 - 4t + 4t - 16 + 15$$

$$= t^2 - 1$$

$$= (t)^2 - (1)^2$$

$$= (t + 1)(t - 1)$$

$$= (x^2 - 8x + 1)(x^2 - 8x - 1) \text{ Ans}$$

$$a^2 - b^2 = (a + b)(a - b)$$

FOR MORE!!!



Class : 9

Exercise : 4.3

Question : 1

Q1: Factorize the following :

v. $(x^2 + 9x - 1)(x^2 + 9x + 5) - 7$

Solution :

$$= (x^2 + 9x - 1)(x^2 + 9x + 5) - 7$$

$$\text{Let } t = x^2 + 9x$$

$$= (t - 1)(t + 5) - 7$$

$$= t^2 + 5t - t - 5 - 7$$

$$= t^2 + 4t - 12$$

$$= t^2 + 6t - 2t - 12$$

$$= t(t + 6) - 2(t + 6)$$

$$= (t + 6)(t - 2)$$

$$= (t - 2)(t + 6)$$

$$= (x^2 + 9x - 2)(x^2 + 9x + 6) \quad \text{Ans}$$

$$\begin{array}{r} t^2 + 4t - 12 = 12t^2 \\ 2 \quad 2 \mid 12 \\ \underline{6} \quad 6 \\ 6 \quad 3 \mid 3 \\ \underline{1} \end{array}$$



$$\therefore t = x^2 + 9x$$



Class : 9

Exercise : 4.3

Question : 1

Q1: Factorize the following:

vi. $(x^2 - 5x + 4)(x^2 - 5x + 6) - 120$

Solution:

$$= (x^2 - 5x + 4)(x^2 - 5x + 6) - 120$$

$$\text{Let } t = x^2 - 5x$$

$$= (t + 4)(t + 6) - 120$$

$$= t^2 + 6t + 4t + 24 - 120$$

$$= t^2 + 10t - 96$$

$$= t^2 + 16t - 6t - 96$$

$$= t(t + 16) - 6(t + 16)$$

$$= (t + 16)(t - 6)$$

$$= (t - 6)(t + 16)$$

$$= (x^2 - 5x - 6)(x^2 - 5x + 16) \quad \text{Ans}$$

$$\begin{array}{r} t^2 x - 96 = -96t^2 \\ 2 \overline{) 96} \\ 48 \\ 24 \\ 12 \\ 6 \\ 3 \\ 1 \end{array}$$



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Class : 9

Exercise : 4.3

Question : 2

Q2: Factorize:

i. $(x+1)(x+2)(x+3)(x+4) - 48$

Solution :

$$= (x+1)(x+2)(x+3)(x+4) - 48$$

$$= (x+1)(x+4)(x+2)(x+3) - 48$$

$$= (x^2 + 4x + x + 4)(x^2 + 3x + 2x + 6) - 48$$

$$= (x^2 + 5x + 4)(x^2 + 5x + 6) - 48$$

$$\text{Let } t = x^2 + 5x$$

$$= (t+4)(t+6) - 48$$

$$= t^2 + 6t + 4t + 24 - 48$$

$$= t^2 + 10t - 24$$

$$= t^2 + 12t - 2t - 24$$

$$= t(t+12) - 2(t+12)$$

$$= (t+12)(t-2)$$

$$= (t-2)(t+12)$$

$$= (x^2 + 5x - 2)(x^2 + 5x + 12) \quad \text{Ans}$$



Class : 9

Exercise : 4.3

Question : 2

Q2: Factorize :

ii- $(x+2)(x+3)(x+4)(x+5) + 24$

Solution :

$$= (x+2)(x+3)(x+4)(x+5) + 24$$

$$= (x+2)(x+5)(x+3)(x+4) + 24$$

$$= (x^2 + 5x + 2x + 10)(x^2 + 4x + 3x + 12) + 24$$

$$= (x^2 + 7x + 10)(x^2 + 7x + 12) + 24$$

$$\text{Let } x^2 + 7x = t$$

$$= (t+10)(t+12) + 24$$

$$= t^2 + 12t + 10t + 120 + 24$$

$$= t^2 + 22t + 144$$

$$= \text{No factors :}$$

MORE!!!



Class : 9

Exercise : 4.3

Question : 2

Q2: Factorize :

iii. $(x-1)(x-2)(x-3)(x-4) - 99$

Solution :

$$= (x-1)(x-2)(x-3)(x-4) - 99$$

$$= (x-1)(x-4)(x-2)(x-3) - 99$$

$$= (x^2 - 4x - x + 4)(x^2 - 3x - 2x + 6) - 99$$

$$= (x^2 - 5x + 4)(x^2 - 5x + 6) - 99$$

$$\text{Let } t = x^2 - 5x$$

$$= (t+4)(t+6) - 99$$

$$= t^2 + 6t + 4t + 24 - 99$$

$$= t^2 + 10t - 75$$

$$= t^2 + 15t - 5t - 75$$

$$= t(t+15) - 5(t+15)$$

$$= (t+15)(t-5)$$

$$= (t-5)(t+15)$$

$$= (x^2 - 5x - 5)(x^2 - 5x + 15)$$



Class : 9

Exercise : 4.3

Question : 2

Q2: Factorize :-

$$\text{iv. } (x-3)(x-5)(x-7)(x-9) + 15$$

Solution :

$$= (x-3)(x-5)(x-7)(x-9) + 15$$

$$= (x-3)(x-9)(x-5)(x-7) + 15$$

$$= (x^2 - 9x - 3x + 27)(x^2 - 7x - 5x + 35) + 15$$

$$= (x^2 - 12x + 27)(x^2 - 12x + 35) + 15$$

$$\text{Let: } x^2 - 12x = t$$

$$= (t + 27)(t + 35) + 15$$

$$= t^2 + 35t + 27t + 945 + 15$$

$$= t^2 + 62t + 960$$

$$= t^2 + 32t + 30t + 960$$

$$= t(t + 32) + 30(t + 32)$$

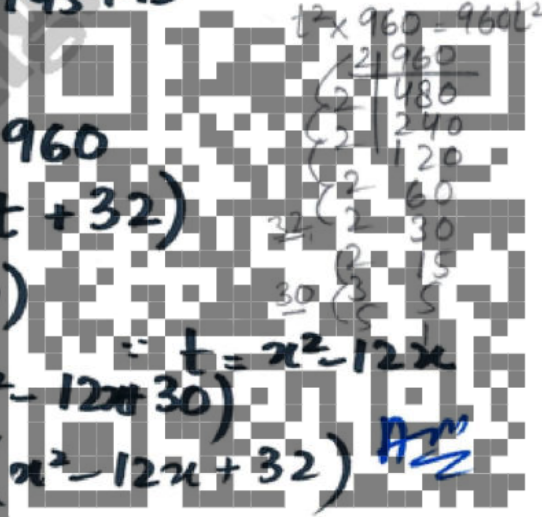
$$= (t + 32)(t + 30)$$

$$= (x^2 - 12x + 32)(x^2 - 12x + 30)$$

$$= (x^2 - 12x + 30)(x^2 - 12x + 32)$$

$$t = x^2 - 12x$$

Ans



Handwritten calculations for the factorization of $t^2 + 62t + 960$:

$$t^2 \times 960 = 960t^2$$

$$\begin{array}{r} 12 \overline{) 960} \\ \underline{24} \\ 72 \\ \underline{60} \\ 120 \\ \underline{120} \\ 0 \end{array}$$

$$\begin{array}{r} 30 \overline{) 960} \\ \underline{90} \\ 60 \\ \underline{60} \\ 0 \end{array}$$


Class: 9

Exercise : 4.3

Question : 2

Q2: Factorize :

$$v. (x-1)(x-2)(x-3)(x-4) - 224$$

Solution :

$$= (x-1)(x-2)(x-3)(x-4) - 224$$

$$= (x-1)(x-4)(x-2)(x-3) - 224$$

$$= (x^2 - 4x - x + 4)(x^2 - 3x - 2x + 6) - 224$$

$$= (x^2 - 5x + 4)(x^2 - 5x + 6) - 224$$

$$\text{Let } x^2 - 5x = t$$

$$= (t+4)(t+6) - 224$$

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$$= t^2 + 6t + 4t + 24 - 224$$

$$= t^2 + 10t - 200$$

$$= t^2 + 20t - 10t - 200$$

$$= t(t+20) - 10(t+20)$$

$$= (t+20)(t-10)$$

$$= (t-10)(t+20) \quad \because t = x^2 - 5x$$

$$= (x^2 - 5x - 10)(x^2 - 5x + 20)$$

Ans



Class : 9

Exercise : 4.3

Question : 2

Q2- Factorize :

vi- $(x-2)(x-3)(x-4)(x-5) - 255$

Solution :

$$= (x-2)(x-3)(x-4)(x-5) - 255$$

$$= (x-2)(x-5)(x-3)(x-4) - 255$$

$$= (x^2 - 5x - 2x + 10)(x^2 - 4x - 3x + 12) - 255$$

$$= (x^2 - 7x + 10)(x^2 - 7x + 12) - 255$$

$$\text{Let } x^2 - 7x = t$$

$$= (t + 10)(t + 12) - 255$$

$$= t^2 + 12t + 10t + 120 - 255$$

$$= t^2 + 22t - 135$$

$$= t^2 + 27t - 5t - 135$$

$$= t(t + 27) - 5(t + 27)$$

$$= (t + 27)(t - 5)$$

$$= (t - 5)(t + 27)$$

$$= (x^2 - 7x - 5)(x^2 - 7x + 27)$$



Class : 9

Exercise : 4.3

Question : 3

Q3: Find the factors of:

i. $(x-2)(x-3)(x+2)(x+3) - 2x^2$

Solution:

$$= (x-2)(x+2)(x-3)(x+3) - 2x^2$$

$$\therefore (a+b)(a-b) = a^2 - b^2$$

$$= (x^2 - 2^2)(x^2 - 3^2) - 2x^2$$

$$= (x^2 - 4)(x^2 - 9) - 2x^2$$

$$= (x^4 - 9x^2 - 4x^2 + 36 - 2x^2)$$

$$= (x^4 - 13x^2 + 36 - 2x^2)$$

$$= (x^4 - 15x^2 + 36)$$

$$= x^4 - 12x^2 - 3x^2 + 36$$

$$= x^2(x^2 - 12) - 3(x^2 - 12)$$

$$= (x^2 - 12)(x^2 - 3)$$

$$= [x^2 - (\sqrt{12})^2][x^2 - (\sqrt{3})^2]$$

$$= [x^2 - (2\sqrt{3})^2][x^2 - (\sqrt{3})^2] \therefore a^2 - b^2 = (a+b)(a-b)$$

$$= (x + 2\sqrt{3})(x - 2\sqrt{3})(x + \sqrt{3})(x - \sqrt{3})$$

$$x^4 \times 36 = 36x^4$$

$$\begin{array}{r} 12 \\ 3 \end{array} \left(\begin{array}{r} 2 \\ 2 \end{array} \right) \begin{array}{r} 36 \\ 18 \\ 9 \\ 3 \\ 1 \end{array}$$



Class : 9

Exercise : 4.3

Question : 3

Q3: Find the factors of:

ii- $(x-1)(x+1)(x+3)(x-3) - 3x^2 - 23$

Solution:

$$= (x-1)(x+1)(x+3)(x-3) - 3x^2 - 23 \quad \because (a+b)(a-b) = a^2 - b^2$$

$$= (x^2 - 1^2)(x^2 - 3^2) - 3x^2 - 23$$

$$= (x^2 - 1)(x^2 - 9) - 3x^2 - 23$$

$$= x^4 - 9x^2 - x^2 + 9 - 3x^2 - 23$$

$$= x^4 - 13x^2 - 14$$

$$= x^4 - 14x^2 + x^2 - 14$$

$$= x^2(x^2 - 14) + 1(x^2 - 14)$$

$$= (x^2 - 14)(x^2 + 1)$$

$$= (x^2 + 1)(x^2 - 14)$$

$$= (x^2 + 1)[x^2 - (\sqrt{14})^2]$$

$$= (x^2 + 1)(x + \sqrt{14})(x - \sqrt{14})$$

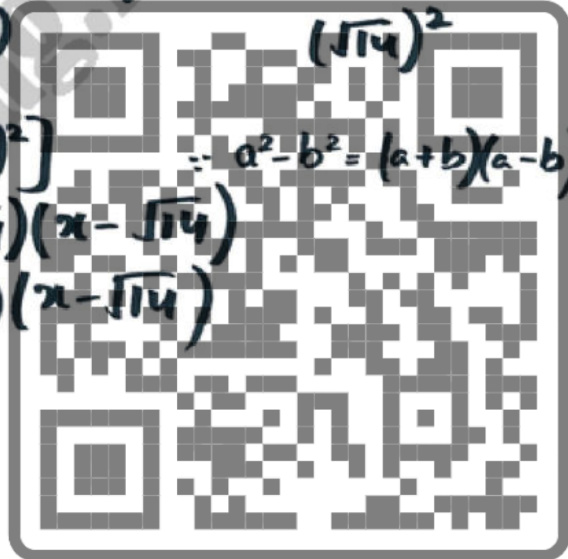
$$= (x^2 + 1)(x + \sqrt{14})(x - \sqrt{14})$$

$$x^4 x - 14 = 14x^4$$

$$\begin{array}{r} 14 \overline{) 214} \\ 28 \\ \hline 14 \\ 14 \\ \hline 0 \end{array}$$

$$(\sqrt{14})^2$$

$$\because a^2 - b^2 = (a+b)(a-b)$$



Class : 9

Exercise : 4.3

Question : 3

Q3: Find the factors of:

iii- $(x-1)(x+1)(x-3)(x+3) + 4x^2$

Solution:

$$= (x-1)(x+1)(x-3)(x+3) + 4x^2$$

$$\therefore (a-b)(a+b) = a^2 - b^2$$

$$= (x^2 - 1^2)(x^2 - 3^2) + 4x^2$$

$$= (x^2 - 1)(x^2 - 9) + 4x^2$$

$$= x^4 - 9x^2 - x^2 + 9 + 4x^2$$

$$= x^4 - 10x^2 + 9 + 4x^2$$

$$= x^4 - 6x^2 + 9$$

$$= x^4 - 3x^2 - 3x^2 + 9$$

$$= x^2(x^2 - 3) - 3(x^2 - 3)$$

$$= (x^2 - 3)(x^2 - 3)$$

$$= (x^2 - 3)^2$$

MORE!!!



Class: 9

Exercise: 4.3

Question: 3

Q3: Find the factors of:

iv. $(x-2)(x+2)(x-4)(x+4) - 14x^2$

Solution:

$$= (x-2)(x+2)(x-4)(x+4) - 14x^2 \quad \therefore (a-b)(a+b) = a^2 - b^2$$

$$= (x^2 - 2^2)(x^2 - 4^2) - 14x^2$$

$$= (x^2 - 4)(x^2 - 16) - 14x^2$$

$$= x^4 - 16x^2 - 4x^2 + 64 - 14x^2$$

$$= x^4 - 20x^2 + 64 - 14x^2$$

$$= x^4 - 34x^2 + 64$$

$$= x^4 - 32x^2 - 2x^2 + 64$$

$$= x^2(x^2 - 32) - 2(x^2 - 32)$$

$$= (x^2 - 32)(x^2 - 2)$$

$$= [x^2 - (\sqrt{32})^2] [(x)^2 - (\sqrt{2})^2]$$

$$= [(x)^2 - (4\sqrt{2})^2] [(x)^2 - (\sqrt{2})^2]$$

$$= (x + 4\sqrt{2})(x - 4\sqrt{2})(x + \sqrt{2})(x - \sqrt{2})$$

$$x^4 \times 64 = 64x^4$$

$$\begin{array}{r} 2 \overline{) 64} \\ 4 \\ \underline{4} \\ 24 \\ 20 \\ \underline{4} \\ 4 \\ 2 \\ \underline{2} \\ 0 \end{array}$$

$$\left. \begin{array}{l} (\sqrt{32})^2, (2) \\ a^2 - b^2 = (a+b)(a-b) \end{array} \right\}$$

$$\begin{array}{r} \sqrt{32} \\ 2 \overline{) 32} \\ 16 \\ \underline{16} \\ 0 \end{array}$$

$$\begin{array}{r} 2 \overline{) 2} \\ 1 \\ \underline{2} \\ 0 \end{array}$$



Class: 9 Exercise : 4.3 Question: 3

Q3: Find the factors of:

v. $(x+5)(x+2)(x-5)(x-2) + 4x^2$

Solution:

$$= (x+5)(x+2)(x-5)(x-2) + 4x^2$$

$$= (x+5)(x-5)(x+2)(x-2) + 4x^2$$

$$= (x^2 - 5^2)(x^2 - 2^2) + 4x^2$$

$$= (x^2 - 25)(x^2 - 4) + 4x^2$$

$$= x^4 - 4x^2 - 25x^2 + 100 + 4x^2$$

$$= x^4 - 25x^2 + 100$$

$$= x^4 - 20x^2 - 5x^2 + 100$$

$$= x^2(x^2 - 20) - 5(x^2 - 20)$$

$$= (x^2 - 20)(x^2 - 5)$$

$$= (x^2 - 5)(x^2 - 20)$$

$$= [(x)^2 - (\sqrt{5})^2] [(x)^2 - (\sqrt{20})^2]$$

$$= (x + \sqrt{5})(x - \sqrt{5})(x + \sqrt{20})(x - \sqrt{20})$$

$$= (x + \sqrt{5})(x - \sqrt{5})(x + 2\sqrt{5})(x - 2\sqrt{5})$$

$$= (x + \sqrt{5})(x - \sqrt{5})(x + 2\sqrt{5})(x - 2\sqrt{5})$$

$$(a+b)(a-b) = a^2 - b^2$$

$$x^4 \times 100 = 100x^4$$

$$-20 \quad \begin{array}{r} 2 \overline{) 100} \\ \underline{4} \\ 20 \\ \underline{40} \\ 20 \\ \underline{40} \\ 0 \end{array}$$

$$-5 \quad \begin{array}{r} 5 \overline{) 25} \\ \underline{10} \\ 15 \\ \underline{15} \\ 0 \end{array}$$

$$a^2 - b^2 = (a+b)(a-b)$$

$$(\sqrt{5})^2$$

$$(\sqrt{20})^2$$

$$\begin{array}{r} 2 \overline{) 20} \\ \underline{4} \\ 16 \\ \underline{16} \\ 0 \end{array}$$

$$\begin{array}{r} 5 \overline{) 25} \\ \underline{10} \\ 15 \\ \underline{15} \\ 0 \end{array}$$

$$\begin{array}{r} 2 \overline{) 20} \\ \underline{4} \\ 16 \\ \underline{16} \\ 0 \end{array}$$



Class: 9

Exercise : 4.3

Question : 3

Q3: Find the factors of:

vi- $(x^2 - x - 12)(x^2 - x - 12) - x^2$

Solution:

$$= (x^2 - x - 12)(x^2 - x - 12) - x^2$$

$$\therefore a^m \times a^n = a^{m+n}$$

$$= (x^2 - x - 12)^2 - x^2$$

$$= \left(\frac{x^2 - x - 12}{a} \right)^2 - \left(\frac{x}{b} \right)^2$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= (x^2 - x - 12 + x)(x^2 - x - 12 - x)$$

$$= (x^2 - 12)(x^2 - 2x - 12)$$

Ans

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Class : 9

Exercise : 4.4

Examples :

Example 1 :

i. $8x^3 + 12x^2y + 6xy^2 + y^3$

Solution:

$$= 8x^3 + 12x^2y + 6xy^2 + y^3$$
$$= (2^3x^3) + 12x^2y + 6xy^2 + (y)^3$$

$$= (2x)^3 + 3(2x)^2(y) + 3(2x)(y)^2 + (y)^3$$

$$\therefore (a^3 + 3a^2b + 3ab^2 + b^3) = (a+b)^3$$

$$= (2x + y)^3 \quad \underline{\underline{\text{Ans}}}$$

$$2 \times 2 \times 2 = 2^3 = 8$$

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Example 2 :

ii. $64x^3 - 12x^2 + \frac{3x}{4} - \frac{1}{64}$

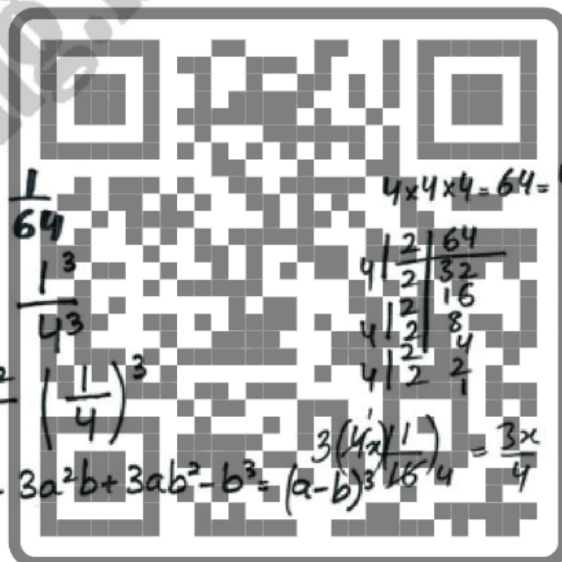
Solution:

$$= (4^3x^3) - 12x^2 + \frac{3x}{4} - \frac{1}{4^3}$$

$$= (4x)^3 - 3(4x)^2\left(\frac{1}{4}\right) + 3(4x)\left(\frac{1}{4}\right)^2 - \left(\frac{1}{4}\right)^3$$

$$\therefore a^3 - 3a^2b + 3ab^2 - b^3 = (a-b)^3$$

$$= \left(4x - \frac{1}{4}\right)^3 \quad \underline{\underline{\text{Ans}}}$$



Class : 9

Exercise : 4.4

Question : 1

Q1: Factorize the following:

i. $b^3 + 3b^2c + 3bc^2 + c^3$

Solution:

$$\begin{aligned}
 &= b^3 + 3b^2c + 3bc^2 + c^3 \\
 &= (b)^3 + 3(b)^2(c) + 3(b)(c)^2 + (c)^3 \\
 &\therefore a^3 + 3a^2b + 3ab^2 + b^3 = (a+b)^3 \\
 &= (b+c)^3
 \end{aligned}$$

ii. $8x^3 + 12x^2y + 6xy^2 + y^3$

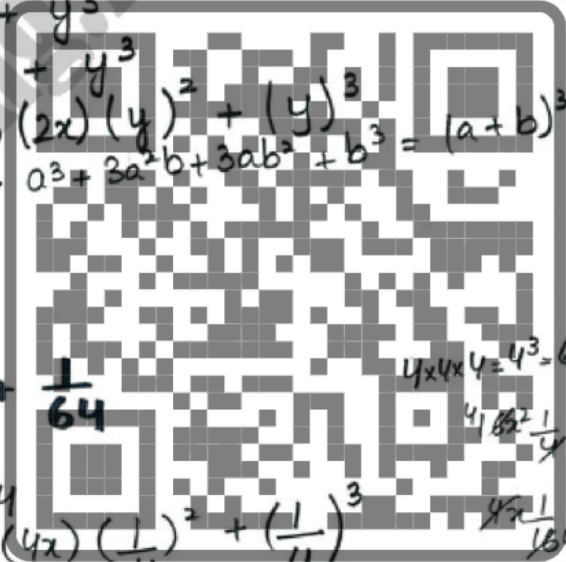
Solution:

$$\begin{aligned}
 &= 8x^3 + 12x^2y + 6xy^2 + y^3 \\
 &= (2x)^3 + 3(2x)^2(y) + 3(2x)(y)^2 + (y)^3 \\
 &\therefore a^3 + 3a^2b + 3ab^2 + b^3 = (a+b)^3 \\
 &= (2x+y)^3
 \end{aligned}$$

iii. $64x^3 + 12x^2 + \frac{3x}{4} + \frac{1}{64}$

Solution:

$$\begin{aligned}
 &= 64x^3 + 12x^2 + \frac{3x}{4} + \frac{1}{64} \\
 &= (4x)^3 + 3(4x)^2\left(\frac{1}{4}\right) + 3(4x)\left(\frac{1}{4}\right)^2 + \left(\frac{1}{4}\right)^3 \\
 &\therefore a^3 + 3a^2b + 3ab^2 + b^3 = (a+b)^3 \\
 &= \left(4x + \frac{1}{4}\right)^3
 \end{aligned}$$



Class : 9

Exercise : 4.4

Question : 1

Q1: Factorization the following:

iv. $8x^3 + 36x^2 + 54x + 27$

Solution:

$$\begin{aligned}
 &= 8x^3 + 36x^2 + 54x + 27 \\
 &= 2^3x^3 + 36x^2 + 54x + 3^3 \\
 &= (2x)^3 + 3(2x)^2(3) + 3(2x)(3)^2 + (3)^3 \\
 &\quad \therefore a^3 + 3a^2b + 3ab^2 + b^3 = (a+b)^3 \\
 &= (2x + 3)^3
 \end{aligned}$$

v. $\frac{1}{27} + \frac{1}{3}y^2 + y^4 + y^6$

$(y^2)^3$

Solution:

$$\begin{aligned}
 &= \frac{1}{27} + \frac{1}{3}y^2 + y^4 + y^6 \\
 &= \left(\frac{1}{3}\right)^3 + 3\left(\frac{1}{3}\right)^2(y^2) + 3\left(\frac{1}{3}\right)(y^2)^2 + (y^2)^3 \\
 &\quad \therefore a^3 + 3a^2b + 3ab^2 + b^3 = (a+b)^3 \\
 &= \left(\frac{1}{3} + y^2\right)^3
 \end{aligned}$$

vi. $\frac{8}{27}x^3 + 2x^2y + \frac{9}{2}xy^2 + \frac{27}{8}y^3$

Solution:

$$\begin{aligned}
 &= \frac{8}{27}x^3 + 2x^2y + \frac{9}{2}xy^2 + \frac{27}{8}y^3 \\
 &= \left(\frac{2}{3}x\right)^3 + 3\left(\frac{2}{3}x\right)^2\left(\frac{3}{2}y\right) + 3\left(\frac{2}{3}x\right)\left(\frac{3}{2}y\right)^2 + \left(\frac{3}{2}y\right)^3 \\
 &\quad \therefore a^3 + 3a^2b + 3ab^2 + b^3 = (a+b)^3 \\
 &= \left(\frac{2}{3}x + \frac{3}{2}y\right)^3
 \end{aligned}$$



Class: 9

Exercise : 4.4

Question: 1

Q:1 Factorize the following:

vii- $\frac{64}{27} + \frac{16}{3}x^2 + 4x^2 + x^3$

Solution:

$$= \frac{64}{27} + \frac{16}{3}x^2 + 4x^2 + x^3$$

$$= \left(\frac{4}{3}\right)^3 + 3\left(\frac{4}{3}\right)^2(x) + 3\left(\frac{4}{3}\right)(x)^2 + (x)^3$$

$\therefore a^3 + 3a^2b + 3ab^2 + b^3 = (a+b)^3$

$$= \left(\frac{4}{3} + x\right)^3$$

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viii- $\frac{z^3}{8} + \frac{z^2y}{4} + \frac{zy^2}{6} + \frac{y^3}{27}$

Solution:

$$= \frac{z^3}{8} + \frac{z^2y}{4} + \frac{zy^2}{6} + \frac{y^3}{27}$$

$$= \left(\frac{z}{2}\right)^3 + 3\left(\frac{z}{2}\right)^2\left(\frac{y}{3}\right) + 3\left(\frac{z}{2}\right)\left(\frac{y}{3}\right)^2 + \left(\frac{y}{3}\right)^3$$

$\therefore a^3 + 3a^2b + 3ab^2 + b^3 = (a+b)^3$

$$= \left(\frac{z}{2} + \frac{y}{3}\right)^3$$



Class : 9

Exercise : 4.4

Question : 2

Q:2 Find the factors of:

i. $d^3 - 6d^2c + 12dc^2 - 8c^3$

Solution:

$$\begin{aligned} &= d^3 - 6d^2c + 12dc^2 - 8c^3 \\ &= (d)^3 - 3(d)^2(2c) + 3(d)(2c)^2 - (2c)^3 \\ &\therefore a^3 - 3a^2b + 3ab^2 - b^3 = (a-b)^3 \\ &= (d - 2c)^3 \end{aligned}$$

ii. $x^6 + \frac{16}{3}x^2 - 4x^4 - \frac{64}{27}$

Solution:

$$\begin{aligned} &= x^6 + \frac{16}{3}x^4 - 4x^4 - \frac{64}{27} = x^6 - 4x^4 + \frac{16}{3}x^2 - \frac{64}{27} \\ &= (x^2)^3 - 3(x^2)^2\left(\frac{4}{3}\right) + 3(x^2)\left(\frac{4}{3}\right)^2 - \left(\frac{4}{3}\right)^3 \\ &\therefore a^3 - 3a^2b + 3ab^2 - b^3 = (a-b)^3 \\ &= \left(x^2 - \frac{4}{3}\right)^3 \end{aligned}$$

iii. $\frac{x^3}{125} + \frac{3}{25}x^2y - \frac{3}{36}xy^2 - y^3$

Solution:

$$\begin{aligned} &= \frac{x^3}{125} + \frac{3}{25}x^2y - \frac{3}{36}xy^2 - y^3 \\ &= \left(\frac{x}{5}\right)^3 - 3\left(\frac{x}{5}\right)^2(y) + 3\left(\frac{x}{5}\right)(y)^2 - (y)^3 \\ &\therefore a^3 - 3a^2b + 3ab^2 - b^3 = (a-b)^3 \\ &= \left(\frac{x}{5} - y\right)^3 \end{aligned}$$



Class : 9

Exercise : 4.4

Question : 2

Q2: Find the factors of:

iv. $125z^3 - 75z^2y^2 + 15zy^4 - y^6$

Solution:

$$\begin{aligned} &= (5z)^3 - 3(5z)^2(y^2) + 3(5z)(y^2)^2 - (y^2)^3 \\ &\therefore (a^3 - 3a^2b + 3ab^2 - b^3) = (a-b)^3 \\ &= (5z - y^2)^3 \quad \underline{\text{Ans}} \end{aligned}$$

v. $\frac{z^3}{27} - 2z^2y + \overset{36}{1}zy^2 - 216y^3$

Solution:

$$\begin{aligned} &= \left(\frac{z}{3}\right)^3 - 3\left(\frac{z}{3}\right)^2(6y) + 3\left(\frac{z}{3}\right)(6y)^2 - (6y)^3 \\ &\therefore a^3 - 3a^2b + 3ab^2 - b^3 = (a-b)^3 \\ &= \left(\frac{z}{3} - 6y\right)^3 \end{aligned}$$

vi. $\frac{b^6}{27} - \frac{b^4c^2}{6} + \frac{b^2c^4}{4} - \frac{c^6}{8}$

Solution:

$$\begin{aligned} &= \left(\frac{b^2}{3}\right)^3 - 3\left(\frac{b^2}{3}\right)^2\left(\frac{c^2}{2}\right) + 3\left(\frac{b^2}{3}\right)\left(\frac{c^2}{2}\right)^2 - \left(\frac{c^2}{2}\right)^3 \\ &\therefore a^3 - 3a^2b + 3ab^2 - b^3 = (a-b)^3 \\ &= \left(\frac{b^2}{3} - \frac{c^2}{2}\right)^3 \end{aligned}$$



Class : 9 Exercise : 4.4

Question : 2

Q2: Find the factors of:

vii. $216 + \frac{9}{2}z^2 - 54z - \frac{z^3}{8}$

Solution:

$$\begin{aligned}
 &= \cancel{(6)^3} - \cancel{3} \left(\cancel{6}^2 \right) \left(\frac{z}{2} \right) + 3 \left(\cancel{6} \right) \left(\frac{z}{2} \right)^2 - \left(\frac{z}{2} \right)^3 \\
 &= 216 - 54z + \frac{9}{2}z^2 - \frac{z^3}{8} \\
 &= (6)^3 - 3(6)^2\left(\frac{z}{2}\right) + 3(6)\left(\frac{z}{2}\right)^2 - \left(\frac{z}{2}\right)^3 \\
 &= \left(6 - \frac{z}{2}\right)^3 \quad \because a^3 - 3a^2b + 3ab^2 - b^3 = (a-b)^3
 \end{aligned}$$

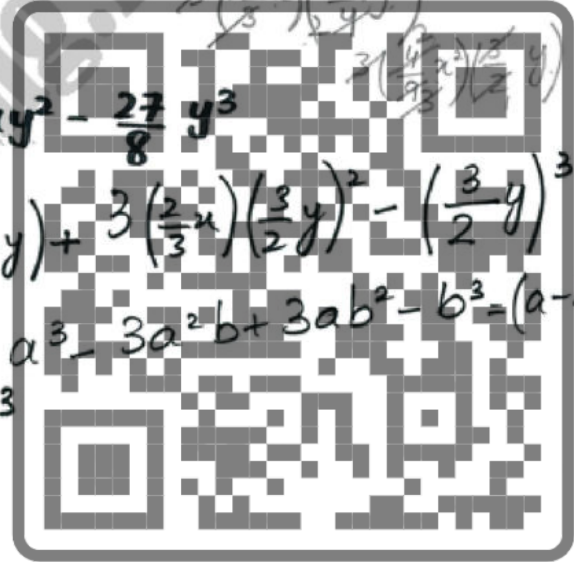
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viii. $\frac{8}{27}x^3 - 2x^2y + \frac{9}{2}xy^2 - \frac{27}{8}y^3$

Solution:

$$\begin{aligned}
 &= \left(\frac{2}{3}x\right)^3 - 3\left(\frac{2}{3}x\right)^2\left(\frac{3}{2}y\right) + 3\left(\frac{2}{3}x\right)\left(\frac{3}{2}y\right)^2 - \left(\frac{3}{2}y\right)^3 \\
 &= \left(\frac{2}{3}x - \frac{3}{2}y\right)^3 \quad \because a^3 - 3a^2b + 3ab^2 - b^3 = (a-b)^3
 \end{aligned}$$



Formula:

$$a^3 + 3a^2b + 3ab^2 + b^3 = (a+b)^3$$

$$a^3 - 3a^2b + 3ab^2 - b^3 = (a-b)^3$$

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Class : 9

Exercise : 4.5

Examples :

Examples :

TYPE VI : $a^3 \pm b^3$

$$\text{i. } a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$\text{ii. } a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

Example 1 :

Factorize $8x^3 + 27$

Solution :

$$= 8x^3 + 27$$

$$= (2x)^3 + (3)^3$$

$$\therefore a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$= (2x+3)[(2x)^2 - (2x)(3) + (3)^2]$$

$$= (2x+3)(4x^2 - 6x + 9) \text{ Ans}$$

$$= 8x^3 + 27 = (2x+3)(4x^2 - 6x + 9)$$

Example 2 :

Factor of $108x^4 - 256xz^3$

Solution :

$$= 2x(54x^3 - 128z^3)$$

$$= 2 \times 2x(27x^3 - 64z^3)$$

$$= 4x[(3x)^3 - (4z)^3]$$

$$\therefore a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$= 4x(3x-4z)[(3x)^2 + (3x)(4z) + (4z)^2]$$

$$= 4x(3x-4z)(9x^2 + 12xz + 16z^2)$$

$$= 4x(3x-4z)(9x^2 + 12xz + 16z^2)$$



Class : 9 Exercise : 4.5

Question : 1

Q1: Factorize the following:

i. $x^3 + 8y^3$

Solution:

$$a = x$$

$$b = 2y$$

$$= x^3 + 8y^3$$

$$= (x)^3 + (2y)^3$$

$$\therefore (a^3 + b^3) = (a+b)(a^2 - ab + b^2)$$

$$= (x + 2y) [(x)^2 - (x)(2y) + (2y)^2]$$

$$= (x + 2y) (x^2 - 2xy + 4y^2)$$

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ii. $a^{11} + a^2 b^9$

Solution:

$$= a^{11} + a^2 b^9$$

$$= a^2 (a^9 + b^9)$$

$$= a^2 [(a^3)^3 + (b^3)^3]$$

$$a = a^3$$

$$b = b^3$$

$$\therefore a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$= a^2 (a^3 + b^3) [(a^3)^2 - (a^3)(b^3) + (b^3)^2]$$

$$= a^2 (a^3 + b^3) (a^6 - a^3 b^3 + b^9)$$

$$= a^2 [(a)^3 + (b)^3] (a^6 - a^3 b^3 + b^9)$$

$$= a^2 [(a+b)(a^2 - (a)(b) + (b)^2)] (a^6 - a^3 b^3 + b^9)$$

$$= a^2 (a+b) (a^2 - ab + b^2) (a^6 - a^3 b^3 + b^9)$$

Ans



Class : 9

Exercise : 4.5

Question : 1

Q1: Factorize the following:

iii. $a^6 + 1$

Solution:

$$\begin{aligned} &= (a^2)^3 + (1)^3 \\ &= (a^2 + 1) [(a^2)^2 - (a^2)(1) + (1)^2] \end{aligned}$$

$a = a^2$
 $b = 1$
 $\therefore (a^3 + b^3) = (a + b)(a^2 - ab + b^2)$

$$= (a^2 + 1)(a^4 - a^2 + 1)$$

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iv. $a^3 b^3 + 512$

Solution:

$$= a^3 b^3 + 512$$

$$= (ab)^3 + (8)^3$$

$$= (ab + 8) [(ab)^2 - (ab)(8) + (8)^2]$$

$$= (ab + 8)(a^2 b^2 - 8ab + 64)$$

$$8^3 = 512$$

$$a = ab$$
$$b = 8$$

$$\therefore a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$



Class : 9

Exercise : 4.5

Question : 1

Q1: Factorize the following :

v- $a^3b^3 + 27b^6$

Solution:

$$= a^3b^3 + 27b^6$$

$$= (ab)^3 + (3b^2)^3$$

$$= (ab + 3b^2) [(ab)^2 - (ab)(3b^2) + (3b^2)^2]$$

$$= (ab + 3b^2) (a^2b^2 - 3ab^3 + 9b^4)$$

$$= a^3b^3 + 27b^6$$

$$= b^3(a^3 + 27b^3)$$

$$= b^3(a^3 + (3b)^3)$$

$$= b^3(a + 3b) [(a)^2 - (a)(3b) + (3b)^2]$$

$$= b^3(a + 3b) (a^2 - 3ab + 9b^2)$$

vi- $\frac{x^3}{125} + \frac{125}{x^3}$

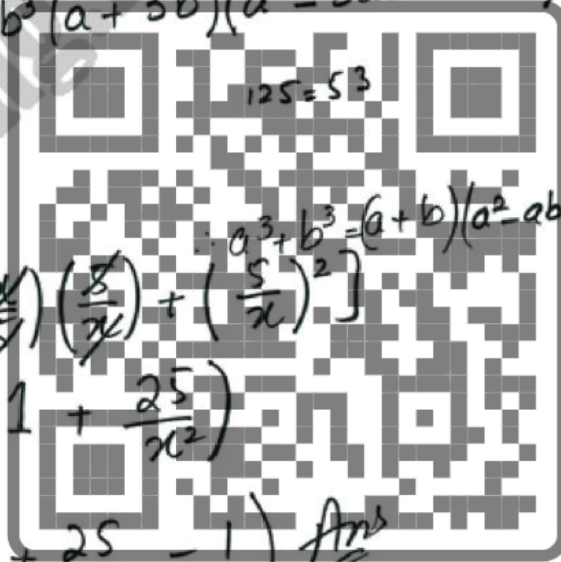
Solution:

$$= \left(\frac{x}{5}\right)^3 + \left(\frac{5}{x}\right)^3$$

$$= \left(\frac{x}{5} + \frac{5}{x}\right) \left[\left(\frac{x}{5}\right)^2 - \left(\frac{x}{5}\right)\left(\frac{5}{x}\right) + \left(\frac{5}{x}\right)^2\right]$$

$$= \left(\frac{x}{5} + \frac{5}{x}\right) \left(\frac{x^2}{25} - 1 + \frac{25}{x^2}\right)$$

$$= \left(\frac{x}{5} + \frac{5}{x}\right) \left(\frac{x^2}{25} + \frac{25}{x^2} - 1\right) \text{ Ans}$$



Class: 9

Exercise: 4.5

Question: 1

Q.1: Factorize the following:

vii. $x^9 + x^3y^6z^9$

Solution:

$$a = x^3$$

$$b = xy^2z^3$$

$$= (x^3)^3 + (xy^2z^3)^3$$

$$\therefore a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$= (x^3 + xy^2z^3) [(x^3)^2 - (x^3)(xy^2z^3) + (xy^2z^3)^2]$$

$$= (x^3 + xy^2z^3) [(x^6 - (x^4y^2z^3) + x^2y^4z^6)]$$

$$= (x^3 + xy^2z^3) (x^6 - x^4y^2z^3 + x^2y^4z^6)$$

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viii. $\frac{x^6}{27} + \frac{8}{x^3}$

Solution:

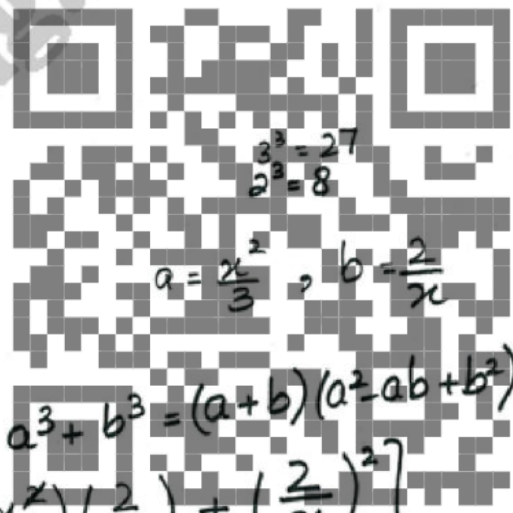
$$= \frac{(x^2)^3}{3^3} + \frac{2^3}{x^3}$$

$$= \left(\frac{x^2}{3}\right)^3 + \left(\frac{2}{x}\right)^3$$

$$\therefore a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$= \left(\frac{x^2}{3} + \frac{2}{x}\right) \left[\left(\frac{x^2}{3}\right)^2 - \left(\frac{x^2}{3}\right)\left(\frac{2}{x}\right) + \left(\frac{2}{x}\right)^2\right]$$

$$= \left(\frac{x^2}{3} + \frac{2}{x}\right) \left(\frac{x^4}{9} - \frac{2x}{3} + \frac{4}{x^2}\right) \text{ Ans}$$



Class : 9

Exercise : 4.5

Question : 2

Q2: Find the factors of:

i. $x^3 - 8y^3$

Solution:

$$a = x$$

$$b = 2y$$

$$= (x)^3 - 2^3 y^3$$

$$= (x)^3 - (2y)^3$$

$$\therefore a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$= (x - 2y) [(x)^2 + (x)(2y) + (2y)^2]$$

$$= (x - 2y)(x^2 + 2xy + 4y^2)$$

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ii. $x^9 - 8y^9$

Solution:

$$= (x^3)^3 - 2^3 y^9$$

$$= (x^3)^3 - (2y^3)^3$$

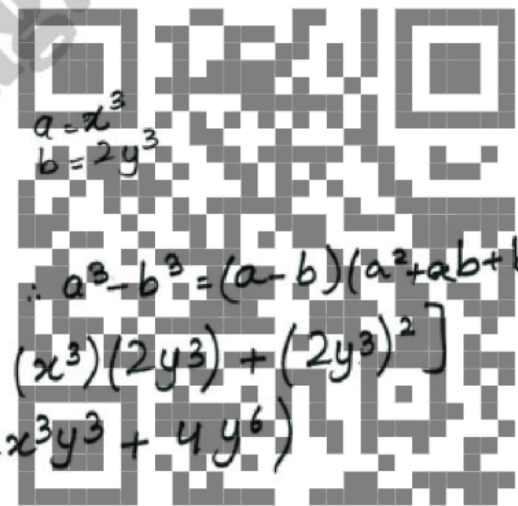
$$= (x^3 - 2y^3) [(x^3)^2 + (x^3)(2y^3) + (2y^3)^2]$$

$$= (x^3 - 2y^3)(x^6 + 2x^3y^3 + 4y^6)$$

$$a = x^3$$

$$b = 2y^3$$

$$\therefore a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$



Class : 9

Exercise : 4.5

Question : 2

Q:2 Find the factors of :

iii- $1000 - \frac{x^3y^3}{125}$

Solution:

$$= 1000 - \frac{x^3y^3}{125}$$

$$= (10)^3 - \frac{x^3y^3}{5^3}$$

$$= (10)^3 - \left(\frac{xy}{5}\right)^3$$

$$= \left(10 - \frac{xy}{5}\right) \left[(10)^2 + (10)\left(\frac{xy}{5}\right) + \left(\frac{xy}{5}\right)^2 \right]$$

$$= \left(10 - \frac{xy}{5}\right) \left(100 + 2xy + \frac{x^2y^2}{25}\right)$$

$$a = 10$$
$$b = \frac{xy}{5}$$

$$\therefore a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$10^3 = 1000$	2	1000
	2	500
10	2	250
10	5	125
10	5	25
	5	5

$$5^3 = 125$$
$$10^3 = 1000$$

iv- $a^6 - b^6$

Solution:

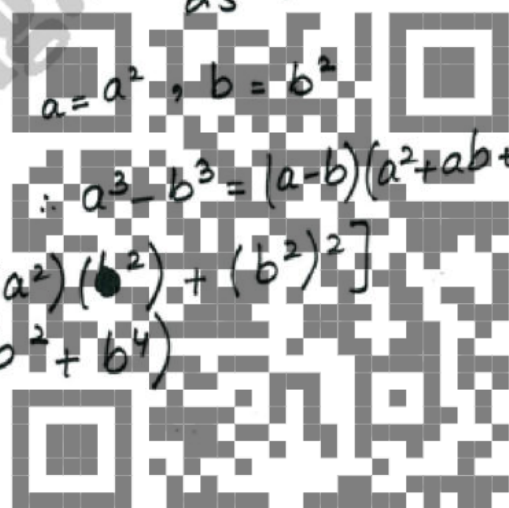
$$= (a^2)^3 - (b^2)^3$$

$$= (a^2 - b^2) \left[(a^2)^2 + (a^2)(b^2) + (b^2)^2 \right]$$

$$= (a^2 - b^2) (a^4 + a^2b^2 + b^4)$$

$$a = a^2, b = b^2$$

$$\therefore a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$



Class : 9 Exercise : 4.5

Question : 2

Q:2 Find the factors of:

v- $\frac{x^6}{64} - \frac{64}{x^{12}}$

Solution:

$$= \left(\frac{x^2}{4}\right)^3 - \left(\frac{4}{x^4}\right)^3$$

$$a = \frac{x^2}{4}, b = \frac{4}{x^4}$$

$$\therefore a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$= \left(\frac{x^2}{4} - \frac{4}{x^4}\right) \left[\left(\frac{x^2}{4}\right)^2 + \left(\frac{x^2}{4}\right)\left(\frac{4}{x^4}\right) + \left(\frac{4}{x^4}\right)^2\right]$$

$$= \left(\frac{x^2}{4} - \frac{4}{x^4}\right) \left(\frac{x^4}{16} + \frac{1}{x^2} + \frac{16}{x^8}\right)$$

$$\begin{array}{r|l} 2 & 64 \\ \hline 2 & 32 \\ 2 & 16 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ & 1 \end{array}$$

$$4^3 = (x^4)^3$$

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vi- $x^{12} - y^{12}$

Solution:

$$= x^{12} - y^{12}$$

$$= (x^4)^3 - (y^4)^3$$

$$= (x^4 - y^4) [(x^4)^2 + (x^4)(y^4) + (y^4)^2]$$

$$= (x^4 - y^4) (x^8 + x^4 y^4 + y^8)$$

$$= (x^4 - y^4) (x^8 + x^4 y^4 + y^8)$$



$$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$a = x^4, b = y^4$$



Class : 9

Exercise : 4.5

Question : 2

Q2: Find the factors of:

vii- $\frac{27}{x^3} - 8y^3$

Solution:

$a = \frac{3}{x}, b = 2y^2$

$= \frac{3^3}{x^3} - 2^3(y^2)^3$

$\therefore a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

$= \left(\frac{3}{x}\right)^3 - (2y^2)^3$

$= \left(\frac{3}{x} - 2y^2\right) \left[\left(\frac{3}{x}\right)^2 + \left(\frac{3}{x}\right)(2y^2) + (2y^2)^2\right]$

$= \left(\frac{3}{x} - 2y^2\right) \left(\frac{9}{x^2} + \frac{6y^2}{x} + 4y^4\right)$

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viii-

$8x^3 - \frac{1}{9}$

Solution:

$= 2^3(x^2)^3 - \frac{1^3}{9^3}$

$= (2x^2)^3 - \left(\frac{1}{9}\right)^3$

$= \left(2x^2 - \frac{1}{9}\right) \left[(2x^2)^2 + (2x^2)\left(\frac{1}{9}\right) + \left(\frac{1}{9}\right)^2\right]$

$= \left(2x^2 - \frac{1}{9}\right) \left[(4x^4) + \frac{2x^2}{9} + \frac{1}{81}\right]$

$= \left(2x^2 - \frac{1}{9}\right) \left(4x^4 + \frac{2x^2}{9} + \frac{1}{81}\right)$ Ans



$a = 2x^2, b = \frac{1}{9}$
 $\therefore a^3 - b^3 = (a-b)(a^2 + ab + b^2)$



Class : 9

Exercise : 4.6

Examples :

Example 1 :

Find the remainder when $x^2 - 3x + 4$ is divided by $x - 2$:

Solution :

$$P(x) = x^2 - 3x + 4$$

$$P(2) = (2)^2 - 3(2) + 4$$

$$P(2) = 4 - 6 + 4$$

$$P(2) = 8 - 6$$

$$P(2) = 2$$

$$\begin{aligned} \therefore x - 2 &= 0 \\ x &= 2 \end{aligned}$$

Thus, remainder is 2 Ans

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Example 2 :

Find the value of k , if the polynomial $x^3 + kx^2 + 3x - 4$ leaves a remainder -2 when divided by $x + 2$:

Solution :

$$P(x) = x^3 + kx^2 + 3x - 4$$

$$P(-2) = (-2)^3 + k(-2)^2 + 3(-2) - 4$$

$$-2 = -8 + k(4) - 6 - 4$$

$$-2 = -8 + 4k - 10$$

$$-2 = -18 + 4k$$

$$-2 + 18 = 4k$$

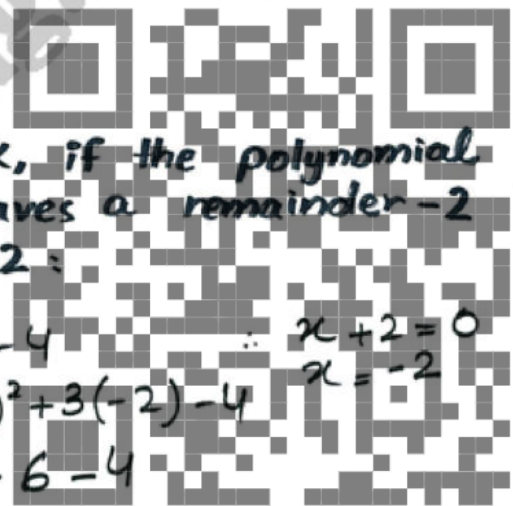
$$16 = 4k$$

$$4k = 16$$

$$k = \frac{16}{4}$$

$$\boxed{k = 4}$$

The value of k is
4 Ans



Class : 9

Exercise : 4.6

Example : 1

Example 1: Determine whether $x+2$ is a factor of $x^3 + \frac{9}{2}x^2 + 3x - 4$ or not:

Solution:

$$P(x) = x^3 + \frac{9}{2}x^2 + 3x - 4$$

$$\therefore R = P(a)$$

$$\begin{aligned} \therefore x+2 &= 0 \\ x &= -2 \end{aligned}$$

$$P(-2) = (-2)^3 + \frac{9}{2}(-2)^2 + 3(-2) - 4$$

$$P(-2) = -8 + 18 - 6 - 4$$

$$P(-2) = -8 + 18 - 6 - 4$$

$$P(-2) = -8 + 18 - 6 - 4$$

$$P(-2) = -8 + 18 - 6 - 4$$

$$P(-2) = -18 + 18$$

$$P(-2) = 0$$

$$R = 0$$

$x+2$ is a factor of $P(x)$

Example 2: Determine whether $x+3$ factor of $x^3 - x^2 - 8x + 12$.

Solution:

$$P(x) = x^3 - x^2 - 8x + 12$$

$$\begin{aligned} \therefore x+3 &= 0 \\ x &= -3 \end{aligned}$$

$$P(-3) = (-3)^3 - (-3)^2 - 8(-3) + 12$$

$$P(-3) = -27 - 9 + 24 + 12$$

$$R = -36 + 36$$

$$R = 0$$

$x+3$ is a factor of $P(x)$



Class: 9

Exercise: 4.6

Question: 1

Q1: Find the remainder by using remainder theorem when:

i. $x^3 - 6x^2 + 11x - 8$ is divided by $(x-1)$

Solution:

$$\Rightarrow x-1=0$$

$$\Rightarrow x=1$$

$$P(x) = x^3 - 6x^2 + 11x - 8$$

$$P(1) = (1)^3 - 6(1)^2 + 11(1) - 8$$

$$P(1) = 1 - 6(1) + 11 - 8$$

$$P(1) = 1 - 6 + 11 - 8$$

$$P(1) = +12 - 14$$

$$P(1) = -2$$

Thus, the Remainder is -2

ii. $x^3 + 6x^2 + 11x + 8$ is divided by $(x+1)$

Solution:

$$\Rightarrow x+1=0$$

$$\Rightarrow x=-1$$

$$P(x) = x^3 + 6x^2 + 11x + 8$$

$$P(-1) = (-1)^3 + 6(-1)^2 + 11(-1) + 8$$

$$P(-1) = -1 + 6(1) - 11 + 8$$

$$P(-1) = -1 + 6 - 11 + 8$$

$$P(-1) = -12 + 14$$

$$P(-1) = +2$$

Remainder = 2

Thus remainder is 2 Ans



Class: 9

Exercise: 4.6

Question: 1

Q1: Find the remainder by using the remainder theorem when:

iii- $x^3 - x^2 - 26 + 40$ is divided by $(x-2)$

Solution:

$$\Rightarrow x-2=0$$

$$\Rightarrow x=2$$

$$P(x) = x^3 - x^2 - 26 + 40$$

$$P(2) = (2)^3 - (2)^2 - 26 + 40$$

$$P(2) = 8 - 4 - 26 + 40$$

$$P(2) = 48 - 30$$

$$P(2) = 18$$

$R = 18$ Thus remainder is 18 Ans

iv- $x^3 - 3x^2 + 4x - 14$ is divided by $(x+2)$

Solution:

$$\Rightarrow x+2=0$$

$$\Rightarrow x=-2$$

$$P(x) = x^3 - 3x^2 + 4x - 14$$

$$P(-2) = (-2)^3 - 3(-2)^2 + 4(-2) - 14$$

$$P(-2) = -8 - 3(4) - 8 - 14$$

$$P(-2) = -8 - 12 - 8 - 14$$

$$P(-2) = -42$$

$$R = -42$$

Thus remainder is -42 Ans



Class: 9 Exercise: 4.6 Question: 1

Q1: Find the remainder by using the remainder theorem when:

v. $(2y-1)^3 + 6(3+4y) - 9$ is divided by $(2y+1)$

Solution:

$$\Rightarrow 2y+1=0$$

$$\Rightarrow 2y = -1$$

$$\Rightarrow y = -\frac{1}{2}$$

$$P(x) = (2y-1)^3 + 6(3+4y) - 9$$

$$P(x) = \left[2\left(-\frac{1}{2}\right) - 1\right]^3 + 6\left[3 + 4\left(-\frac{1}{2}\right)\right] - 9$$

$$P(x) = (-1-1)^3 + 6(3-2) - 9$$

$$P(x) = (-2)^3 + 6(1) - 9$$

$$P(x) = -8 + 6 - 9$$

$$P(x) = -11$$

Thus, Remainder is -11 Ans

vi. $4y^3 - 4y + 3$ is divided by $(2y-1)$

Solution:

$$\Rightarrow 2y-1=0 \Rightarrow 2y=1$$

$$\Rightarrow y = \frac{1}{2}$$

$$P(y) = 4y^3 - 4y + 3$$

$$P\left(\frac{1}{2}\right) = 4\left(\frac{1}{2}\right)^3 - 4\left(\frac{1}{2}\right) + 3$$

$$P\left(\frac{1}{2}\right) = 4 \frac{1}{8} - 2 + 3$$

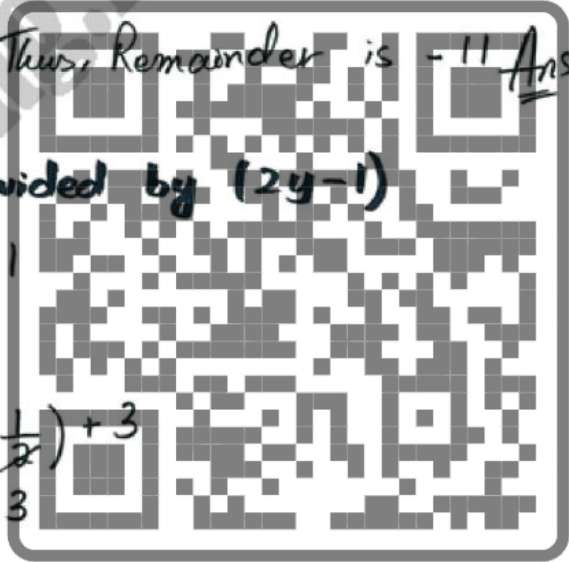
$$P\left(\frac{1}{2}\right) = \frac{1}{2} - 2 + 3$$

$$P\left(\frac{1}{2}\right) = \frac{1-4+6}{2}$$

$$P\left(\frac{1}{2}\right) = \frac{3}{2}$$

$$R = \frac{3}{2}$$

Thus Remainder is $\frac{3}{2}$



Class: 9 Exercise: 4.6

Question: 1

Q1: Find the remainder by using the remainder theorem when:

vii- $(2y+1)^3 - 6(3-4y) - 10$ is divided by $(2y-1)$

Solution:

$$\Rightarrow 2y-1=0$$

$$\Rightarrow 2y=1$$

$$\Rightarrow y=\frac{1}{2}$$

$$P(y) = (2y+1)^3 - 6(3-4y) - 10$$

$$P\left(\frac{1}{2}\right) = \left(2\left(\frac{1}{2}\right)+1\right)^3 - 6\left[3-4\left(\frac{1}{2}\right)\right] - 10$$

$$P\left(\frac{1}{2}\right) = (1+1)^3 - 6(3-2) - 10$$

$$P\left(\frac{1}{2}\right) = 2^3 - 6 - 10$$

$$P\left(\frac{1}{2}\right) = 8 - 6 - 10$$

$$P\left(\frac{1}{2}\right) = -16 + 8$$

$$\Rightarrow P\left(\frac{1}{2}\right) = -8$$

$$R = -8$$

Thus, Remainder is -8

viii- $x^4 + x^2y^2 + y^4$ is divided by $(x-y)$

Solution:

$$\Rightarrow x-y=0$$

$$\Rightarrow x=y$$

$$P(x) = x^4 + x^2y^2 + y^4$$

$$P(y) = (y)^4 + (y)^2y^2 + y^4$$

$$P(y) = y^4 + y^4 + y^4$$

$$P(y) = 3y^4$$

$$R = 3y^4$$

Thus Remainder is $3y^4$



Class: 9

Exercise: 4.6

Question: 2

Q:2 Find the value of m , if $P(y) = my^3 + 4y^2 + 3y - 4$ and $q(y) = y^3 - 4y + m$ leaves the same remainder when divided by $(y-3)$:

Solution:

$$P(y) = my^3 + 4y^2 + 3y - 4 \rightarrow (1)$$

$$q(y) = y^3 - 4y + m \rightarrow (2)$$

$$P(y) = q(y)$$

$$\Rightarrow y - 3 = 0$$

$$\Rightarrow y = 3$$

Put it in eqn (1)

$$(1) \Rightarrow P(y) = my^3 + 4y^2 + 3y - 4$$

$$P(3) = m(3)^3 + 4(3)^2 + 3(3) - 4$$

$$P(3) = 27m + 4(9) + 9 - 4$$

$$P(3) = 27m + 36 + 9 - 4$$

$$P(3) = 27m + 41$$

Put the value of y in eqn (2)

$$(2) \Rightarrow q(y) = y^3 - 4y + m$$

$$q(3) = (3)^3 - 4(3) + m$$

$$q(3) = 27 - 12 + m$$

$$q(3) = 15 + m$$

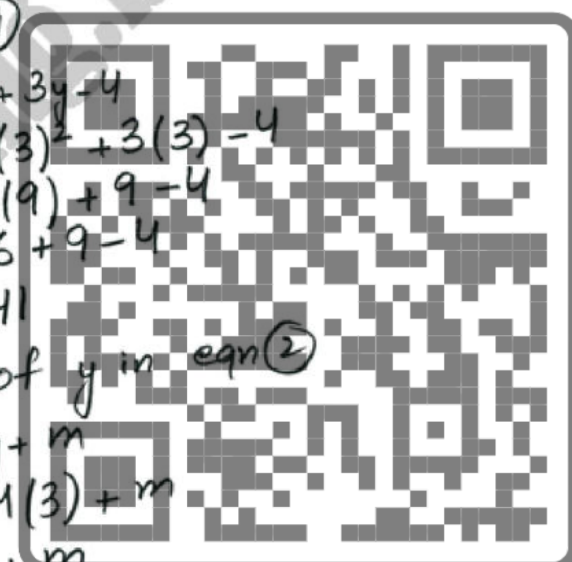
Now comparing equation $P(3)$ and $q(3)$:

$$\Rightarrow 27m + 41 = 15 + m$$

$$\Rightarrow 27m - m = 15 - 41$$

$$\Rightarrow 26m = -26$$

$$m = \frac{-26}{26} \quad \boxed{m = -1} \text{ Ans}$$



Class : 9 Exercise : 4.6 Question : 3

Q3: If the polynomial $4x^3 - 7x^2 + 6x - 3k$ is exactly divisible by $(x+2)$, find the value of k .

Solution:

$$P(x) = 4x^3 - 7x^2 + 6x - 3k$$

$$\Rightarrow x + 2 = 0$$

$$\Rightarrow x = -2$$

$$P(-2) = 4(-2)^3 - 7(-2)^2 + 6(-2) - 3k$$

$$P(-2) = 4(-8) - 7(4) - 12 - 3k$$

$$P(-2) = -32 - 28 - 12 - 3k$$

$$P(-2) = -72 - 3k$$

~~$(x+2)$ is exactly divided~~

If $(x+2)$ is exactly divided the given polynomial then $R = 0$

$$-72 - 3k = 0$$

$$-3k = 72$$

$$k = \frac{72}{-3}$$

$$\boxed{k = -24} \text{ Ans}$$



Class: 9 Exercise: 4.6 Question: 4

Q: 4: Find the value of r , if $(y+2)$ is a factor of the polynomial $3y^2 - 4ry - 4r^2$.

Solution:

$$P(y) = 3y^2 - 4ry - 4r^2$$

$$\Rightarrow y+2 = 0$$

$$\Rightarrow y = -2$$

$$P(-2) = 3(-2)^2 - 4r(-2) - 4r^2$$

$$P(-2) = 3(4) + 8r - 4r^2$$

$$P(-2) = 12 + 8r - 4r^2$$

$$P(-2) = 12 + 8r - 4r^2$$

If $(y+2)$ is a factor of given polynomial then $R = 0$

$$\Rightarrow 12 + 8r - 4r^2 = 0$$

$$\Rightarrow 12 + 12r - 4r - 4r^2 = 0$$

$$\Rightarrow 12(1+r) - 4r(1+r) = 0$$

$$\Rightarrow (1+r)(12 - 4r) = 0$$

$$1+r = 0$$

$$r = -1$$

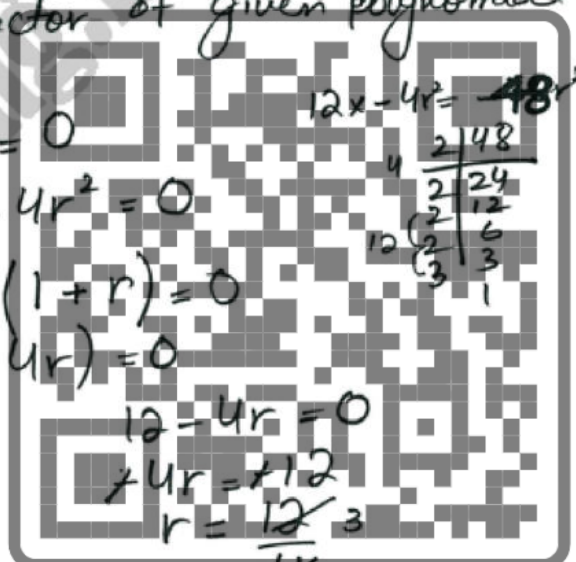
$$\boxed{r = -1}$$

$$12 - 4r = 0$$

$$4r = 12$$

$$r = \frac{12}{4} = 3$$

$$\boxed{r = 3}$$



Class: 9 Exercise: 4.7 Examples:

Example 1:

Divide the polynomial $P(x) = x^3 - 3x^2 + 5x + 7$ by $(x-1)$ using synthetic division:

Solution:

$$P(x) = x^3 - 3x^2 + 5x + 7$$

$$\text{Here } x-1=0$$

$$x=1 \quad (1 \text{ is a multiplier})$$

Using Synthetic division method:

$$\begin{array}{r|rrrr} 1 & 1 & -3 & 5 & 7 \end{array}$$

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$$Q(x) = x^2 - 2x + 3$$

$$Q(x) = x^2 - 2x + 3$$

$$\text{Remainder} = 10 \quad \underline{\text{Ans}}$$



Class : 9 Exercise : 4.7 Examples:

Example : 1 Find quotient and remainder when :

$$P(x) = x^4 - 12x^3 + 50x^2 - 84x + 49$$

is divided by a linear polynomial $(x-5)$:

Solution:

$$P(x) = x^4 - 12x^3 + 50x^2 - 84x + 49$$

and linear polynomial is $x-5$

$$\Rightarrow x - 5 = 0$$

$$\Rightarrow x = 5$$

(5 is a multiplier)

$$P(5) = R = ? \quad Q(x) = ?$$

To find quotient and Remainder, we will use synthetic division method:

5	1	-12	+50	-84	49
		5	-35	75	-45
	1	-7	15	-9	4

4 → R

$$Q(x) = 1x^3 - 7x^2 + 15x - 9$$

$$Q(x) = x^3 - 7x^2 + 15x - 9$$

and Remainder = 4

$R \neq 0$, therefore $x-5$ is not the factor of given polynomial:



Class : 9 Exercise : 4.7 Examples :

Example : 2 For what value of m ,

1 is a zero of the polynomial

$$p(x) = x^3 - mx^2 + x - 1$$

Solution:

$$p(x) = x^3 - mx^2 + x - 1$$

Here, the multiplier is 1

Using Synthetic division method:-

$$\begin{array}{r|rrrr} 1 & 1 & -m & 1 & -1 \\ & & 1 & 1-m & 2-m \\ \hline & 1 & 1-m & 2-m & 1-m \end{array}$$

Since 1 is the zero of the polynomial
 $\therefore x-1$ is a factor of given polynomial. So Remainder will be zero

$$1-m=0$$

$$-m = -1$$

$$m = 1$$

Thus, the value of m is 1 Ans



Class: 9 Exercise: 4.7 Question: 1

Q1: By Using synthetic division method to divide the following polynomials and also find their quotient and remainder:

i- $p(x) = x^3 - x^2 + x - 1$ by $x - 1$

Solution:

$$\Rightarrow x - 1 = 0$$

$$\Rightarrow x = 1 \quad (\text{Here multiplier is } 1)$$

By using synthetic division:-

$$\begin{array}{r|rrrr} 1 & 1 & -1 & 1 & -1 \\ & & 1 & 0 & 1 \\ \hline & 1 & 0 & 1 & 0 \end{array}$$

$$q(x) = 1x^2 + 0x + 1$$

$$q(x) = x^2 + 1$$

$$\text{Remainder} = 0$$

Thus, quotient $q(x) = x^2 + 1$ and Remainder = 0

Ans



Class: 9 Exercise: 4.7 Question: 1
Q:1 (ii) $P(x) = x^3 - x^2 - x - 1$ by $x+1$

Solution:

$$\Rightarrow x+1 = 0$$

$$\Rightarrow x = -1 \quad (\text{Here multiplier is } -1)$$

By Using Synthetic division method:

$$\begin{array}{r|rrrr} -1 & 1 & -1 & -1 & -1 \\ & & -1 & +2 & -1 \\ \hline & 1 & -2 & 1 & -2 \end{array} \rightarrow \text{Remainder}$$

$$Q(x) = x^2 - 2x + 1$$

$$R(x) = x^2 - 2x + 1$$

$$\text{Remainder} = -2$$

Ans

iii. $P(x) = x^3 - 6x^2 + 11x - 6$ by $x+2$

Solution:

$$\Rightarrow x+2 = 0$$

$$\Rightarrow x = -2 \quad (\text{Here } -2 \text{ is a multiplier})$$

By Using synthetic division method:

$$\begin{array}{r|rrrr} -2 & 1 & -6 & +11 & -6 \\ & & -2 & +16 & -54 \\ \hline & 1 & -8 & 27 & -60 \end{array} \rightarrow \text{Remainder:}$$

$$Q(x) = x^2 - 8x + 27$$

$$\text{Remainder} = -60 \quad \underline{\text{Ans}}$$



Class : 9 Exercise : 4.7 Question : 1
 Q1 (iv) : $P(x) = x^3 + 6x^2 - 11x - 6$ by $x-2$

Solution :

$$\Rightarrow x - 2 = 0$$

$$\Rightarrow x = 2 \text{ (Here multiplier is 2)}$$

By Using synthetic Division method:

$$\begin{array}{r|rrrr} 2 & 1 & 6 & -11 & -6 \\ & & 2 & 16 & 10 \\ \hline & 1 & 8 & 5 & 4 \end{array} \rightarrow \text{Remainder}$$

$$Q(x) = x^2 + 8x + 5$$

$$\text{Remainder} = 4$$

Ans

v. $P(x) = x^4 - x^3 + x^2 - x - 1$ by $x+2$

Solution :

$$\Rightarrow x + 2 = 0$$

$$\Rightarrow x = -2 \text{ (Here } -2 \text{ is a multiplier)}$$

By Using Synthetic division method:-

$$\begin{array}{r|rrrrr} -2 & 1 & -1 & +1 & -1 & -1 \\ & & -2 & +6 & -14 & +30 \\ \hline & 1 & -3 & 7 & -15 & +29 \end{array} \rightarrow \text{Remainder}$$

$$Q(x) = x^3 - 3x^2 + 7x - 15$$

$$Q(x) = x^3 - 3x^2 + 7x - 15$$

$$\text{Remainder} = 29$$

Ans



Class : 9 Exercise : 4.7 Question 1
 Q1 (vi) : $P(x) = x^4 + x^3 - x^2 + x - 1$ by $(x-1)$

Solution:

$\Rightarrow x-1 = 0$
 $\Rightarrow x = 1$ (Here multiplier is 1)

By Using Synthetic division method:

1		1	1	-1	1	-1	
			1	+2	1	+2	
		1	2	1	2	1	→ Remainder:

$Q(x) = x^3 + 2x^2 + x + 2$

Remainder = 1 Ans

vii. $P(x) = x^5 + x^3 - 2x^2 - 3$ by $x+3$

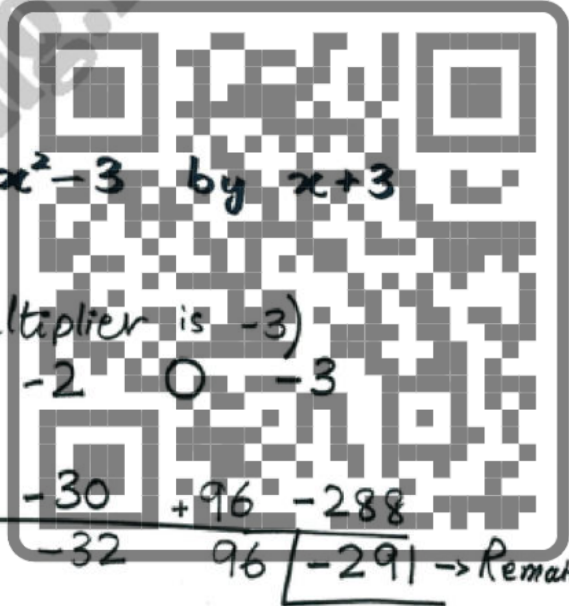
Solution:

$\Rightarrow x+3 = 0$
 $\Rightarrow x = -3$ (Here multiplier is -3)

-3		1	0	1	-2	0	-3	
			-3	+9	-30	+96	-288	
		1	-3	10	-32	96	-291	→ Remainder

$Q(x) = x^4 - 3x^3 + 10x^2 - 32x + 96$

Remainder = -291 Ans



Class : 9 Exercise : 4.7 Question : 1

Q1 (viii) : $P(x) = x^5 - x^4 + x^3 - 3x^2 + 6x - 6$
by $x-3$:

Solution:

$$\Rightarrow x-3=0$$

$$\Rightarrow x=3 \text{ (Here multiplier is 3)}$$

By Using Synthetic division method:-

3		1	-1	1	-3	6	-6	
			+3	6	-21	54	-180	
		1	2	7	18	60	174	→ Remain

$$Q(x) = x^4 + 2x^3 + 7x^2 + 18x + 60$$

Remainder = 174 Ans

(ix) : $P(x) = 2x^4 - 2x^3 + 100x^2 - 168x + 95$
by $x-2$:

Solution:

$$\Rightarrow x-2=0$$

$$\Rightarrow x=2 \text{ (Here multiplier is 2)}$$

By Using Synthetic Division method:-

2		2	-2	100	-168	95	
			+4	4	+208	80	
		2	2	104	40	175	→ Remain

$$Q(x) = 2x^3 + 2x^2 + 104x + 40$$

Remainder = 175 Ans



Class: 9 Exercise: 4.7 Question: 1
 Q1(x): $P(x) = 6x^4 - 72x^3 + 300x^2 - 564x + 270$ by $x-5$

Solution:

$\Rightarrow x - 5 = 0$

$\Rightarrow x = 5$

(Here 5 is a multiplier):
 Synthetic Division method:

Using	5	6	-72	300	-564	270
			30	-210	+450	-570
		6	-42	90	-114	<u>-300</u>

$q(x) = 6x^3 - 42x^2 + 90x - 114$

Remainder = -300 Ans

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Class : 9

Exercise : 4.7

Question : 2

Q:2 : For what value of k , -2 is zero of the polynomial $P(x) = x^3 + x^2 - 14x - k$

Solution :

-2 is zero of the polynomial, here multiplier is -2 .

$$P(x) = x^3 + x^2 - 14x - k$$

By Synthetic division method we have,

$$\begin{array}{r|rrrr} -2 & 1 & 1 & -14 & -k \\ & & -2 & +2 & +24 \\ \hline & 1 & -1 & -12 & -k+24 \end{array}$$

Remainder: $-k+24$

Since, -2 is the zero of $P(x)$:
 $x+2$ is a factor :

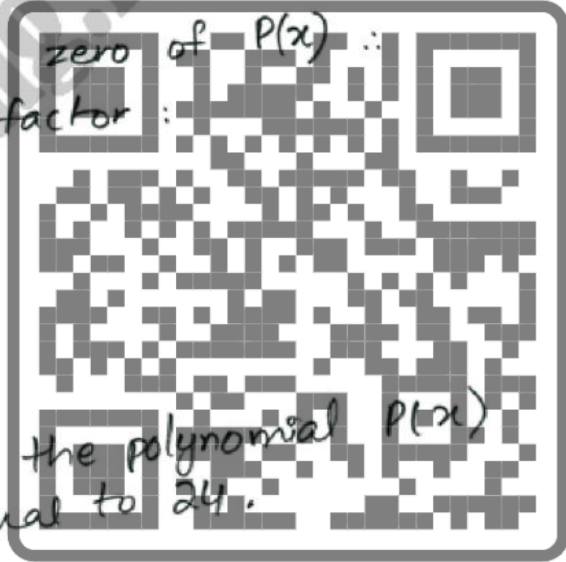
$$\text{Here, } R = 0$$

$$\Rightarrow -k+24 = 0$$

$$\Rightarrow -k = -24$$

$$\Rightarrow k = 24$$

Thus, for zero of the polynomial $P(x)$
 k must be equal to 24 .



Class: 9

Exercise: 4.7

Question: 3

Q3: For what value of m , $(x-2)$ be factor of $x^3 + mx^2 - 7x - 10$.

Solution:

$$P(x) = x^3 + mx^2 - 7x - 10$$

$x-2$ is a factor of $P(x)$

$$\Rightarrow x-2=0$$

$$\Rightarrow x=2 \quad (\text{Here multiplier is } 2)$$

$$\begin{array}{r|rrrr} 2 & 1 & m & -7 & -10 \\ & & 2 & 4+2m & -6+4m \\ \hline & 1 & 2+m & -3+2m & -16+4m \end{array}$$

$$2(2+m) = 4+2m$$

$$4+2m-7 = -3+2m$$

$$2(-3+2m) = -6+4m$$

Remainder:

$$-6+4m$$

Since $x-2$ is a factor of $P(x)$

Here $R=0$

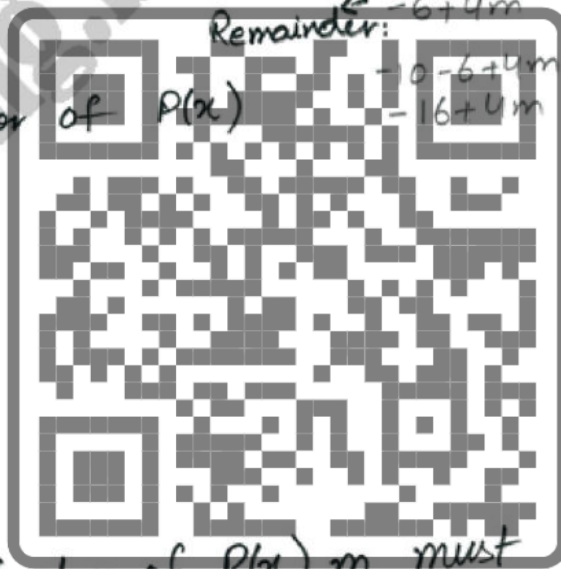
$$-6+4m = 0$$

$$4m = 6$$

$$m = \frac{6}{4}$$

$$m = \frac{3}{2}$$

Thus, $x-2$ is a factor of $P(x)$ m must be equal to $\frac{3}{2}$



Class: 9 Exercise: 4.7 Question: 4

Q4: For what value of m , $(x+2)$ is factor of $4x^3 - 7x^2 + 6x - 3m$.

Solution:

$$P(x) = 4x^3 - 7x^2 + 6x - 3m$$

$x+2$ is a factor of $P(x)$

$$\Rightarrow x+2 = 0$$

$$\Rightarrow x = -2 \quad (\text{Here multiplier is } -2)$$

By Synthetic division method:

$$\begin{array}{r|rrrr} -2 & 4 & -7 & 6 & -3m \end{array}$$

$$\begin{array}{r} -8 & +30 & -12 \end{array}$$

$$\hline \begin{array}{r} 4 & -15 & +36 & -3m-12 \end{array} \rightarrow \text{Remainder}$$

Since, $x+2$ is a factor of $P(x)$

$$\text{Hence, } R = 0$$

$$\Rightarrow -3m - 12 = 0$$

$$\Rightarrow -3m = 12$$

$$\Rightarrow m = \frac{12 \times 24}{-3}$$

$$\Rightarrow m = \frac{24}{-1}$$

$$\Rightarrow \boxed{m = -24}$$

Thus, $x+2$ is a factor of $P(x)$ m must be equal to -24



Class : 9

Exercise : 4.7

Question : 5

Q5: For what value of k , -1 is a zero of the polynomial, $P(x) = 2x^3 - 4mx^2 + x - 1$.

Solution:

$$P(x) = 2x^3 - 4mx^2 + x - 1$$

-1 is a zero of the polynomial

Here multiplier is -1

By Using Synthetic division method

$$\begin{array}{r|rrrr} -1 & 2 & -4m & 1 & -1 \\ & & -2 & 4m+2 & -4m-3 \\ \hline & 2 & -4m-2 & 4m+3 & -4m-4 \end{array}$$

$-1(-4m-2) + 4m+2$
 $-4m-4 \rightarrow \text{Remainder}$

Since, -1 is zero of $P(x) \therefore x+1$ is a factor of $P(x)$, Hence $R=0$

$$\Rightarrow -4m-4 = 0$$

$$\Rightarrow -4m = 4$$

$$\Rightarrow m = \frac{4}{-4}$$

$$\Rightarrow m = -1$$

$$\Rightarrow \boxed{m = -1}$$

Thus for zero of the polynomial $P(x)$ m must be equal to -1 .



Class : 9

Exercise : 4.8

Examples :

* Use Factor theorem to Factorize a Cubic Polynomial :

Example : 1

Find the factors of $x^3 - 6x^2 + 11x - 6$

Solution :

Let $P(x) = x^3 - 6x^2 + 11x - 6$

The factors of 6 are $\pm 1, \pm 2, \pm 3, \pm 6$

$$P(1) = (1)^3 - 6(1)^2 + 11(1) - 6$$

$$P(1) = 1 - 6 + 11 - 6$$

$$P(1) = +12 - 12$$

$$P(1) = 0$$

Here $x-1$ is a factor of $P(x)$

By **Synthetic Division method :**

$$\begin{array}{r|rrrr} 1 & 1 & -6 & 11 & -6 \\ & & 1 & -5 & 6 \\ \hline & 1 & -5 & 6 & 0 \end{array}$$

$\Rightarrow$ Remainder :

$$P(x) = (x-1)(x^2 - 5x + 6)$$

$$P(x) = (x-1)(x^2 - 2x - 3x + 6)$$

$$P(x) = (x-1)[(x(x-2) - 3(x-2))]$$

$$P(x) = (x-1)(x-2)(x-3)$$

$$\begin{aligned} 1 \times 6 &= 6 \\ -2 \times 3 &= 6 \\ -3 \times 2 &= 6 \\ -6 \times 1 &= 6 \end{aligned}$$

$$\begin{aligned} x &= 1 \\ x-1 &= 0 \end{aligned}$$

$$\begin{aligned} 1x^2 \times 6 &= 6x^2 \\ 2x &= 2x \\ 3 &= 3 \end{aligned}$$



Class: 9 Exercise: 4.8 Examples:

Example: 2

Find the factors of $x^3 - 4x^2 + x + 6$

Solution:

Let $P(x) = x^3 - 4x^2 + x + 6$

The factors of 6 are $\pm 1, \pm 2, \pm 3, \pm 6$

$-1 \times 6 = 6$
 $-2 \times 3 = 6$
 $-3 \times 2 = 6$
 $-6 \times 1 = 6$

Put $x = 1$

$$P(1) = (1)^3 - 4(1)^2 + (1) + 6$$

$$P(1) = 1 - 4 + 1 + 6$$

$$P(1) = 8 - 4$$

$$P(1) = 4 \neq 0$$

Here $x - 1$ is not factor of $P(x)$

Put $x = -1$

$$P(-1) = (-1)^3 - 4(-1)^2 + (-1) + 6$$

$$P(-1) = -1 - 4(1) - 1 + 6$$

$$P(-1) = -1 - 4 - 1 + 6$$

$$P(-1) = -6 + 6$$

$$P(-1) = 0$$

Here -1 is a multiplier

Here $x + 1$ is a factor of $P(x)$:

By Synthetic division method:-

-1		1	-4	1	6
			-1	+5	-6
		1	-5	+6	0

0 → Remainder:

$$P(x) = (x+1)(x^2 - 5x + 6)$$

$$P(x) = (x+1)(x^2 - 2x - 3x + 6)$$

$$P(x) = (x+1)[x(x-2) - 3(x-2)]$$

$$P(x) = (x+1)(x-2)(x-3)$$

$x^2 \times 6 = 6x^2$

$\begin{array}{r} 2 \overline{) 6} \\ 3 \overline{) 3} \end{array}$



Class : 9

Exercise : 4.8

Question : 1

Find the factors by using factor theorem:

1. $x^3 - x^2 + x - 1$

Solution:

Let $P(x) = x^3 - x^2 + x - 1$

The factor of 1 are ± 1

Put $x = 1$

$P(x) = x^3 - x^2 + x - 1$

$P(1) = (1)^3 - (1)^2 + (1) - 1$

$P(1) = 1 - 1 + 1 - 1$

$P(1) = +2 - 2$

$P(1) = 0$ (Here 1 is a multiplier)

Here $x - 1$ is a factor of $P(x)$:

Using Synthetic Division method:

1	1	-1	1	-1
		1	0	1
	1	0	1	0

0 → Remainder

$P(x) = (x - 1)(x^2 + 0x + 1)$

$P(x) = (x - 1)(x^2 + 1)$ Ans



Class: 9

Exercise : 4.8

Question: 2

Find the factors by using factor theorem:

2- $x^3 - x^2 - x + 1$

± 1

Solution:

Let $P(x) = x^3 - x^2 - x + 1$

The factors of 1 are ± 1

Put $x = -1$

$P(x) = x^3 - x^2 - x + 1$

$P(-1) = (-1)^3 - (-1)^2 - (-1) + 1$

$P(-1) = -1 - 1 + 1 + 1$

$P(-1) = 0$ (Here -1 is a multiplier)

Here $x+1$ is a factor of $P(x)$

Using synthetic Division method:-

-1	1	-1	-1	1
		-1	+2	-1
		-2	1	0

Remainder =

$P(x) = (x+1)(x^2 - 2x + 1)$

$P(x) = (x+1)(x^2 - 2x + 1)$

$P(x) = (x+1)(x^2 - x - x + 1)$

$P(x) = (x+1)[x(x-1) - 1(x-1)]$

$P(x) = (x+1)(x-1)(x-1)$ Ans



Class: 9

Exercise: 4.8

Question: 3

Find the factors by using factor theorem:

3. $x^3 - 6x^2 + 11x - 6$

Solution:

Let $P(x) = x^3 - 6x^2 + 11x - 6$

The factor of 6 are $\pm 1, \pm 2, \pm 3, \pm 6$

Put $x = 1$

$P(1) = (1)^3 - 6(1)^2 + 11(1) - 6$

$P(1) = 1 - 6 + 11 - 6$

$P(1) = 1 - 1$

$P(1) = 0$ (Here multiplier is 1)

Here $x-1$ is a factor of $P(x)$

Using synthetic method:

1	1	-6	+11	-6
		1	-5	+6
		-5	6	0

0 → Remainder :-

$P(x) = (x-1)(x^2 - 5x + 6)$

$P(x) = (x-1)(x^2 - 5x + 6)$

$P(x) = (x-1)(x^2 - 2x - 3x + 6)$

$P(x) = (x-1)[x(x-2) - 3(x-2)]$

$P(x) = (x-1)(x-2)(x-3)$ Ans



Class: 9

Exercise: 4.8

Question: 4

Find the factors by using factor theorem:

4. $x^3 + 5x^2 - 4x - 20$

Solution:

Let $P(x) = x^3 + 5x^2 - 4x - 20$

The factors of 20 are

$\pm 1, \pm 2, \pm 4, \pm 5, \pm 10, \pm 20$:

Put $x = 2$

$P(2) = (2)^3 + 5(2)^2 - 4(2) - 20$

$P(2) = 8 + 5(4) - 8 - 20$

$P(2) = 8 + 20 - 8 - 20$

$P(2) = 0$ (Here 2 is a multiplier)

Here, $x - 2$ is a factor of $P(x)$

Use synthetic Division method:

$$\begin{array}{r|rrrr} 2 & 1 & +5 & -4 & -20 \\ & & +2 & +14 & +28 \\ \hline & 1 & +7 & +10 & 0 \end{array}$$

$$\begin{array}{r|rrrr} 2 & 1 & +5 & -4 & -20 \\ & & +2 & +14 & +28 \\ \hline & 1 & +7 & +10 & 0 \end{array}$$

$$\begin{array}{r|rrrr} 2 & 1 & +5 & -4 & -20 \\ & & +2 & +14 & +28 \\ \hline & 1 & +7 & +10 & 0 \end{array} \rightarrow \text{Remainder}$$

$P(x) = (x - 2)(1x^2 + 7x + 10)$

$P(x) = (x - 2)(x^2 + 7x + 10)$

$P(x) = (x - 2)(x^2 + 5x + 2x + 10)$

$P(x) = (x - 2)[x(x + 5) + 2(x + 5)]$

$P(x) = (x - 2)(x + 5)(x + 2)$

$\checkmark 1 \times 20 = 20$

$\checkmark 2 \times 10 = 20$

$\checkmark 4 \times 5 = 20$

$\checkmark 5 \times 4 = 20$

$\checkmark 10 \times 2 = 20$

$\checkmark 20 \times 1 = 20$

$(2)^3 + 5(2)^2 - 4(2) - 20$

$8 + 5(4) - 8 - 20$

$8 + 20 - 8 - 20$

$x^2 \times 10 = 10x^2$

$(2)10$

$(5)5$

1



Class : 9

Exercise : 4.8

Question : 5

Find the factors by using factor theorem:

5. $x^3 + x^2 - x - 1$

Solution :

Let, $P(x) = x^3 + x^2 - x - 1$

The factors of 1 are ± 1 .

Put $x = 1$

$P(x) = x^3 + x^2 - x - 1$

$P(1) = (1)^3 + (1)^2 - (1) - 1$

$P(1) = 1 + 1 - 1 - 1$

$P(1) = 0$ (Here multiplier is 1)

Since, $x-1$ is a factor of $P(x)$

By Using Synthetic Division divis method:

$$\begin{array}{r|rrrr} 1 & 1 & 1 & -1 & -1 \\ & & 1 & 2 & 1 \\ \hline & 1 & 2 & 1 & 0 \end{array}$$

[0 $\rightarrow$ Remainder]

$P(x) = (x-1)(x^2 + 2x + 1)$

$P(x) = (x-1)(x^2 + x + x + 1)$

$P(x) = (x-1)[x(x+1) + 1(x+1)]$

$P(x) = (x-1)(x+1)(x+1)$

$P(x) = (x-1)(x+1)^2$

$P(x) = (x+1)^2(x-1)$ **Ans**



Class: 9 Exercise: 4.8 Question: 6

Find the factors by using factor theorem:

6. $x^3 - 2x^2 + 9x - 18$

Solution:

Let $P(x) = x^3 - 2x^2 + 9x - 18$

The factors of 18 are $\pm 1, \pm 2, \pm 3, \pm 6, \pm 9, \pm 18$

$$\begin{aligned} 1 \times 18 &= 18 \\ 2 \times 9 &= 18 \\ 3 \times 6 &= 18 \\ 6 \times 3 &= 18 \\ 9 \times 2 &= 18 \\ 18 \times 1 &= 18 \end{aligned}$$

Put $x = 2$

$P(2) = (2)^3 - 2(2)^2 + 9(2) - 18$

$$(2)^3 - 2(2)^2 + 9(2) - 18 \\ 8 - 8 + 18 - 18$$

$P(2) = 8 - 8 + 18 - 18$

$P(2) = 0$

(Here multiplier is 2)

Here $x - 2$ is a factor of $P(x)$:

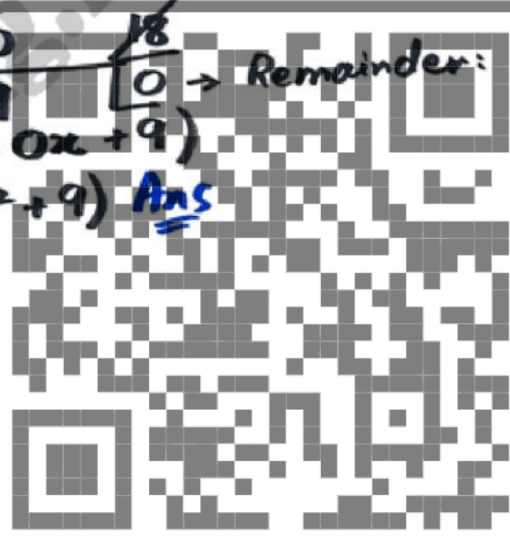
By Synthetic division method:

$$\begin{array}{r|rrrr} 2 & 1 & -2 & 9 & -18 \\ & & 2 & 0 & 18 \\ \hline & 1 & 0 & 9 & 0 \end{array}$$

$P(x) = (x - 2)(x^2 + 0x + 9)$

$P(x) = (x - 2)(x^2 + 9)$ Ans

0 → Remainder:



Class : 9

Exercise : 4.8

Question : 7

Find the factors by using factor theorem:

7. $6x^3 + 7x^2 - x - 2$

Solution:

Let $P(x) = 6x^3 + 7x^2 - x - 2$

The factors of 2 are $\pm 1, \pm 2$

Put $x = -1$

$P(-1) = 6(-1)^3 + 7(-1)^2 - (-1) - 2$

$P(-1) = 6(-1) + 7(+1) + 1 - 2$

$P(-1) = -6 + 7 + 1 - 2$

$P(-1) = -8 + 8$

$P(-1) = 0$

Here $x+1$ is a factor of $P(x)$

Using Synthetic division method:

		6	7	-1	-2
-1			-6	-1	+2
		6	1	-2	0

$P(x) = (x+1)(6x^2 + x - 2)$

$P(x) = (x+1)(6x^2 + 4x - 3x - 2)$

$P(x) = (x+1)[2x(3x+2) - 1(3x+2)]$

$P(x) = (x+1)(3x+2)(2x-1)$

$P(x) = (x+1)(2x-1)(3x+2)$ Ans

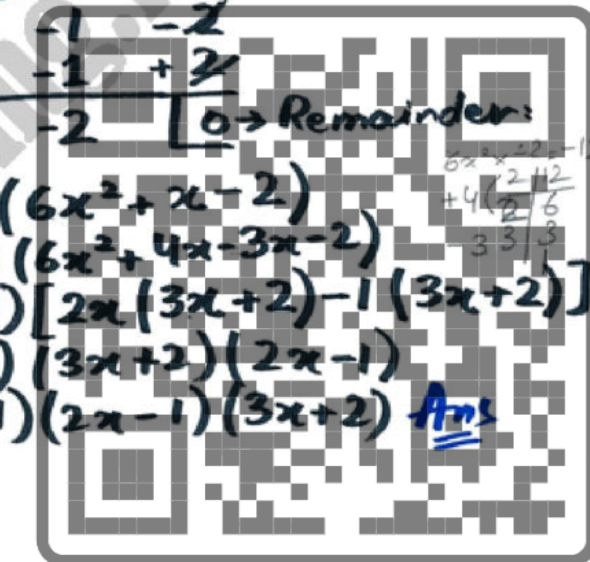
$1 \times 2 = 2$
 $2 \times 1 = 2$

$6(-1)^3 + 7(-1)^2 - (-1) - 2$

$6(-1) + 7(+1) + 1 - 2$

$-6 + 7 + 1 - 2$

$-8 + 8$



Class

Exercise : 4.8

Question : 8

Find the factors by using factor theorem:

8. $x^3 + 8x^2 + 19x + 12$

Solution :

Let $P(x) = x^3 + 8x^2 + 19x + 12$

The factors of 12 are $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12$

Put $x = -1$

$P(-1) = (-1)^3 + 8(-1)^2 + 19(-1) + 12$

$P(-1) = -1 + 8 - 19 + 12$

$P(-1) = +26 - 26$

$P(-1) = 0$ (Here multiplier is -1)

Since $x+1$ is a factor of $P(x)$:

By Synthetic Division method :-

-1	1	8	19	12
		-1	-7	-12
	1	7	12	0

$P(x) = (x+1)(x^2 + 7x + 12)$

$P(x) = (x+1)(x^2 + 4x + 3x + 12)$

$P(x) = (x+1)[x(x+4) + 3(x+4)]$

$P(x) = (x+1)(x+4)(x+3)$

$P(x) = (x+1)(x+3)(x+4)$

$1 \times 12 = 12$
 $2 \times 6 = 12$
 $3 \times 4 = 12$
 $4 \times 3 = 12$
 $6 \times 2 = 12$
 $12 \times 1 = 12$



Class: 9 Exercise: 4.8 Question: 9

Find the factors by using factor theorem:

9. $2x^3 + 9x^2 + 10x + 3$

Solution:

Let $P(x) = 2x^3 + 9x^2 + 10x + 3$

The factors of 3 are $\pm 1, \pm 3$

Put $x = -1$

$P(-1) = 2(-1)^3 + 9(-1)^2 + 10(-1) + 3$

$P(-1) = 2(-1) + 9(1) - 10 + 3$

$P(-1) = -2 + 9 - 10 + 3$

$P(-1) = -2 + 7$

$P(-1) = 0$ (Here -1 is a multiplier)

Since $x+1$ is a factor of $P(x)$

By Using Synthetic division method:

-1	2	9	10	3
		-2	-7	-3
	2	7	3	0



$P(x) = (x+1)(2x^2 + 7x + 3)$

$P(x) = (x+1)(2x^2 + 6x + x + 3)$

$P(x) = (x+1)[2x(x+3) + 1(x+3)]$

$P(x) = (x+1)(x+3)(2x+1)$

$P(x) = (x+1)(2x+1)(x+3)$ Ans



Class : 9 Exercise : 4.8 Question : 10

Find the factors by using factor theorem:

10. $x^3 + 7x^2 + 14x + 8$.

Solution:

Let $P(x) = x^3 + 7x^2 + 14x + 8$

The factors of 8 are $\pm 1, \pm 2, \pm 4, \pm 8$

Put $x = -1$

$P(-1) = (-1)^3 + 7(-1)^2 + 14(-1) + 8$

$P(-1) = -1 + 7 - 14 + 8$

$P(-1) = -1 + 8$

$P(-1) = 0$ (Here multiplier is -1)

Here $x+1$ is a factor of $P(x)$

By Synthetic division method:

$$\begin{array}{r|rrrr} -1 & 1 & 7 & 14 & 8 \end{array}$$

$$\begin{array}{r|rrrr} & & -1 & -6 & -8 \end{array}$$

$$\hline \begin{array}{r|rrrr} & 1 & 6 & 8 & 0 \end{array}$$

$$P(x) = (x+1)(x^2 + 6x + 8)$$

$$P(x) = (x+1)(x^2 + 4x + 2x + 8)$$

$$P(x) = (x+1)[x(x+4) + 2(x+4)]$$

$$P(x) = (x+1)(x+4)(x+2)$$

$$P(x) = (x+1)(x+2)(x+4)$$

$$P(x) = (x+1)(x+2)(x+4)$$

$$\begin{array}{l} 1 \times 8 = 8 \\ 2 \times 4 = 8 \\ 4 \times 2 = 8 \\ 8 \times 1 = 8 \end{array}$$

$$\begin{array}{r} 2 \times 8 = 16 \\ 2 \times 4 = 8 \\ 4 \times 2 = 8 \end{array}$$

Ans



Class: 9

Exercise: 4.8

Question: 11

Find the factors by using factor theorem:

11. $x^3 + 9x^2 + 26x + 24$

Solution:

Let $P(x) = x^3 + 9x^2 + 26x + 24$

The factors of 24 are $\pm 1, \pm 2,$

$\pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24.$

Put $x = -2$

$P(-2) = (-2)^3 + 9(-2)^2 + 26(-2) + 24$

$P(-2) = -8 + 36 - 52 + 24$

$P(-2) = -60 + 60$

$P(-2) = 0$

(Here -2 is a multiplier)

Since $x+2$ is a factor of $P(x)$:

Using Synthetic Division method:-

-2		1	9	26	24
			-2	-14	-24
		1	7	12	0

Remainder = 0

$P(x) = (x+2)(x^2 + 7x + 12)$

$P(x) = (x+2)(x^2 + 4x + 3x + 12)$

$P(x) = (x+2)[x(x+4) + 3(x+4)]$

$P(x) = (x+2)(x+3)(x+4)$ Ans

$\begin{aligned} 1 \times 24 &= 24 \\ 2 \times 12 &= 24 \\ 3 \times 8 &= 24 \\ 4 \times 6 &= 24 \\ 6 \times 4 &= 24 \\ 8 \times 3 &= 24 \\ 12 \times 2 &= 24 \\ 24 \times 1 &= 24 \end{aligned}$

$\begin{aligned} (-2)^3 + 9(-2)^2 + 26(-2) + 24 \\ -8 + 36 - 52 + 24 \\ -60 + 60 \end{aligned}$

$\begin{array}{r} x^2 + 7x + 12 \\ 4 \overline{) 12} \\ 4 \quad 6 \\ \underline{3} \quad 3 \\ 3 \quad 12 \\ \underline{3} \quad 12 \\ 0 \end{array}$



Class: 9

Exercise : 4.8

Question: 12

Find the factors by using factor theorem:

12. $x^3 + 12x^2 + 44x + 48$

Solution:

Let $P(x) = x^3 + 12x^2 + 44x + 48$

The factors of 48 are $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 16, \pm 24, \pm 48$

Put $x = -2$

$P(-2) = (-2)^3 + 12(-2)^2 + 44(-2) + 48$

$P(-2) = -8 + 48 - 88 + 48$

$P(-2) = -96 + 96$

$P(-2) = 0$ (Here -2 is a multiplier)

Since $x+2$ is a factor of $P(x)$:

By Synthetic division method:-

-2	1	12	44	48
		-2	-20	-48
	1	10	24	0

0 → Remainder

$P(x) = (x+2)(x^2 + 10x + 24)$

$P(x) = (x+2)(x^2 + 4x + 6x + 24)$

$P(x) = (x+2)[x(x+4) + 6(x+4)]$

$P(x) = (x+2)(x+6)(x+4)$

Ans

- $\frac{24}{48}$
- $1 \times 48 = 48$
- $2 \times 24 = 48$
- $3 \times 16 = 48$
- $4 \times 12 = 48$
- $6 \times 8 = 48$
- $8 \times 6 = 48$
- $12 \times 4 = 48$
- $16 \times 3 = 48$
- $24 \times 2 = 48$
- $48 \times 1 = 48$



Class : 9

Exercise : 5.1

Example : 1

Example : 1

Find the H.C.F of the following expression by using factorization method:

1. $x^2 + x - 20$ and $x^2 + 12x + 35$

Solution:

We factorize the given expression $x^2 + x - 20$ and $x^2 + 12x + 35$

The factors are as under:

$$x^2 + x - 20 = x^2 + 5x - 4x - 20$$

$$= x(x+5) - 4(x+5)$$

$$= (x-4)(x+5)$$

$$x^2 + 12x + 35 = x^2 + 5x + 7x + 35$$

$$= x(x+5) + 7(x+5)$$

$$= (x+7)(x+5)$$

Common factor in both the expression is $(x+5)$

$$\therefore \text{HCF} = (x+5)$$

$$x^2x - 20 = -20x^2$$

$$\begin{array}{r} 2 \overline{) 20} \\ -4 \\ \hline 10 \\ 5 \\ \hline 5 \\ 5 \\ \hline 1 \end{array}$$

$$x^2 \times 35 = 35x^2$$

$$\begin{array}{r} 5 \overline{) 35} \\ 17 \\ \hline 1 \end{array}$$

Ans



Class: 9 Exercise: 5.1 Examples: 1

ii- $(x+1)^2$, (x^2-1) and x^2+4x+3

Solution:

We factorize the given expression

$(x+1)^2$, (x^2-1) and x^2+4x+3

The factors are as under:

$$(x+1)^2 = (x+1)(x+1)$$

$$\begin{aligned} x^2-1 &= x^2-1^2 \\ &= (x+1)(x-1) \end{aligned}$$

$$x^2+4x+3 = x^2+3x+x+3$$

$$= x(x+3)+1(x+3)$$

$$= (x+1)(x+3)$$

Common factor in all the three expression is $(x+1)$

$$\text{H.C.F} = (x+1) \quad \text{Ans}$$

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Class : 9 Exercise : 5.1 Examples : 2

Find the H.C.F of the following expression by using factorization method :

$$a^3 - b^3, a^6 - b^6$$

Solution :

We factorize the following expression:
 $a^3 - b^3, a^6 - b^6$

The factors are as under :

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

$$\therefore a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

$$a^6 - b^6 = (a^3)^2 - (b^3)^2$$

$$\therefore a^2 - b^2 = (a + b)(a - b)$$

$$a^6 - b^6 = (a^3 + b^3)(a^3 - b^3)$$

$$\therefore (a^3 + b^3) = (a + b)(a^2 - ab + b^2)$$

$$a^6 - b^6 = (a + b)(a^2 - ab + b^2)(a - b)(a^2 + ab + b^2)$$

The common factors in two expressions are

$$(a - b)(a^2 + ab + b^2)$$

$$\text{H.C.F} = a^3 - b^3$$

Ans



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Class : 9 Exercise : 5.1 Examples : 1

(b) Least Common Multiple (LCM)
by factorization method:

L.C.M = Common factors $\times$ Uncommon factors.

Example : 1

Find the L.C.M of $x^3 - 8$ and
 $x^2 + x - 6$

Solution:

We factorize the following expressions:

$$x^3 - 8, x^2 + x - 6$$

The factors of $x^3 - 8, x^2 + x - 6$ are:

$$\begin{aligned} x^3 - 8 &= x^3 - 2^3 \quad \therefore (a^3 - b^3) = (a - b)(a^2 + ab + b^2) \\ &= (x - 2)[x^2 - (x)(2) + (2)^2] \\ &= (x - 2)(x^2 + 2x + 4) \end{aligned}$$

$$\begin{aligned} x^2 + x - 6 &= x^2 + 3x - 2x - 6 \\ &= x(x + 3) - 2(x + 3) \\ &= (x - 2)(x + 3) \end{aligned}$$

Common factors = $x - 2$

Uncommon factors = $(x + 3)(x^2 + 2x + 4)$

L.C.M = Uncommon factors $\times$ Common factors

$$\text{L.C.M} = (x - 2)(x + 3)(x^2 + 2x + 4)$$

$$\text{L.C.M} = (x^3 - 2^3)(x + 3)$$

$$\text{L.C.M} = (x^3 - 8)(x + 3) \quad \underline{\text{Ans}}$$

$$\therefore (a - b)(a^2 + ab + b^2) = \frac{a^3 - b^3}{a^2 - b^2}$$



Class : 9

Exercise : 5.1

Example : 2

Example : 2

Find the L.C.M of x^3-1 , x^3-2x^2+x

Solution :

We have to factorize the following expressions:

$$x^3-1, x^3-2x^2+x$$

The factors are as under:

$$x^3-1 = x^3-1^3$$

$$\therefore a^3-b^3=(a-b)(a^2+ab+b^2)$$

$$= (x-1)(x^2+x+1)$$

$$x^3-2x^2+x = x(x^2-2x+1)$$

$$= x(x^2-x-x+1)$$

$$= x[x(x-1)-1(x-1)]$$

$$= x(x-1)(x-1)$$

$$= x(x-1)^2$$

$$\text{Common factors} = (x-1)$$

$$\text{Uncommon factors} = x(x-1)(x^2+x+1)$$

$$\text{L.C.M} = \text{Common factors} \times \text{Uncommon factors}$$

$$\text{L.C.M} = (x-1)(x-1)(x^2+x+1)x$$

$$\text{L.C.M} = x(x-1)^2(x^2+x+1) \quad \underline{\text{Ans}}$$

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Class : 9 Exercise : 5.1 Example : 1
Relationship between HCF and LCM :

$$\text{L.C.M} \times \text{H.C.F} = P(x) \times Q(x) \rightarrow i$$

Example : 1 Find the HCF and LCM of the polynomials $P(x)$ and $Q(x)$ given below, and verify the relation of HCF and LCM :

$$P(x) = x^2 - 5x + 6 \text{ and } Q(x) = x^2 - 9$$

Solution :

Find factors of given polynomials :

$$\begin{aligned} P(x) &= x^2 - 5x + 6 \\ &= x^2 - 2x - 3x + 6 \\ &= x(x-2) - 3(x-2) \\ &= (x-3)(x-2) \end{aligned}$$

$$\begin{aligned} \text{and } Q(x) &= x^2 - 9 \\ &= x^2 - 3^2 \\ &= (x+3)(x-3) \end{aligned}$$

$$\text{Thus, H.C.F} = x-3$$

$$\text{L.C.M} = (x-3)(x-2)(x+3)$$

Now, find the Product of H.C.F and L.C.M

$$\begin{aligned} \text{H.C.F} \times \text{L.C.M} &= (x-3)(x-3)(x-2)(x+3) \\ &= (x-3)(x+3)(x-3)(x-2) \\ &= (x^2 - 3^2)(x^2 - 2x - 3x + 6) \end{aligned}$$

$$\text{H.C.F} \times \text{L.C.M} = (x^2 - 9)(x^2 - 5x + 6) \rightarrow (i)$$

$$P(x) \times Q(x) = (x^2 - 5x + 6)(x^2 - 9) \rightarrow (ii)$$

We know that the relation of H.C.F &

$$\text{H.C.F} \times \text{L.C.M} = P(x) \times Q(x)$$

$$(x^2 - 9)(x^2 - 5x + 6) = (x^2 - 9)(x^2 - 5x + 6)$$

$$\text{H.C.F} \times \text{L.C.M} = P(x) \times Q(x) \text{ hence Proved}$$



Class : 9

Exercise : 5.1

Examples : 2

Example : 2

Find the LCM of the following Polynomials by using the formula:

$$P(x) = x^2 + 14x + 48 \text{ and } Q(x) = x^2 + 8x + 12$$

Solution:

Now, first we find factors of given express

$$\begin{aligned} P(x) &= x^2 + 14x + 48 \\ &= x^2 + 8x + 6x + 48 \\ &= x(x+8) + 6(x+8) \\ &= (x+6)(x+8) \end{aligned}$$

$$\begin{array}{r} x^2 \times 48 = 48x^2 \\ 2 \overline{) 48} \\ \underline{24} \\ 24 \\ \underline{24} \\ 0 \\ 6 \overline{) 48} \\ \underline{36} \\ 12 \\ \underline{12} \\ 0 \end{array}$$

$$\begin{aligned} Q(x) &= x^2 + 8x + 12 \\ &= x^2 + 6x + 2x + 12 \\ &= x(x+6) + 2(x+6) \\ &= (x+2)(x+6) \end{aligned}$$

$$\begin{array}{r} x^2 \times 12 = 12x^2 \\ x^2 \overline{) 12} \\ \underline{12} \\ 0 \\ 2 \overline{) 12} \\ \underline{6} \\ 6 \\ \underline{6} \\ 0 \end{array}$$

$$\begin{aligned} \text{Common factors} &= x+6 \\ \text{H.C.F} &= (x+6) \end{aligned}$$

We know that:

$$\text{L.C.M} \times \text{H.C.F} = P(x) \times Q(x)$$

$$\text{L.C.M} = \frac{P(x) \times Q(x)}{\text{H.C.F}}$$

$$\text{L.C.M} = \frac{(x^2 + 14x + 48)(x^2 + 8x + 12)}{x+6}$$

$$\text{L.C.M} = \frac{(x+6)(x+8)(x+2)(x+6)}{(x+6)}$$

$$\text{L.C.M} = (x+6)(x+8)(x+2) \text{ Ans}$$



Class : 9 Exercise : 5.1

Example : 01

Use division method to determine highest common factor and least Common multiple :

Example : 1

Find the HCF by division method of the following polynomials :

$$2x^3 + 7x^2 + 4x - 4 \text{ and } 2x^3 + 9x^2 + 11x + 2$$

Solution :

The given polynomials

$$2x^3 + 7x^2 + 4x - 4, 2x^3 + 9x^2 + 11x + 2$$

$$\begin{array}{r} 1 \\ 2x^3 + 7x^2 + 4x - 4 \overline{) 2x^3 + 9x^2 + 11x + 2} \\ \underline{2x^3 + 7x^2 + 4x - 4} \\ 2x^2 + 7x + 6 \end{array}$$

$$\begin{array}{r} \text{Again, } x \\ 2x^2 + 7x + 6 \overline{) 2x^3 + 7x^2 + 4x - 4} \\ \underline{2x^3 + 7x^2 + 6x} \\ -2x - 4 \end{array}$$

We take common factor -2 from -2x-4 and omit it
we get divisor x+2

$$\begin{array}{r} x+2 \overline{) 2x^2 + 7x + 6} \quad (2x+3) \\ \underline{2x^2 + 4x} \\ 3x + 6 \\ \underline{3x + 6} \\ 0 \end{array}$$

The H.C.F of the following polynomial is (x+2)



2x-4
-2(x+2)

2x(x+2)
2x^2+4x
3(x+2)
3x+6



Class: 9

Exercise: 5.1

Example: 2

Example: 2

Find the HCF by division method of the following polynomials:

$$x^2 + 2x + 1, x^2 - 1 \text{ and } x^2 + 4x + 3$$

Solution:

The given polynomials are,

$$x^2 + 2x + 1, x^2 - 1 \text{ and } x^2 + 4x + 3$$

$$\begin{array}{r} x^2 + 2x + 1 \overline{) x^2 + 4x + 3} \\ \underline{x^2 + 2x + 1} \\ 2x + 2 \end{array}$$

$$\begin{array}{l} 2x + 2 \\ 2(x + 1) \end{array}$$

We take common factor 2 from $2x + 2$ and omit it, we get $x + 1$

$$\begin{array}{r} x + 1 \overline{) x^2 + 2x + 1} \\ \underline{x^2 + x} \\ x + 1 \\ \underline{x + 1} \\ 0 \end{array}$$

$$x(x + 1)$$

$$x^2 + x$$

The H.C.F of the polynomial $x^2 + 2x + 1$ and $x^2 + 4x + 3$ is $x + 1$

Now, we find H.C.F of $x + 1$ and $x^2 - 1$

$$\begin{array}{r} x - 1 \overline{) x^2 - 1} \\ \underline{x^2 + x} \\ -x - 1 \\ \underline{-x - 1} \\ 0 \end{array}$$

we take $x + 1$

$$x(x + 1)$$

$$x^2 + x$$

$$-1(x + 1)$$

$$-x - 1$$

The H.C.F of the given three polynomial is $(x + 1)$ Ans



Class: 9

Exercise : 5.1

Example :

Find L.C.M by Division:

$$\text{LCM} = \frac{\text{Product of two polynomials}}{\text{HCF of two polynomials}}$$

Example :

Find the LCM of $x^3 - 6x^2 + 11x - 6$
and $x^3 - 4x + 3$:

Solution:

Now, find H.C.F by actual division :

$$\begin{array}{r} x^3 - 4x + 3 \overline{) x^3 - 6x^2 + 11x - 6} \\ \underline{x^3 + 4x } \\ -6x^2 + 15x - 9 \end{array}$$

We take common factor -3 from $-6x^2 + 15x - 9$ and
omit it, we get $2x^2 - 5x + 3$

Again,

$$2x^2 - 5x + 3 \overline{) x^3 - 4x + 3}$$

$$\begin{array}{l} -6x^2 + 15x - 9 \\ -3(2x^2 - 5x + 3) \end{array}$$



Continue on next page



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now, multiply $x^2 - 4x + 3$ by 2 Continue:

$$2x^3 - 8x^2 + 6x$$

Again,

$$\begin{array}{r} x+2 \\ 2x^3-5x^2+3x \overline{) 2x^3-8x^2+6x} \\ \underline{-2x^3+5x^2+3x} \\ 5x^2-11x+6 \\ \underline{-4x^2+10x+8} \\ x^2-x \end{array}$$

We take common factor x from $x^2 - x$ and omit it we get $x-1$

$$\begin{array}{r} 2x-3 \\ x-1 \overline{) 2x^2-5x+3} \\ \underline{2x^2-2x} \\ -3x+3 \\ \underline{+3x-3} \\ 0 \end{array}$$

$$\begin{array}{l} x(2x^2-5x+3) \\ 2x^3-5x^2+3x \\ 2(2x^2-5x+3) \\ 4x^2-10x+6 \end{array}$$

$$\begin{array}{l} x^2-x \\ x(x-1) \end{array}$$

$$\begin{array}{l} 2x(x-1) \\ 2x^2-2x \\ -3(x-1) \\ -3x+3 \end{array}$$

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The H.C.F of given polynomial is $x-1$

We know that:-

$$\text{L.C.M} = \frac{\text{Product of two polynomials}}{\text{H.C.F of two polynomials}}$$

$$\text{L.C.M} = \frac{(x^3-6x^2+11x-6)(x^3-4x+3)}{(x-1)}$$

$$\begin{array}{r} x^2-5x+6 \\ x-1 \overline{) x^3-6x^2+11x-6} \\ \underline{x^3-x^2} \\ -5x^2+11x-6 \\ \underline{-5x^2+5x} \\ 6x-6 \\ \underline{6x-6} \\ 0 \end{array}$$

$$\text{L.C.M} = \frac{(x-1)(x^2-5x+6)(x^3-4x+3)}{(x-1)}$$

$$\text{L.C.M} = (x^2-5x+6)(x^3-4x+3) \quad \underline{\underline{\text{Ans}}}$$



Class : 9

Exercise : 5-1

Example : 2

Example : 2

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Class : 9 Exercise : 5.1 Example : 1
Solve real Life Problems related to
HCF and LCM:
Example : 1

In Book
page # 112

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Class : 9 Exercise : 5.1 Question : 1

Q1: Find the HCF of the following expressions by factorization method:

i. $72x^4y^5z^2$ and $120x^3y^6z^8$

Solution:

$$72x^4y^5z^2 = \underline{2 \times 2 \times 2 \times 3 \times 3 \times \underline{x \times x \times x \times x} \times \underline{y \times y \times y} \times \underline{z \times z}}$$

$$120x^3y^6z^8 = \underline{2 \times 2 \times 2 \times 3 \times 5 \times \underline{x \times x \times x} \times \underline{y \times y \times y \times y \times y \times y} \times \underline{z \times z \times z \times z \times z \times z \times z \times z}}$$

$$\text{H.C.F} = \underline{2 \times 2 \times 2 \times 3 \times x \times x \times x \times y \times y \times y \times y \times y \times z \times z}$$

$$\text{H.C.F} = \underline{24x^3y^5z^2} \text{ Ans}$$

iv. $4x^2 - 9$ and $2x^2 - 5x + 3$

Solution:

$$= 4x^2 - 9$$

$$= (2x)^2 - (3)^2$$

$$= (2x+3)(2x-3)$$

$$= 2x^2 - 5x + 3$$

$$= 2x^2 - 2x - 3x + 3$$

$$= 2x(x-1) - 3(x-1)$$

$$= (2x-3)(x-1)$$

$$\text{Common factor} = 2x-3$$

$$\text{H.C.F} = 2x-3$$

$$= a^2 - b^2 = (a+b)(a-b)$$

$$2x^2 \times 3 = 6x^2$$

$$\begin{array}{r} 2 \times 3 \\ 3 \times 3 \\ 1 \times 3 \end{array}$$



Class: 9 Exercise: 5.1 Question: 1

Q1: Find the HCF of the following expression by factorization method:

ii. $18r^3s^4t^5$, $120r^4s^3t^8$ and $210r^7s^7t^3$

Solution:

$$18r^3s^4t^5 = 2 \times 3 \times 3 \times r \times r \times r \times s \times s \times s \times s \times t \times t \times t \times t \times t$$

$$120r^4s^3t^8 = 2 \times 2 \times 2 \times 3 \times 5 \times r \times r \times r \times r \times s \times s \times s \times t \times t \times t \times t \times t \times t \times t \times t$$

$$210r^7s^7t^3 = 2 \times 3 \times 5 \times 7 \times r \times r \times r \times r \times r \times r \times r \times s \times s \times s \times s \times s \times s \times s \times t \times t \times t$$

Common factor = $2 \times 3 \times r \times r \times r \times s \times s \times s \times t \times t \times t$

H.C.F = $6r^3s^3t^3$ Ans

iii. $x^2 - 3x - 18$ and $x^2 + 5x + 6$

Solution:

$$\begin{aligned} \Rightarrow x^2 - 3x - 18 &= x^2 - 6x + 3x - 18 \\ &= x(x - 6) + 3(x - 6) \\ &= (x + 3)(x - 6) \end{aligned}$$

$$\begin{aligned} \Rightarrow x^2 + 5x + 6 &= x^2 + 3x + 2x + 6 \\ &= x(x + 3) + 2(x + 3) \\ &= (x + 2)(x + 3) \end{aligned}$$

Common factor = $(x + 3)$

H.C.F = $(x + 3)$

Part (iv) Part (i)

$$-\frac{x}{c} \frac{iv}{7} \frac{2}{2}$$



v. $(2a^2 - 8b^2)$, $(4a^2 + 4ab - 24b^2)$ and $(2a^2 - 12ab + 16b^2)$

Solution:

Part (v)

$$= 2a^2 - 8b^2$$

$$= 2(a^2 - 4b^2)$$

$$= 2[(a)^2 - (2b)^2]$$

$$= 2(a+2b)(a-2b)$$

$$\therefore (a^2 - b^2) = (a+b)(a-b)$$

$$= 4a^2 + 4ab + 24b^2$$

$$= 4(a^2 + ab - 6b^2)$$

$$= 4(a^2 + 3ab - 2ab - 6b^2)$$

$$= 4[a(a+3b) - 2b(a+3b)]$$

$$= 4(a+3b)(a-2b) = 2 \times 2(a+3b)(a-2b)$$

$$= 2a^2 - 12ab + 16b^2$$

$$= 2(a^2 - 6ab + 8b^2)$$

$$= 2(a^2 - 4ab - 2ab + 8b^2)$$

$$= 2[a(a-4b) - 2b(a-4b)]$$

$$= 2(a-4b)(a-2b)$$

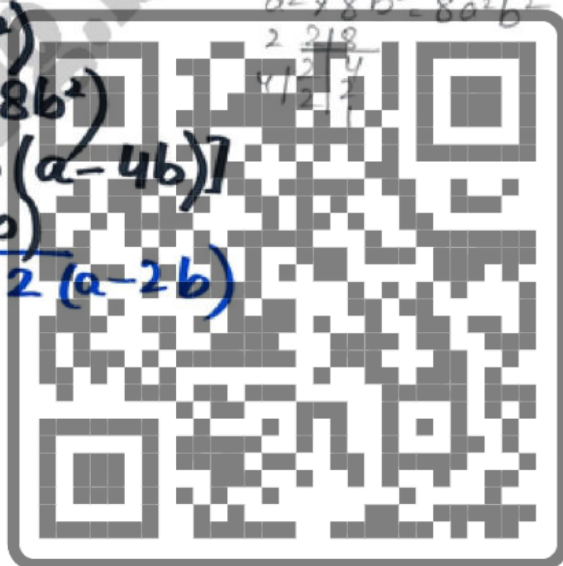
Common factors = $2(a-2b)$

H.C.F = $2(a-2b)$

$$\begin{array}{r} a^2x - 6b^2 \\ -6a^2b^2 \\ \hline 2/6 \\ 3/3 \\ \hline 1 \end{array}$$

$$a^2 \times 8b^2 - 8a^2b^2$$

$$\begin{array}{r} 2 \times 8 \\ 4/2/4 \\ \hline 2/2/2 \end{array}$$



vi- $x^3 + x^2 + x + 1$ and $x^3 + 3x^2 + 3x + 1$

Solution:

$= x^3 + x^2 + x + 1$

Let $P(x) = x^3 + x^2 + x + 1$

The factors of 1 are ± 1

Put $x = -1$

$P(-1) = (-1)^3 + (-1)^2 + (-1) + 1$

$P(-1) = -1 + 1 - 1 + 1$

$P(-1) = 0$

Here -1 is a multiplier:-

Here $x+1$ is a factor of given polynomial.

-1	1	1	1	1
		-1	0	-1
	1	0	1	0

$0 \rightarrow$ Remainder.

$a=1, b=0, c=1$

$Q(x) = ax^2 + bx + c$

$\Rightarrow 1x^2 + 0x + 1$

$\Rightarrow x^2 + 1$

$P(x) = (x+1)(x^2+1)$

$\Rightarrow x^3 + 3x^2 + 3x + 1$

Let $P(x) = x^3 + 3x^2 + 3x + 1$

The factors of 1 are ± 1

Put $x = -1$

$P(-1) = (-1)^3 + 3(-1)^2 + 3(-1) + 1$

$P(-1) = -1 + 3 - 3 + 1$

$P(-1) = 0$

Here multiplier is -1

Here, $x+1$ is a factor of given expression.

-1	1	3	3	1
		-1	-2	-1
	1	2	1	0

$0 \rightarrow$ Remainder:-

$P(x) = (x+1)(x^2+2x+1)$



$$\begin{aligned}
 P(x) &= (x+1)(x^2+x+x+1) \\
 P(x) &= (x+1)[x(x+1)+1(x+1)] \\
 P(x) &= (x+1)(x+1)(x+1) \\
 P(x) &= (x+1)^3 \\
 \text{common factors} &= (x+1) \\
 \text{H.C.F} &= (x+1)
 \end{aligned}$$

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Class: 9

Exercise: 5.1

Question: 2

Q:2 Find the HCF of the following expressions by division method:

i. $x^2 + 3x + 2$ and $3x^2 - 3x - 6$

Solution: 3

$$\begin{array}{r} x^2 + 3x + 2 \overline{) 3x^2 - 3x - 6} \\ \underline{- 3x^2 + 9x + 6} \\ -12x - 12 \\ = -12x - 12 \\ = -12(x+1) \end{array}$$

$$\text{Again, } x+1 \overline{) x^2 + 3x + 2} \\ \underline{- x^2 + x} \\ 2x + 2 \\ \underline{- 2x + 2} \\ 0$$

H.C.F = $x+1$

ii. $2x^3 + 15x^2 + 31x + 12$ and $3x^3 + 23x^2 + 50x + 24$

Solution: 1

$$\begin{array}{r} 2x^3 + 15x^2 + 31x + 12 \overline{) 3x^3 + 23x^2 + 50x + 24} \\ \underline{- 2x^3 + 15x^2 + 31x + 12} \\ x^3 + 8x^2 + 19x + 12 \end{array}$$

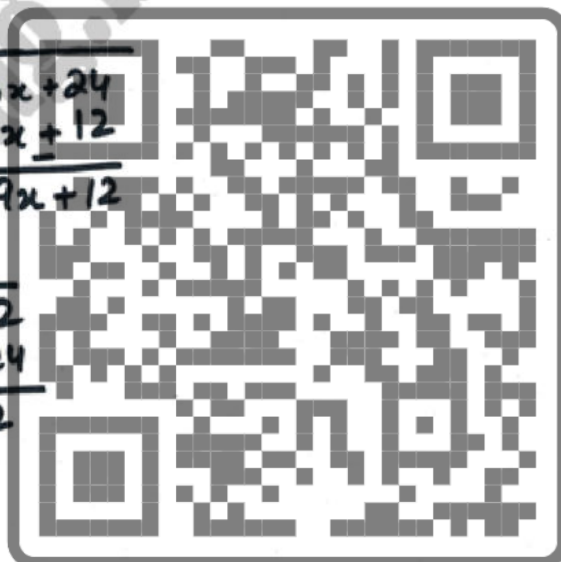
$$\text{Again, } x^3 + 8x^2 + 19x + 12 \overline{) 2x^3 + 15x^2 + 31x + 12} \\ \underline{- 2x^3 + 16x^2 + 38x + 24} \\ -x^2 - 7x - 12$$

$$= -x^2 - 7x - 12 \\ = -(x^2 + 7x + 12)$$

$$\text{Again, } x^2 + 7x + 12 \overline{) x^3 + 8x^2 + 19x + 12} \\ \underline{- x^3 + 7x^2 + 12x} \\ x^2 + 7x + 12 \\ \underline{- x^2 + 7x + 12} \\ 0$$

$$\begin{aligned} \text{H.C.F} &= x^2 + 7x + 12 \times x \times x \\ &= x^2 + 3x + 4x + 12 \\ &= x(x+3) + 4(x+3) \\ &= (x+4)(x+3) \text{ Ans} \end{aligned}$$

$$\begin{array}{r} 12x^2 \\ 4 \overline{) 2 \overline{) 12}} \\ \underline{2 \overline{) 6}} \\ 3 \overline{) 3} \\ 1 \end{array}$$



Class : 9

Exercise : 5-1

Question : 2

iii- $4x^3 - 2x^2 - 100x - 50$ and $x^4 + 10x^3 + 16x^2 - 250x - 225$

Solution :

*Solution
Not possible -*

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Class: 9

Exercise: 5.1

Question: 2

iv. $x^2+xy-2y^2$, $x^2+3y+2y^2$ and $x^3+3x^2y+2xy^2+2y^3$

Solution:

$$x^2+xy-2y^2, x^2+3xy+2y^2, x^3+3x^2y+3xy^2+2y^3$$

$$\begin{array}{r} x^2+xy-2y^2 \overline{) x^2+3xy+2y^2} \\ \underline{-(x^2+xy-2y^2)} \\ 2xy+4y^2 \end{array}$$

$$= 2xy+4y^2$$

$$= 2y(x+2y)$$

$$\begin{array}{r} x-y \\ x+2y \overline{) x^2+xy-2y^2} \\ \underline{-(x^2+2xy)} \\ -xy-2y^2 \end{array}$$

$$\begin{array}{r} -xy-2y^2 \\ \underline{+(xy+2y^2)} \\ 0 \end{array}$$

$$\begin{array}{r} x^2+xy+y^2 \\ x+2y \overline{) x^3+3x^2y+3xy^2+2y^3} \\ \underline{-(x^3+2x^2y)} \\ x^2y+3xy^2+2y^3 \end{array}$$

$$\begin{array}{r} x^2y+3xy^2+2y^3 \\ \underline{-(x^2y+2xy^2)} \\ xy^2+2y^3 \end{array}$$

$$\begin{array}{r} xy^2+2y^3 \\ \underline{-(xy^2+2y^3)} \\ 0 \end{array}$$

$$\text{H.C.F} = (x+2y)^x$$



Class : 9

Exercise # 5.1

Question : 3

L.C.M = Common factor $\times$ Uncommon factor

Find the LCM of the following expressions by factorization method:

i. $27a^4b^5c^2$ and $81ab^2c^8$

Solution:

$$27a^4b^5c^2 = \underline{3 \times 3 \times 3} \times \underline{a \times a \times a \times a} \times \underline{b \times b \times b \times b} \times \underline{c \times c}$$

$$81ab^2c^8 = \underline{3 \times 3 \times 3 \times 3} \times \underline{a} \times \underline{b \times b} \times \underline{c \times c \times c \times c \times c \times c \times c \times c}$$

L.C.M = Common factor $\times$ Uncommon factor:

$$L.C.M = 3 \times 3 \times 3 \times a \times b \times b \times c \times c \times a \times a \times a \times b \times b \times b \times 3 \times c \times c \times c \times c \times c \times c$$

$$L.C.M = 81a^4b^5c^8 \quad \underline{\text{Ans}}$$

ii. $24p^2q^3r^4$, $104p^5q^4r^5$ and $300p^3q^2r^8$

Solution:

$$24p^2q^3r^4 = \underline{2 \times 2 \times 2 \times 3} \times \underline{p \times p} \times \underline{q \times q \times q} \times \underline{r \times r \times r \times r}$$

$$104p^5q^4r^5 = \underline{2 \times 2 \times 2 \times 13} \times \underline{p \times p \times p \times p \times p} \times \underline{q \times q \times q \times q} \times \underline{r \times r \times r \times r \times r}$$

$$300p^3q^2r^8 = \underline{2 \times 2 \times 3 \times 5 \times 5} \times \underline{p \times p \times p} \times \underline{q \times q} \times \underline{r \times r \times r \times r \times r \times r \times r \times r}$$

$$\text{Common factor} = 2 \times 2 \times 2 \times 3 \times p \times p \times p \times q \times q \times q \times r \times r \times r \times r$$

Uncommon factor =

$$\text{Uncommon factor} = 13 \times p \times p \times q \times 5 \times 5 \times r \times r \times r$$

L.C.M = Common factor $\times$ Uncommon factors.

$$L.C.M = 2 \times 2 \times 2 \times 3 \times p \times p \times p \times q \times q \times q \times r \times r \times r \times r \times r \times 13 \times 5 \times 5 \times p \times p \times q \times r \times r \times r$$

$$L.C.M = 7800p^9q^4r^8 \quad \underline{\text{Ans}}$$



Class : 9

Exercise # 5-1

Question : 3

iii - $21x^2 - 14x$ and $3x^2 - 5x + 2$

Solution:

$$21x^2 - 14x = 7x(3x - 2)$$

$$\begin{aligned} 3x^2 - 5x + 2 &= 3x^2 - 2x - 3x + 2 \\ &= x(3x - 2) - 1(3x - 2) \\ &= (x - 1)(3x - 2) \end{aligned}$$

L.C.M = Common factor $\times$ Uncommon factor.

$$L.C.M = (3x - 2)(x - 1)7x$$

$$L.C.M = 7x(3x - 2)(x - 1)$$

$$\begin{array}{r} 2 \overline{) 6} \\ 3 \overline{) 3} \\ 1 \end{array}$$

iv - $x^2 + 11x + 28$ and $x^2 + x - 12$

Solution:

$$\Rightarrow x^2 + 11x + 28$$

$$\Rightarrow x^2 + 4x + 7x + 28$$

$$\Rightarrow x(x + 4) + 7(x + 4)$$

$$\Rightarrow (x + 7)(x + 4)$$

$$\Rightarrow x^2 + x - 12$$

$$= x^2 + 4x - 3x - 12$$

$$= x(x + 4) - 3(x + 4)$$

$$= (x + 4)(x - 3)$$

L.C.M = Common factor $\times$ Uncommon factor.

$$L.C.M = (x + 4)(x + 7)(x - 3) \underline{\underline{Ans}}$$



$$\begin{array}{r} x^2 \times 28 = 28x^2 \\ 2 \overline{) 28} \\ 14 \end{array}$$

$$\begin{array}{r} x^2x - 12 = 12x^2 \\ 4 \overline{) 12} \\ 3 \end{array}$$



Class: 9

Exercise # 5.1

Question: 3

v. $6x^2 + 11x + 3$, $2x^2 - 5x - 11$ and $3x^2 - 11x - 4$

Solution:

$$= 6x^2 + 11x + 3$$

$$= 6x^2 + 9x + 2x + 3$$

$$= 3x(2x+3) + 1(2x+3)$$

$$= (2x+3)(3x+1)$$

$$= 2x^2 - 5x - 11$$

$$= 2x^2 - 5x - 11$$

$$= 3x^2 - 11x - 4$$

$$= 3x^2 - 12x + x - 4$$

$$= 3x(x-4) + 1(x-4)$$

$$= (x-4)(3x+1)$$

L.C.M = Common factor $\times$ Uncommon factor.

$$\text{L.C.M} = (3x+1)(2x+3)(2x^2-5x-11)(x-4) \text{ Ans}$$

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Class : 9

Exercise # 5.1

Question # 3

vi- $x^2 - y^2$, $x^3 - y^3$ and $x^4 + x^2y^2 + y^4$

Solution:

$$= x^2 - y^2$$

$$= (x)^2 - (y)^2$$

$$= (x+y)(x-y)$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$= x^3 - y^3$$

$$= (x)^3 - (y)^3$$

$$= (x-y)(x^2 + xy + y^2)$$

$$\therefore a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$= x^4 + x^2y^2 + y^4$$

$$x^4 \times y^4 = x^4 y^4$$

L.C.M = Common factor $\times$ Uncommon factor

$$= (x-y)(x+y)(x^2 + xy + y^2)(x^4 + x^2y^2 + y^4)$$
$$= (x-y)(x^2 + xy + y^2)(x+y)(x^4 + x^2y^2 + y^4)$$
$$= (x^3 - y^3)(x+y)(x^4 + x^2y^2 + y^4) \text{ Ans}$$

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Class: 9

Exercise # 5-1

Question # 4

Find the LCM by Division method:

i. $x^2 - 25x + 100$ and $x^2 - x - 20$

Solution:

$$\text{L.C.M} = \frac{P(x) \times Q(x)}{\text{H.C.F}} \rightarrow \textcircled{1}$$

$$\begin{array}{r} 1 \\ x^2 - x - 20 \overline{) x^2 - 25x + 100} \\ \underline{+ x^2 + x + 20} \\ -24x + 120 \end{array}$$

$$= -24x + 120$$

$$= -24(x - 5)$$

Again,

$$\begin{array}{r} x+4 \\ x-5 \overline{) x^2 - x - 20} \\ \underline{+ x^2 + 5x} \\ 4x - 20 \\ \underline{4x - 20} \\ 0 \end{array}$$

$$\text{H.C.F} = x-5$$

$$\text{L.C.M} = \frac{(x^2 - 25x + 100)(x^2 - x - 20)}{x-5}$$

$$\begin{array}{r} x-20 \\ x-5 \overline{) x^2 - 25x + 100} \\ \underline{+ x^2 + 5x} \\ -20x + 100 \\ \underline{-20x + 100} \\ 0 \end{array}$$

$$\text{L.C.M} = \frac{(x-5)(x-20)(x-5)(x+4)}{(x-5)}$$

$$\text{L.C.M} = (x-20)(x-5)(x+4) \underline{\underline{\text{Ans}}}$$



Class: 9

Exercise # 5.1

Question # 4

Find the LCM by Division method:

ii. $3x^2 + 14x + 8$ and $6x^2 + x - 2$

Solution: L.C.M = $\frac{P(x)Q(x)}{H.C.F} \rightarrow \textcircled{1}$

$$\begin{array}{r} 2 \\ 3x^2+14x+8 \overline{) 6x^2+x-2} \\ \underline{-6x^2+28x+16} \\ -27x-18 \end{array}$$

$$\begin{array}{r} 2(3x^2+14x+8) \\ 6x^2+28x+16 \end{array}$$

$$\begin{aligned} &= -27x - 18 \\ &= -9(3x+2) \end{aligned}$$

$$\begin{array}{r} x+4 \\ 3x+2 \overline{) 3x^2+14x+8} \\ \underline{-3x^2+2x} \\ 12x+8 \end{array}$$

H.C.F = $3x+2$

L.C.M = $\frac{(3x^2+14x+8)(6x^2+x-2)}{3x+2}$

$$\begin{array}{r} x+4 \\ 3x+2 \overline{) 3x^2+14x+8} \\ \underline{-3x^2+2x} \\ 12x+8 \end{array}$$

$$\begin{array}{r} 2x-1 \\ 3x+2 \overline{) 6x^2+x-2} \\ \underline{-6x^2+4x} \\ -3x-2 \\ \underline{+3x+2} \\ 0 \end{array}$$

L.C.M = $\frac{(3x+2)(x+4)(3x+2)(2x-1)}{(3x+2)}$

L.C.M = $(x+4)(3x+2)(2x-1)$ Ans

$$\begin{array}{r} 5 \\ 13 \overline{) 72} \\ \underline{65} \\ 7 \end{array} \quad \begin{array}{r} 1 \\ 7 \overline{) 13} \\ \underline{7} \\ 6 \end{array} \quad \begin{array}{r} 1 \\ 6 \overline{) 7} \end{array}$$



Class: 9

Exercise # 5.1

Question: 4

Find the LCM by Division method:

iii. $x^2 - y^2 - z^2 - 2yz$ and $y^2 - z^2 - x^2 - 2xz$

Solution: $L.C.M = \frac{P(x)Q(x)}{H.C.F}$

$$\begin{aligned} &= x^2 - y^2 - z^2 - 2yz \\ &= -(-y^2 + z^2 + x^2 + 2xz) \\ &= -(x^2 - y^2 + z^2 + 2xz) \end{aligned}$$

$$\begin{array}{r} \overline{1} \\ x^2 - y^2 + z^2 + 2xz \overline{) x^2 - y^2 - z^2 - 2yz} \\ \underline{-x^2 + y^2 - z^2} \\ -2z^2 - 2yz - 2xz \end{array}$$

$$\begin{aligned} &= -2z^2 - 2yz - 2xz \\ &= -2z(z + y + x) \\ &= -2z(x + y + z) \end{aligned}$$

$$\begin{array}{r} \overline{x - y + z} \\ x + y + z \overline{) x^2 - y^2 + z^2 + 2xz} \\ \underline{-x^2 + y^2 - z^2} \\ -y^2 + z^2 + xz \\ \underline{+y^2} \\ z^2 + xz \\ \underline{-z^2 + xz} \\ xz \\ \underline{-xz} \\ \end{array}$$

H.C.F = $x + y + z$

L.C.M = $\frac{(x^2 - y^2 - z^2 - 2yz)(y^2 - z^2 - x^2 - 2xz)}{(x + y + z)}$ Ans



$$\begin{array}{r}
 x-y-z \\
 x+y+z \overline{) x^2 - y^2 - z^2 - 2yz} \quad +xy +xz \\
 \underline{-x^2} \\
 -y^2 - z^2 - 2yz - xy - xz \\
 \underline{+y^2} \\
 -z^2 - yz - xz \\
 \underline{+z^2} \\
 -yz - xz \\
 \underline{+yz} \\
 -xz \\
 \underline{+xz} \\
 0
 \end{array}$$

$$\begin{array}{r}
 y-z-x \\
 x+y+z \overline{) y^2 - z^2 - x^2 - 2xz} \quad +xy +yz \\
 \underline{-y^2} \\
 -z^2 - x^2 - 2xz - xy - yz \\
 \underline{+z^2} \\
 -x^2 - xz - yz \\
 \underline{+x^2} \\
 -xz - yz \\
 \underline{+xz} \\
 -yz \\
 \underline{+yz} \\
 0
 \end{array}$$

$$L.C.M = (x+y+z)(x-y-z)(x+y+z)(y-z-x)$$

$$L.C.M = (x-y-z)(x+y+z)(y-z-x)$$

MORE!!!



Class: 9

Exercise # 5-1

Question: 4

Find the LCM by division method:

iv. $3x^3 + 9x^2 - 84x$ and $4x^4 - 24x^3 + 32x^2$

Solution: L.C.M = $\frac{P(x)Q(x)}{H.C.F}$

$$\begin{aligned} &= 3x^3 + 9x^2 - 84x \\ &= 3x(x^2 + 3x - 28) \\ &= 4x^4 - 24x^3 + 32x^2 \\ &= 4x^2(x^2 - 6x + 8) \end{aligned}$$

$$\begin{array}{r} x^2 - 6x + 8 \overline{) x^2 + 3x - 28} \\ \underline{-(x^2 - 6x + 8)} \\ 9x - 36 \end{array}$$

$$\begin{aligned} &= 9x - 36 \\ &= 9(x - 4) \end{aligned}$$

$$\begin{array}{r} x - 2 \\ x - 4 \overline{) x^2 - 6x + 8} \\ \underline{-(x^2 - 4x)} \\ -2x + 8 \\ \underline{-(2x - 8)} \\ 0 \end{array}$$

H.C.F = $(x - 4)$

$$L.C.M = \frac{(3x^3 + 9x^2 - 84x)(4x^4 - 24x^3 + 32x^2)}{(x - 4)}$$

$$L.C.M = \frac{3x(x^2 + 3x - 28) \cdot 4x^2(x^2 - 6x + 8)}{(x - 4)}$$

$$L.C.M = \frac{12x^3(x^2 + 3x - 28)(x^2 - 6x + 8)}{(x - 4)}$$



Class: 9

Question: 5

$$\begin{array}{r} x+7 \\ x-4 \overline{) x^2+3x-28} \\ \underline{-x^2+4x} \\ 7x-28 \\ \underline{-7x+28} \\ 0 \end{array}$$

$$\begin{array}{r} x-2 \\ x-4 \overline{) x^2-6x+8} \\ \underline{-x^2+4x} \\ -2x+8 \\ \underline{+2x-8} \\ 0 \end{array}$$

$$\text{L.C.M} = \frac{12x^3 (x-4)(x+7)(x-4)(x-2)}{(x-4)}$$

$$\text{L.C.M} = 12x^3 (x+7)(x-4)(x-2) \text{ Ans}$$

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Class: 9

Exercise # 5.1

Question : 5

If the HCF of the $x^2 - 11x + 24$ and $x^2 - 6x + 6$ is $(x-3)$. Find the LCM :

Solution:

$$\text{L.C.M} = \frac{P(x) \cdot Q(x)}{\text{H.C.F}}$$

$$\text{L.C.M} = \frac{(x^2 - 11x + 24)(x^2 - 6x + 6)}{(x-3)}$$

$$\begin{array}{r} x-8 \\ x-3 \overline{) x^2 - 11x + 24} \\ \underline{-(x^2 - 3x)} \\ -8x + 24 \\ \underline{+(8x - 24)} \\ 0 \end{array}$$

$$\begin{array}{r} x-3 \\ x-3 \overline{) x^2 - 6x + 9} \\ \underline{-(x^2 - 3x)} \\ -3x + 9 \\ \underline{+(3x - 9)} \\ 0 \end{array}$$

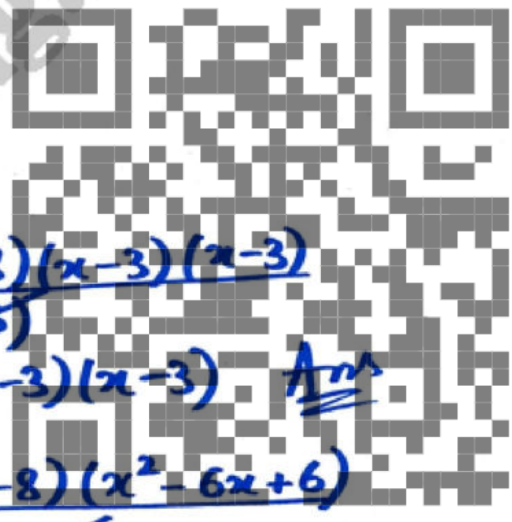
$$\text{L.C.M} = \frac{(x-3)(x-8)(x-3)(x-3)}{(x-3)}$$

$$\text{L.C.M} = (x-8)(x-3)(x-3) \quad \underline{\underline{\text{Ans}}}$$

$$\text{L.C.M} = \frac{(x-3)(x-8)(x^2 - 6x + 6)}{(x-3)}$$

$$\text{L.C.M} = (x-8)(x^2 - 6x + 6)$$

Ans



Class: 9

Exercise # 5.1

Question: 6

The HCF and LCM of two expressions are $(x+3)$ and $(x^3+7x^2+7x-15)$, if one expression is $x^2+8x+15$. Find the second expression.

Solution: $\text{HCF} \times \text{L.C.M} = \text{1st Poly} \times \text{2nd Poly}$
 $\text{2nd Polynomial} = \frac{\text{H.C.F} \times \text{L.C.M}}{\text{1st Poly}}$

$$\text{2nd Polynomial} = \frac{(x+3)(x^3+7x^2+7x-15)}{x^2+8x+15} \rightarrow \textcircled{1}$$

To find the factors of L.C.M:

$$\begin{array}{r} x+3 \overline{) x^3+7x^2+7x-15} \quad (x^2+4x-5) \\ \underline{x^3+3x^2} \\ 4x^2+7x-15 \\ \underline{4x^2+12x} \\ -5x-15 \\ \underline{-5x-15} \\ 0 \end{array}$$

$$\begin{aligned} \text{L.C.M} &= (x+3)(x^2+4x-5) \\ &= (x+3)(x^2+5x-x-5) \\ &= (x+3)[x(x+5)-1(x+5)] \\ &= (x+3)(x+5)(x-1) \end{aligned}$$

Now find factors of 1st polynomial.

$$\begin{aligned} \text{1st polynomial} &= x^2+8x+15 \\ &= x^2+5x+3x+15 \\ &= [x(x+5)+3(x+5)] \\ &= (x+5)(x+3) \end{aligned}$$

Put all the factor in above formula:-

$$\text{2nd Polynomial} = \frac{(x+3)(x+3)(x+5)(x-1)}{(x+5)(x+3)}$$

$$\begin{aligned} &= (x+3)(x-1) \\ &= x^2-x+3x-3 \end{aligned}$$

$$\text{2nd Polynomial} = x^2+2x-3$$



Class: 9

Exercise # 5.1

Question: 7

The HCF and LCM of two polynomial of the second degree are $(3x-2)$ and $(3x^3+7x^2-4)$ respectively. Find the product of two polynomial.

Solution:

$H.C.F \times L.C.M = 1^{st} \text{ polynomial} \times 2^{nd} \text{ Polynomial}$

$$\begin{aligned} 1^{st} \times 2^{nd} &= (3x-2)(3x^3+7x^2-4) \\ &= 3x(3x^3+7x^2-4) - 2(3x^3+7x^2-4) \\ &= 9x^4 + 21x^3 - 12x - 6x^3 - 14x^2 + 8 \end{aligned}$$

$$\text{Product} = 9x^4 + 15x^3 - 14x^2 - 12x + 8$$

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Exercise # 5.1

Question: 8

Verify the relationship between HCF and LCM.

i.e: $(\text{HCF} \times \text{LCM}) = P(x) \times Q(x)$ for the polynomial $P(x) = x^2 - 8x - 20$ and

$$Q(x) = x^2 - 15x + 50$$

Solution:

$$\text{L.C.M} \times \text{H.C.F} = P(x) \times Q(x)$$

To find L.C.M and H.C.F of $P(x)$ and $Q(x)$ we factorize:

$$P(x) = x^2 - 8x - 20$$

$$P(x) = x^2 - 10x + 2x - 20$$

$$P(x) = x(x-10) + 2(x-10)$$

$$P(x) = (x-10)(x+2)$$

$$Q(x) = x^2 - 15x + 50$$

$$Q(x) = x^2 - 10x - 5x + 50$$

$$Q(x) = x(x-10) - 5(x-10)$$

$$Q(x) = (x-10)(x-5)$$

L.C.M = Common factor $\times$ Uncommon factors.

$$\text{L.C.M} = (x-10)(x+2)(x-5)$$

H.C.F = Common factors

$$\text{H.C.F} = (x-10)$$

$$\text{L.C.M} \times \text{H.C.F} = P(x) \times Q(x)$$

$$\Rightarrow (x-10)(x+2)(x-5)(x-10) = (x^2 - 8x - 20)(x^2 - 15x + 50)$$

$$\Rightarrow (x^2 + 2x - 10x - 20)(x^2 - 10x - 5x + 50) = x^4 - 15x^3 + 50x^2 - 8x^3 + 120x^2 - 400x - 20x^2 + 300x - 1000$$

$$\Rightarrow x^4 - 23x^3 + 130x^2 - 100x - 1000$$

$$\Rightarrow x^4 - 15x^3 + 50x^2 - 8x^3$$

continue in next page

$$\begin{array}{r} x^2 - 8x - 20 \\ 2 \overline{) 20} \\ 4 \\ \underline{20} \\ 0 \\ 2 \\ \underline{20} \\ 0 \end{array}$$

$$\begin{array}{r} x^2 - 15x + 50 \\ 5 \overline{) 50} \\ 25 \\ \underline{25} \\ 0 \\ 5 \\ \underline{50} \\ 0 \end{array}$$



Now, we find Product of L.C.M & H.C.F

$$\begin{aligned} \text{L.C.M} \times \text{H.C.F} &= (x-10)(x+2)(x-5)(x-10) \\ &= (x^2+2x-10x-20)(x^2-10x-5x+50) \\ &= (x^2-8x-20)(x^2-15x+50) \\ &= x^4-15x^3+50x^2-8x^3+120x^2-400x \\ &\quad -20x^2+300x-1000 \end{aligned}$$

$$\text{L.C.M} \times \text{H.C.F} = x^4 - 23x^3 + 150x^2 - 100x - 1000$$

$$\begin{aligned} P(x) \times Q(x) &= (x^2-8x-20)(x^2-15x+50) \\ &= x^4 - 23x^3 + 150x^2 - 100x - 1000 \end{aligned}$$

$$\text{H.C.F} \times \text{L.C.M} = P(x) \times Q(x)$$

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Proved.

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Class: 9

Exercise # 5.1

Question: 9

A Carpenter got given some free wooden planks. Some are 12cm long and some are 18 cm. He wants to cut them so that he has equal size planks to make using them easier. What size planks should he cut them into to avoid wasting any wood?

Solution:

The H.C.F of 12 and 18 are:

$$12 = 2 \times 2 \times 3$$

$$18 = 2 \times 3 \times 3$$

H.C.F = Common factors:

$$\text{H.C.F} = 2 \times 3$$

$$\text{H.C.F} = 6$$

Carpenter should cut each piece to be 6cm.

$$\begin{array}{r|l} 2 & 12 \\ & 6 \\ 2 & 3 \\ 3 & 1 \end{array}$$

$$\begin{array}{r|l} 2 & 18 \\ & 9 \\ 3 & 3 \\ 3 & 1 \end{array}$$

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Class: 9

Exercise # 5.1

Question: 10

Train A and B stops at Hyderabad at 10:30 am. Train A stops every 12 minutes and train B stops every 14 minutes. When do they both stop together?

Solution:

Train A stops every 12 minutes:

Train B stops every 14 minutes:

Now, find L.C.M of 12 and 14:

$$12 = 2 \times 2 \times 3$$

$$14 = 2 \times 7$$

L.C.M = Common factors $\times$ Uncommon factors:

$$\text{L.C.M} = 2 \times 2 \times 3 \times 7$$

$$\text{L.C.M} = 84$$

Train A and B will stop together every 84 minutes.

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Simplify the following:

$$x - 2 \left(\frac{x^2 + 7x + 12}{x^2 - 16} \right) + \frac{x^2 + x - 2}{x^2 + 4x + 4} \times \frac{x^2 - 2x - 8}{2x + 8x^2 + 4}$$

Solution:

$$= 2 \left(\frac{x^2 + 4x + 3x + 12}{x^2 - 4^2} + \frac{x^2 + 2x - x - 2}{x^2 + 2x + 2x + 4} \right) \times \frac{x^2 - 4x + 2x - 8}{2(x + 4x^2 + 2)}$$

$$= 2 \left(\frac{x(x+4) + 3(x+4)}{(x+4)(x-4)} + \frac{x(x+2) - 1(x+2)}{x(x+2) + 2(x+2)} \right) \times \frac{x(x-4) + 2(x-4)}{2(4x^2 + x + 2)}$$

$$= 2 \left(\frac{(x+4)(x+3)}{(x+4)(x-4)} + \frac{(x+2)(x-1)}{(x+2)(x+2)} \right) \times \frac{(x-4)(x+2)}{2(4x^2 + x + 2)}$$

$$= 2 \left(\frac{x+3}{x-4} + \frac{x-1}{x+2} \right) \times \frac{(x-4)(x+2)}{2(4x^2 + x + 2)}$$

$$= 2 \left(\frac{(x+3)(x+2) + (x-1)(x-4)}{(x-4)(x+2)} \right) \times \frac{(x-4)(x+2)}{2(4x^2 + x + 2)}$$

$$= 2 \left(\frac{x^2 + 2x + 3x + 6 + x^2 - 4x - x + 4}{(x-4)(x+2)} \right) \times \frac{(x-4)(x+2)}{2(4x^2 + x + 2)}$$

$$= 2 \left(\frac{2x^2 + 10}{(x-4)(x+2)} \right) \times \frac{(x-4)(x+2)}{2(4x^2 + x + 2)}$$

$$= \frac{2x^2 + 10}{4x^2 + x + 2}$$

$$= \frac{2(x^2 + 5)}{4x^2 + x + 2}$$

Ans



Class : 9

Exercise # 5.2

Examples :

Basic Operations On Algebraic Fractions :

Example # 1 : Simplify :

$$i) \frac{x^2 - x - 6}{2x^2 - 5x - 3} + \frac{1}{4x^2 - 1}$$

Solution :

$$= \frac{x^2 - x - 6}{2x^2 - 5x - 3} + \frac{1}{4x^2 - 1}$$

$$= \frac{x^2 - x - 6}{2x^2 - 6x + x - 3} + \frac{1}{(2x)^2 - (1)^2}$$

$$= \frac{x^2 - x - 6}{2x(x-3) + 1(x-3)} + \frac{1}{(2x+1)(2x-1)}$$

$$= \frac{x^2 - x - 6}{(x-3)(2x+1)} + \frac{1}{(2x+1)(2x-1)}$$

$$= \frac{(x^2 - x - 6)(2x-1) + (x-3)}{(2x+1)(x-3)(2x-1)}$$

$$= 2x^3$$

$$2x^2 \times 3 = 6x^2$$
$$\begin{array}{r} 2 \ 6 \\ - 6 \ 3 \\ \hline 1 \end{array}$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$L.C.M = C \times U$$

continue on next page



$$= \frac{x^2 - 3x + 2x - 6}{2x^2 - 6x + x - 3} + \frac{1}{(2x)^2 - (1)^2}$$

$$x^2 \times -6 = -6x^2$$

$$\begin{array}{r} 2 \overline{) 6} \\ 4 \\ \hline 2 \\ 2 \\ \hline 0 \end{array}$$

$$= \frac{x(x-3) + 2(x-3)}{2x(x-3) + 1(x-3)} + \frac{1}{(2x+1)(2x-1)}$$

$$= \frac{\cancel{(x-3)}(x+2)}{\cancel{(x-3)}(2x+1)} + \frac{1}{(2x+1)(2x-1)}$$

$$= \frac{x+2}{(2x+1)} + \frac{1}{(2x+1)(2x-1)}$$

$$= \frac{(x+2)(2x-1) + 1}{(2x+1)(2x-1)}$$

$$= \frac{2x^2 - x + 4x - 2 + 1}{(2x+1)(2x-1)}$$

$$= \frac{2x^2 + 3x - 1}{(2x)^2 - (1)^2}$$

$$= \frac{2x^2 + 3x - 1}{4x^2 - 1}$$

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Exercise # 5.2

Examples :

Example # 2 : Simplify :

$$\text{ii. } \frac{2}{x+2} - \frac{x-4}{2x^2+x-6}$$

Solution :

$$= \frac{2}{x+2} - \frac{x-4}{2x^2+x-6}$$

$$= \frac{2}{x+2} - \frac{x-4}{2x^2+4x-3x-6}$$

$$= \frac{2}{x+2} - \frac{x-4}{2x(x+2)-3(x+2)}$$

$$= \frac{2}{x+2} - \frac{x-4}{(x+2)(2x-3)}$$

$$= \frac{2(2x-3) - (x-4)}{(x+2)(2x-3)}$$

$$= \frac{2(2x-3) - x + 4}{(x+2)(2x-3)}$$

$$= \frac{4x-6-x+4}{2x^2-3x+4x-6}$$

$$= \frac{3x-2}{2x^2+x-6}$$

Ans

$$\begin{array}{r} 2x^2 + x - 6 = -12x^2 \\ +4 \quad 2 \quad 12 \\ -3 \quad 3 \quad 1 \end{array}$$



Class: 9

Exercise # 5.2

Examples:

Example # 3 : Simplify :

iii- $\frac{ab^2 + 2a}{ab - 6 + 2b - 3a} \times \frac{b^2 - 6b + 9}{b^3 + 2b}$

Solution:

$$= \frac{ab^2 + 2a}{ab - 6 + 2b - 3a} \times \frac{b^2 - 6b + 9}{b^3 + 2b}$$

$$= \frac{a(b^2 + 2)}{ab + 2b - 3a - 6} \times \frac{b^2 - 3b - 3b + 9}{b(b^2 + 2)}$$

$$= \frac{a(b^2 + 2)}{b(a + 2) - 3(a + 2)} \times \frac{b(b - 3) - 3(b - 3)}{b(b^2 + 2)}$$

$$= \frac{a(b^2 + 2)}{(a + 2)(b - 3)} \times \frac{(b - 3)(b - 3)}{b(b^2 + 2)}$$

$$= \frac{a}{(a + 2)} \times \frac{(b - 3)}{b}$$
$$= \frac{a(b - 3)}{b(a + 2)} \quad \text{Ans}$$

$$b^2 \times 9 = 9b^2$$
$$\begin{array}{r} 3 \overline{) 9} \\ 3 \overline{) 3} \\ 1 \end{array}$$



Class: 9

Exercise # 5.2

Examples:

Example # 4: Simplify:

iv- $\frac{p^2 - q^2}{r^2 + 2rs + s^2} \div \frac{2(p+q)}{3(r+s)s}$

Solution:

$$= \frac{p^2 - q^2}{r^2 + 2rs + s^2} \div \frac{2(p+q)}{3(r+s)s}$$

$$= \frac{(p+q)(p-q)}{r^2 + rs + rs + s^2} \div \frac{2(p+q)}{3s(r+s)}$$

$$= \frac{(p+q)(p-q)}{r(r+s) + s(r+s)} \div \frac{2(p+q)}{3s(r+s)}$$

$$= \frac{(p+q)(p-q)}{(r+s)(r+s)} \times \frac{3s(r+s)}{2(p+q)}$$

$$= \frac{3s(p-q)}{2(r+s)} \quad \underline{\underline{\text{Ans}}}$$

$$\therefore a^2 - b^2 = (a+b)(a-b)$$

$$r^2 \times s^2 = r^2 s^2$$

$$\begin{array}{c} 1 \\ 1 \end{array}$$



Example # 2

Simplify : $\frac{2}{x+2} - \frac{x-4}{2x^2+x-6}$

Solution:

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Simplify the following :

i. $\frac{4x}{x^2+2x+1} + \frac{3}{x+1}$

Solution:

$$= \frac{4x}{x^2+2x+1} + \frac{3}{x+1}$$

$$= \frac{4x}{x^2+x+x+1} + \frac{3}{x+1}$$

$$= \frac{4x}{x(x+1)+1(x+1)} + \frac{3}{x+1}$$

$$= \frac{4x}{(x+1)(x+1)} + \frac{3}{(x+1)}$$

$$= \frac{4x + 3(x+1)}{(x+1)(x+1)}$$

$$= \frac{4x + 3x + 3}{(x+1)(x+1)}$$

$$= \frac{7x + 3}{(x+1)^2}$$

Ans



L.C.M = Common $\times$ Uncommon



Simplify the following:

ii. $\frac{3}{x(2x+1)} + \frac{6x+7}{3x(x+1)}$

Solution:

$$= \frac{3}{x(2x+1)} + \frac{6x+7}{3x(x+1)}$$

$$= \frac{3}{x(2x+1)} + \frac{6x+7}{3x(x+1)}$$

$$= \frac{3 \times 3(x+1) + (6x+7)(2x+1)}{3x(2x+1)(x+1)}$$

$$= \frac{9x+9 + 12x^2+6x+14x+7}{3x(2x+1)(x+1)}$$

$$= \frac{12x^2 + 29x + 16}{3x(2x+1)(x+1)}$$

MORE!!!



Simplify the following:

$$\text{iii. } \frac{3x-1}{x^2+2x+1} - \frac{4x^2-1}{x^2-2x-3}$$

Solution:

$$= \frac{3x-1}{x^2+2x+1} - \frac{4x^2-1}{x^2-2x-3}$$

$$= \frac{3x-1}{x^2+x+x+1} - \frac{(2x)^2-(1)^2}{x^2-3x+x-3}$$

$$= \frac{3x-1}{x(x+1)+1(x+1)} - \frac{4x^2-1}{x(x-3)+1(x-3)}$$

$$= \frac{3x-1}{(x+1)(x+1)} - \frac{4x^2-1}{(x-3)(x+1)}$$

$$= \frac{(3x-1)(x-3) - [4x^2-1](x+1)}{(x+1)(x+1)(x-3)}$$

$$= \frac{3x^2-9x-x+3 - (4x^3+4x^2-x-1)}{(x+1)^2(x-3)}$$

$$= \frac{3x^2-10x+3-4x^3-4x^2+x+1}{(x+1)^2(x-3)}$$

$$= \frac{-4x^3-x^2-9x+4}{(x+1)^2(x-3)}$$

$$= -\frac{(4x^3+x^2+9x-4)}{(x+1)^2(x-3)}$$



Simplify the following:

iv. $\frac{1}{x+1} - \frac{2}{x+2} + \frac{3}{x+3}$

Solution:

$$= \frac{1}{x+1} - \frac{2}{x+2} + \frac{3}{x+3}$$

$$= \frac{(x+2)(x+3) - [2(x+1)(x+3)] + 3(x+1)(x+2)}{(x+1)(x+2)(x+3)}$$

$$= \frac{x^2 + 3x + 2x + 6 - [2(x^2 + 3x + x + 3)] + 3(x^2 + 2x + x + 2)}{(x+1)(x+2)(x+3)}$$

$$= \frac{x^2 + 5x + 6 - (2x^2 + 8x + 6) + 3x^2 + 9x + 6}{(x+1)(x+2)(x+3)}$$

$$= \frac{x^2 + 5x + \cancel{6} - 2x^2 - 8x - \cancel{6} + 3x^2 + 9x + 6}{(x+1)(x+2)(x+3)}$$

$$= \frac{2x^2 + 6x + 6}{(x+1)(x+2)(x+3)}$$

$$= \frac{2(x^2 + 3x + 3)}{(x+1)(x+2)(x+3)}$$

Ans



Simplify the following:

v. $\frac{x^2+4x+3}{5} \times \frac{10}{x+1}$

Solution:

$$= \frac{x^2+4x+3}{5} \times \frac{10}{x+1}$$

$$= \frac{x^2+3x+x+3}{5} \times \frac{10}{x+1}$$

$$= \frac{x(x+3)+1(x+3)}{5} \times \frac{10}{(x+1)}$$

$$= \frac{(x+3)(x+1)}{5} \times \frac{10}{(x+1)}$$

$$= 2(x+3)$$

$$= 2x+6 \quad \underline{\text{Ans}}$$

MORE!!!



Simplify the following:

$$\text{vi. } \frac{x^2 - 4x - 21}{x^2 - 6x - 7} \div \frac{x+9}{x+1}$$

Solution:

$$= \frac{x^2 - 4x - 21}{x^2 - 6x - 7} \div \frac{x+9}{x+1}$$

$$= \frac{x^2 - 7x + 3x - 21}{x^2 - 7x + x - 7} \div \frac{x+9}{x+1}$$

$$= \frac{x(x-7) + 3(x-7)}{x(x-7) + 1(x-7)} \div \frac{x+9}{x+1}$$

$$= \frac{(x-7)(x+3)}{(x-7)(x+1)} \times \frac{(x+1)}{(x+9)}$$

$$= \frac{(x+3)}{(x+9)} \quad \underline{\underline{\text{Ans}}}$$

$$\begin{array}{r} x^2 - 21 = -21x^2 \\ 3 \overline{) 21} \\ 7 \overline{) 7} \\ 1 \end{array}$$



Simplify the following:

$$\text{vii} - \left[\frac{3}{x+1} + \frac{1}{x+2} \right] \div \left[\frac{2}{x+3} - 1 \right]$$

Solution:

$$= \left[\frac{3}{x+1} + \frac{1}{x+2} \right] \div \left[\frac{2}{x+3} - 1 \right]$$

$$= \left[\frac{3(x+2) + (x+1)}{(x+1)(x+2)} \right] \div \left[\frac{2 - (x+3)}{(x+3)} \right]$$

$$= \left[\frac{3x+6+x+1}{(x+1)(x+2)} \right] \div \left[\frac{2-x-3}{(x+3)} \right]$$

$$= \left[\frac{4x+7}{(x+1)(x+2)} \right] \div \left[\frac{-1-x}{(x+3)} \right]$$

$$= \frac{(4x+7)}{(x+1)(x+2)} \times \frac{(x+3)}{(-x-1)}$$

$$= \frac{(4x+7)(x+3)}{(x+1)(x+2)(-x-1)}$$

$$= \frac{(4x+7)(x+3)}{-(x+1)(x+1)(x+2)}$$

$$= \frac{(4x+7)(x+3)}{-(x+1)^2(x+2)}$$

$$= \frac{-(4x+7)(x+3)}{(-x-1)(x+2)(-x-1)}$$

$$= \frac{-(4x+7)(x+3)}{(-x-1)^2(x+2)}$$



Simplify the following:

Viii. $\left(\frac{1}{x^2-9}\right) \div \left(\frac{1}{x+3}\right) - \frac{3}{x-2}$

Solution:

$$= \left(\frac{1}{x^2-9}\right) \div \left(\frac{1}{x+3}\right) - \frac{3}{x-2}$$

$$= \left(\frac{1}{x^2-3^2}\right) \div \left(\frac{1}{x+3}\right) - \frac{3}{x-2}$$

$$\therefore a^2-b^2 = (a+b)(a-b)$$

$$= \left(\frac{1}{(x+3)(x-3)}\right) \div \left(\frac{1}{(x+3)}\right) - \frac{3}{x-2}$$

$$= \frac{1}{(x+3)(x-3)} \times (x+3) - \frac{3}{x-2}$$

$$= \frac{1}{(x-3)} - \frac{3}{(x-2)}$$

$$= \frac{(x-2) - 3(x-3)}{(x-3)(x-2)}$$

$$= \frac{x-2-3x+9}{(x+3)(x-2)}$$

$$= \frac{-2x+7}{(x+3)(x-2)}$$



Simplify the following:

$$\text{ix. } \frac{1}{x^2+8x+15} + \frac{1}{x^2+7x+12} - \frac{1}{x^2+x-12}$$

Solution:

$$= \frac{1}{x^2+8x+15} + \frac{1}{x^2+7x+12} - \frac{1}{x^2+x-12}$$

$$= \frac{1}{x^2+5x+3x+15} + \frac{1}{x^2+4x+3x+12} - \frac{1}{x^2+4x-3x-12}$$

$$= \frac{1}{x(x+5)+3(x+5)} + \frac{1}{x(x+4)+3(x+4)} - \frac{1}{x(x+4)-3(x+4)}$$

$$= \frac{1}{(x+5)(x+3)} + \frac{1}{(x+4)(x+3)} - \frac{1}{(x+4)(x-3)}$$

$$= \frac{(x+4)(x-3) + (x+5)(x-3) - [(x+3)(x+5)]}{(x+3)(x+4)(x+5)(x-3)}$$

$$= \frac{(x^2+3x+4x-12) + (x^2-3x+5x-15) - (x^2+5x+3x+15)}{(x+3)(x-3)(x+4)(x+5)}$$

$$= \frac{(x^2+x-12) + x^2+2x-15 - (x^2+8x+15)}{(x+3)(x-3)(x+4)(x+5)}$$

$$= \frac{x^2+x-12 + x^2+2x-15 - x^2-8x-15}{(x+3)(x-3)(x+4)(x+5)}$$

$$= \frac{x^2-5x-42}{(x^2-3^2)(x+4)(x+5)}$$

$$= \frac{x^2-5x-42}{(x^2-9)(x+4)(x+5)} \quad \underline{\underline{\text{Ans}}}$$

$$x^2 \div 15 = 15x^2$$

$$\begin{array}{r} 3 \overline{) 15} \\ 5 \end{array}$$

$$x^2 \div 12 = 12x^2$$

$$\begin{array}{r} 2 \overline{) 12} \\ 6 \end{array}$$

$$x-12 = 12x^2$$

$$\begin{array}{r} 2 \overline{) 12} \\ 2 \end{array}$$

$$\begin{array}{r} 3 \overline{) 3} \\ 1 \end{array}$$



Examples :

Find square root of the expression $49x^2 + 126xy + 81y^2$ by factorization method:

$$\therefore a^2 + 2ab + b^2 = (a+b)^2$$

$$\begin{aligned} &= 49x^2 + 126xy + 81y^2 \\ &= (7x)^2 + 2(7x)(9y) + (9y)^2 \\ &= (7x + 9y)^2 \\ &= \sqrt{(7x + 9y)^2} = 7x + 9y \end{aligned}$$

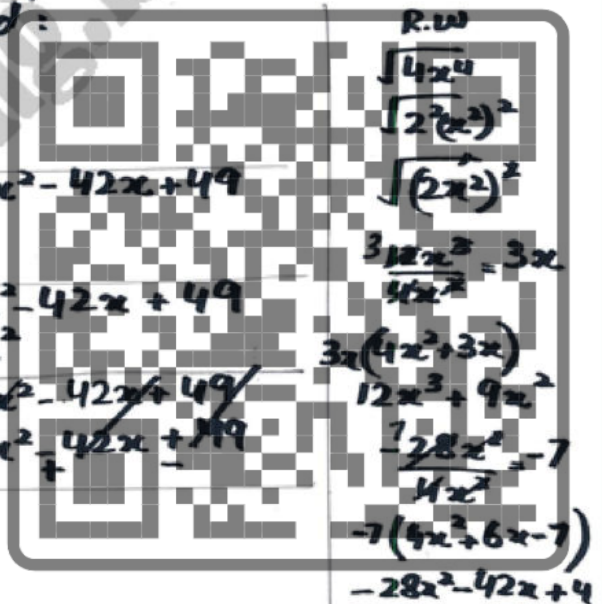
b) Square Root by Division method:

Solution:

$$\begin{array}{r}
 2x^2 + 3x - 7 \\
 2x^2 \quad 4x^4 + 12x^3 - 19x^2 - 42x + 49 \\
 + 2x^2 \quad + 4x^4 \\
 \hline
 4x^2 + 3x \quad 12x^3 - 19x^2 - 42x + 49 \\
 \quad 3x \quad + 12x^3 + 9x^2 \\
 \hline
 4x^2 + 6x - 7 \quad - 28x^2 - 42x + 49 \\
 \quad - 7 \quad + 28x^2 + 42x + 49 \\
 \hline
 4x^2 + 6x - 14
 \end{array}$$

Therefore,

$$\sqrt{4x^4 + 12x^3 - 19x^2 - 42x + 49} = 2x^2 + 3x - 7.$$



Example # 03:

What should be added to $x^4 + 4x^3 + 10x^2 + 5$, so that it may be a perfect square?

Solution:

	$x^2 + 2x + 3$
x^2	$x^4 + 4x^3 + 10x^2 + 5$
$+ x^2$	$\underline{-x^4}$
$2x^2 + 2x$	$4x^3 + 10x^2 + 5$
$+ 2x$	$\underline{-4x^3 + 4x^2}$
$2x^2 + 4x + 3$	$6x^2 + 5$
	$\underline{-6x^2 + 12x + 9}$
	$-12x - 4$
	$\underline{-(12x + 4)}$

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Thus, the perfect square will be obtained by adding $12x + 4$ to the given expression. Ans

R.W

$$\sqrt{x^4}$$

$$\sqrt{(x^2)^2}$$

$$2 \frac{4x^3}{2x^2} = 2x$$

$$2x(2x^2 + 2x)$$

$$4x^3 + 4x^2$$

$$3 \frac{6x^2}{2x^2} = 3$$

$$3(2x^2 + 4x + 3)$$

$$6x^2 + 12x + 9$$



Example 02:

For what value of a the $36x^4 + 36x^3 + 57x^2 + 24x + a$ will be the perfect square?

Solution:

	$6x^2 + 3x + 4$	R.W
$6x^2$	$36x^4 + 36x^3 + 57x^2 + 24x + a$	$\sqrt{36x^4}$
$6x^2$	$\pm 36x^4$	$\sqrt{6^2(x^2)^2}$
$12x^2 + 3x$	$\times 36x^3 + 57x^2 + 24x + a$	$\sqrt{(6x^2)^2}$
$+ 3x$	$\pm 36x^3 \pm 9x^2$	$6x^2$
$12x^2 + 6x + 4$	$48x^2 + 24x + a$	$3 \frac{36x^2}{12x^2} = 3x$
	$\pm 48x^2 \pm 24x \pm 16$	$3x(12x^2 + 3x)$
	$a - 16$	$36x^3 + 9x^2$
		$448x^2 = 4$
		$12x^2$
		$4(12x^2 + 6x + 4)$
		$48x^2 + 24x + 16$

Given expression will be a perfect square if,

$$a - 16 = 0$$

$a = 16$ will make the given expression a perfect square.



Exercise # 5.3

Question # 01:

Find the square root of the following algebraic expressions by factorization method:

i. $36x^2 - 60xy + 25y^2$

Solution:

$$= 36x^2 - 60xy + 25y^2 \quad \therefore a^2 - 2ab + b^2 = (a-b)^2$$

$$= (6x)^2 - 2(6x)(5y) + (5y)^2$$

$$= (6x - 5y)^2$$

$$= \sqrt{(6x - 5y)^2} = 6x - 5y \quad \text{Ans}$$

$$= 36x^2 - 60xy + 25y^2$$

$$= 36x^2 - 30xy - 30xy + 25y^2$$

$$= 6x(6x - 5y) - 5y(6x - 5y)$$

$$= (6x - 5y)(6x - 5y)$$

$$= (6x - 5y)^2$$

$$\sqrt{(6x - 5y)^2} = 6x - 5y$$

$$36x^2 \times 25y^2 = 900x^2y^2$$

$$\begin{array}{r} 2 \overline{) 400} \\ 2 \overline{) 400} \\ 2 \overline{) 400} \\ 2 \overline{) 400} \\ 2 \overline{) 400} \\ 2 \overline{) 400} \\ 2 \overline{) 400} \\ 2 \overline{) 400} \\ 2 \overline{) 400} \\ 2 \overline{) 400} \end{array}$$



ii. $9x^2 + \frac{1}{x^2} + 6$

Solution:

$$= 9x^2 + 6 + \frac{1}{x^2}$$

$$\therefore a^2 + 2ab + b^2 = (a+b)^2$$

$$= (3x)^2 + 2 \left(3x \right) \left(\frac{1}{x} \right) + \left(\frac{1}{x} \right)^2$$

$$= \left(3x + \frac{1}{x} \right)^2$$

$$= \sqrt{\left(3x + \frac{1}{x} \right)^2} = 3x + \frac{1}{x} \quad \text{Ans}$$

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$$\therefore a^2 - 2ab + b^2 = (a-b)^2$$

iii. $4x^4y^4 - \frac{12x^3y^3}{z^2} + \frac{9x^2y^2}{z^4}$

Solution:

$$= (2x^2y^2)^2 - 2 \left(2x^2y^2 \right) \left(\frac{3xy}{z^2} \right) + \left(\frac{3xy}{z^2} \right)^2$$

$$= \left(2x^2y^2 - \frac{3xy}{z^2} \right)^2$$

$$= \sqrt{\left(2x^2y^2 - \frac{3xy}{z^2} \right)^2}$$

$$= 2x^2y^2 - \frac{3xy}{z^2} \quad \text{Ans}$$



$$\text{iv. } 36(3-2x)^2 - 40(3-2x)y + 16y^2$$

Solution:

$$= 36(3-2x)^2 - 40(3-2x)y + 16y^2$$

$$= 4 [9(3-2x)^2 - 10(3-2x)y + 4y^2]$$

$$= 4 [9(3-2x)^2 - (30-20x)y + 4y^2]$$

$$= 4 [9(3-2x)^2 - (30y - 20xy) + 4y^2]$$

$$= 4 [9(3-2x)^2 - 30y + 20xy + 4y^2]$$

$$= 4 [9(3-2x)^2 + 2y(-15 + 10x + 2y)]$$

$$= 4 [9(3-2x)^2 + 2y(2y + 10x - 15)]$$

$$= \sqrt{4[9(3-2x)^2 + 2y(2y + 10x - 15)]}$$

$$= 2\sqrt{9(3-2x)^2 + 2y(2y + 10x - 15)} \quad \text{Ans}$$

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$$v = \left(x^2 + \frac{1}{x^2}\right) - 4\left(x - \frac{1}{x}\right) + 2$$

Solution:

$$= x^2 + \frac{1}{x^2} - 4\left(x - \frac{1}{x}\right) + 2$$

$$= x^2 + \frac{1}{x^2} - 4\left(x - \frac{1}{x}\right) + 2 + 2 - 2$$

$$= x^2 - 2 + \frac{1}{x^2} - 4\left(x - \frac{1}{x}\right) + 4$$

$$= (x)^2 - 2(x)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2 - 4\left(x - \frac{1}{x}\right) + 4$$

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$$= \left(x - \frac{1}{x}\right)^2 - 4\left(x - \frac{1}{x}\right) + \frac{4}{b}$$

$$a^2 - 2ab + b^2 = (a - b)^2$$

$$= \left(x - \frac{1}{x}\right)^2 - 2\left(x - \frac{1}{x}\right)(2) + \left(\frac{2}{b}\right)^2$$

$$= \left(x - \frac{1}{x} - 2\right)^2$$

$$= \sqrt{\left(x - \frac{1}{x} - 2\right)^2}$$

$$= \left(x - \frac{1}{x} - 2\right) \underline{\underline{\text{Ans}}}$$



$$\text{vi- } (4x^2 - 4x + 1)(9x^2 - 54x + 81)$$

Solution:

$$= (4x^2 - 4x + 1)(9x^2 - 54x + 81)$$

$$= [(2x)^2 - 2(2x)(1) + (1)^2][(3x)^2 - 2(3x)(9) + (9)^2]$$

$$\therefore (a^2 - 2ab + b^2) = (a - b)^2$$

$$= (2x - 1)^2 (3x - 9)^2$$

$$= \sqrt{(2x - 1)^2 (3x - 9)^2}$$

$$= (2x - 1)(3x - 9) \quad \underline{\underline{\text{Ans}}}$$

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vii- $(x^2 - 2x + 1)(x^2 - 6x + 9)$

Solution:

$$= (x^2 - 2x + 1)(x^2 - 6x + 9)$$

$$= [(x)^2 - 2(x)(1) + (1)^2] [(x)^2 - 2(x)(3) + (3)^2]$$

$$\therefore a^2 - 2ab + b^2 = (a - b)^2$$

$$= (x - 1)^2 (x - 3)^2$$

$$= \sqrt{(x-1)^2 (x-3)^2}$$

$$= (x-1)(x-3)$$

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$$= (x^2 - 2x + 1)(x^2 - 6x + 9)$$

$$= (x^2 - x - x + 1)(x^2 - 3x - 3x + 9)$$

$$= [x(x-1) - 1(x-1)] [x(x-3) - 3(x-3)]$$

$$= (x-1)(x-1)(x-3)(x-3)$$

$$= (x-1)^2 (x-3)^2$$

$$= \sqrt{(x-1)^2 (x-3)^2}$$

$$= (x-1)(x-3) \text{ Ans}$$



viii. $(x^2 + 8x + 15)(x^2 + 7x + 10)(x^2 + 5x + 6)$

Solution:

$$= (x^2 + 8x + 15)(x^2 + 7x + 10)(x^2 + 5x + 6)$$

$$= (x^2 + 3x + 5x + 15)(x^2 + 2x + 5x + 10)$$

$$= [x(x+3) + 5(x+3)][x(x+2) + 5(x+2)]$$

$$= (x+3)(x+5)(x+2)(x+5)(x+2)(x+3)$$

$$= (x+3)^2 (x+5)^2 (x+2)^2$$

$$= \sqrt{(x+3)^2 (x+5)^2 (x+2)^2}$$

$$= (x+3)(x+5)(x+2) \quad \text{Ans}$$

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Exercise # 5.3

Question # 02 :

Find the square root of the following algebraic expressions by division method:

i. $x^4 + 2x^3 + 3x^2 + 2x + 1$

Solution:

$$\begin{array}{r}
 x^2 + x + 1 \\
 x^2 \overline{) x^4 + 2x^3 + 3x^2 + 2x + 1} \\
 \underline{x^4} \\
 2x^3 + 3x^2 + 2x + 1 \\
 \underline{2x^3 + x^2} \\
 x^2 + 2x + 1 \\
 \underline{x^2 + 2x + 1} \\
 0
 \end{array}$$

Therefore,

$$\sqrt{x^4 + 2x^3 + 3x^2 + 2x + 1} = x^2 + x + 1$$

R.W

$$\begin{array}{l}
 \sqrt{x^4} \\
 \sqrt{(x^2)^2} \\
 x^2 \\
 \frac{2x^3}{2x^2} = x \\
 x(2x^2 + x) \\
 2x^3 + x^2 \\
 \frac{2x}{2x} = 1 \\
 2x + 1
 \end{array}$$



ii- $25x^4 + 40x^3 + 26x^2 + 8x + 1$

Solution:

$$\begin{array}{r}
 5x^2 + 4x + 1 \\
 5x^2 \overline{) 25x^4 + 40x^3 + 26x^2 + 8x + 1} \\
 \underline{+ 5x^2 \quad \pm 25x^4} \\
 10x^3 + 4x \\
 \underline{+ 4x} \\
 10x^3 + 8x + 1 \\
 \underline{10x^3 + 8x + 1} \\
 0
 \end{array}$$

Therefore,

$$\sqrt{25x^4 + 40x^3 + 26x^2 + 8x + 1} = 5x^2 + 4x + 1$$

R.w

$$\sqrt{25x^4} = \sqrt{5^2 x^4}$$

$$\sqrt{(5x^2)^2} = 5x^2$$

$$4 \frac{40x^3}{10x^2} = 4x$$

$$4x(10x^2 + 4x)$$

$$40x^3 + 16x^2$$

$$\frac{10x^2}{10x^2} = 1$$

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iii- $4x^4 + 8x^3 + 20x^2 + 16x + 16$

Solution:

$$\begin{array}{r}
 2x^2 + 2x + 4 \\
 2x^2 \overline{) 4x^4 + 8x^3 + 20x^2 + 16x + 16} \\
 \underline{2x^2 \quad \pm 4x^4} \\
 4x^3 + 2x \\
 \underline{+ 2x} \\
 4x^3 + 4x + 4 \\
 \underline{4x^3 + 8x^2 + 4x^2} \\
 16x^2 + 16x + 16 \\
 \underline{+ 16x^2 + 16x + 16} \\
 0
 \end{array}$$

Therefore,

$$\sqrt{4x^4 + 8x^3 + 20x^2 + 16x + 16} =$$

$$2x^2 + 2x + 4 \quad \text{Ans}$$

R.w

$$\sqrt{4x^4}$$

$$\sqrt{(2x^2)^2} = 2x^2$$

$$2 \frac{8x^3}{4x^2} = 2x$$

$$2x(4x^2 + 2x)$$

$$8x^3 + 4x^2$$

$$4 \frac{16x^2}{4x^2} = 4$$

$$4(4x^2 + 4x + 4)$$

$$16x^2 + 16x + 16$$



$$\text{iv. } \frac{x^2}{y^2} + \frac{y^2}{x^2} + 47 - \frac{14y}{x} + \frac{14x}{y}$$

Solution: $\frac{x^2}{y^2} + \frac{14x}{y} + 47 - \frac{14y}{x} + \frac{y^2}{x^2}$

$$\begin{array}{r} \frac{x^2}{y^2} + \frac{14x}{y} + 47 - \frac{14y}{x} + \frac{y^2}{x^2} \\ + \frac{x}{y} \quad + \frac{x^2}{y^2} \\ \hline \frac{2x}{y} + 7 \quad \frac{14x}{y} + 47 - \frac{14y}{x} + \frac{y^2}{x^2} \\ + 7 \quad + \frac{14x}{y} + 49 \end{array}$$

$$\begin{array}{r} \frac{2x}{y} + 14 - \frac{y}{x} \\ -2 \quad - \frac{14y}{x} + \frac{y^2}{x^2} \\ \hline \frac{2x}{y} + 7 \quad \frac{14x}{y} + 47 - \frac{14y}{x} + \frac{y^2}{x^2} \\ + 7 \quad + \frac{14x}{y} + 49 \end{array}$$

$$\sqrt{\frac{x^2}{y^2} + \frac{14x}{y} + 47 - \frac{14y}{x} + \frac{y^2}{x^2}} = \left(\frac{x}{y} + 7 - \frac{y}{x} \right)$$

$$\text{v. } x^2 - 2x + 3 - \frac{2}{x} + \frac{1}{x^2}$$

Solution:

$$\begin{array}{r} x^2 - 2x + 3 - \frac{2}{x} + \frac{1}{x^2} \\ + x \quad + x^2 \\ \hline 2x - 1 \quad -2x + 3 - \frac{2}{x} + \frac{1}{x^2} \\ -1 \quad - \frac{2}{x} + 1 \end{array}$$

$$\begin{array}{r} 2x - 2 + \frac{1}{x} \\ 2 \quad - \frac{2}{x} + \frac{1}{x^2} \\ \hline 2x - 2 + \frac{1}{x} \quad 2 - \frac{2}{x} + \frac{1}{x^2} \end{array}$$

$$\sqrt{x^2 - 2x + 3 - \frac{2}{x} + \frac{1}{x^2}} = \left(x - 1 + \frac{1}{x} \right)$$

$$\sqrt{\frac{x^2}{y^2}} = \frac{x}{y}$$

$$\frac{1}{y} + \frac{14x}{y} = \frac{2x}{y}$$

$$\frac{14x}{y} \div \frac{2x}{y} = 7$$

$$7 \left(\frac{2x}{y} + 7 \right) = \frac{14x}{y} + 49$$

$$\frac{-2}{x} \div \frac{2x}{y} = -\frac{y}{x}$$

$$\frac{-y}{x} \left(\frac{2x}{y} + 14 - \frac{y}{x} \right)$$

$$\sqrt{x^2} = x$$

$$\frac{-2x}{2x} = -1$$

$$-1(2x - 1) = -2x + 1$$

$$\frac{2}{2x} = \frac{1}{x}$$

$$\frac{1}{x} \left(2x - 2 + \frac{1}{x} \right)$$

$$2 - \frac{2}{x} + \frac{1}{x^2}$$



$$\text{vi- } x^2 + \frac{y^2}{9} + 9z^2 + \frac{2xy}{3} + 2yz + 6xz$$

Solution:

$$= x^2 + \frac{2xy}{3} + \frac{y^2}{9} + 6xz + 2yz + 9z^2$$

			R.W
		$x + \frac{y}{3} + 3z$	$\sqrt{x^2} = x$
x	$x^2 + \frac{2xy}{3} + \frac{y^2}{9} + 6xz + 2yz + 9z^2$		
x	$-x^2$		$\frac{2xy}{3} \div 2x$
			$\frac{2xy}{3} \times \frac{1}{2x}$
$2x + \frac{y}{3}$	$\frac{2xy}{3} + \frac{y^2}{9} + 6xz + 2yz + 9z^2$		$\frac{y}{3} (2x + \frac{y}{3})$
$+ \frac{y}{3}$	$- \frac{2xy}{3} - \frac{y^2}{9}$		$\frac{2xy}{3} + \frac{y^2}{9}$
$2x + \frac{2y}{3} + 3z$	$6xz + 2yz + 9z^2$		$\frac{y}{3} + \frac{y}{3}$
	$- 6xz - 2yz - 9z^2$		$\frac{2y}{3}$
			$6xz \div 2x$
			$3z (2x + \frac{2y}{3} + 3z)$
			$6xz + 2yz + 9z^2$

$\sqrt{x^2 + \frac{2xy}{3} + \frac{y^2}{9} + 6xz + 2yz + 9z^2} =$

$(x + \frac{y}{3} + 3z)^2$ Ans



$$\text{vii- } \left(x^2 + \frac{1}{x^2}\right)^2 - 8\left(x^2 - \frac{1}{x^2}\right) + 12$$

Solution:

$$= (x^2)^2 + 2(x^2)\left(\frac{1}{x^2}\right) + \left(\frac{1}{x^2}\right)^2 - 8x^2 + \frac{8}{x^2} + 12$$

$$= x^4 + 14 + \frac{1}{x^4} - 8x^2 + \frac{8}{x^2}$$

$$\begin{array}{r} x^4 - 8x^2 + 14 + \frac{8}{x^2} + \frac{1}{x^4} \\ + x^4 \end{array}$$

$$\begin{array}{r} 2x^4 - 8x^2 + 14 + \frac{8}{x^2} + \frac{1}{x^4} \\ - 4 \end{array}$$

$$\begin{array}{r} 2x^4 - 8x^2 - \frac{1}{x^2} \\ - 2 + \frac{8}{x^2} + \frac{1}{x^4} \\ + \frac{8}{x^2} + \frac{1}{x^4} \end{array}$$

$$\sqrt{x^4 - 8x^2 + 14 + \frac{8}{x^2} + \frac{1}{x^4}} = \left(x^2 - 4 - \frac{1}{x^2}\right)$$

R.W

$$\sqrt{x^4} = \sqrt{(x^2)^2}$$

$$= x^2$$

$$\frac{-8x^2}{2x^2} = -4$$

$$(2x^2 - 4)4 = 8x^2 + 16$$

$$\frac{-2}{2x^2} = -\frac{1}{x^2}$$

$$\frac{-1}{x^2} \left(2x^2 - 8 - \frac{1}{x^2}\right)$$

$$-2 + \frac{8}{x^2} + \frac{1}{x^4}$$



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$$\text{viii} - x^6 + \frac{1}{x^6} - 4\left(x^3 + \frac{1}{x^3}\right) + 6, x \neq 0$$

Solution:

$$= x^6 + \frac{1}{x^6} - 4x^3 - \frac{4}{x^3} + 6$$

$$= x^6 + 4x^3 + 6 - \frac{4}{x^3} + \frac{1}{x^6}$$

$$\begin{array}{r} x^3 \quad x^3 - 2 + \frac{1}{x^3} \\ \underline{x^6 - 4x^3 + 6 - \frac{4}{x^3} + \frac{1}{x^6}} \\ + x^3 \quad \underline{x^6} \end{array}$$

$$\begin{array}{r} 2x^3 - 2 \quad -4x^3 + 6 - \frac{4}{x^3} + \frac{1}{x^6} \\ \underline{-2} \quad \underline{-4x^3 + 4} \end{array}$$

$$\begin{array}{r} 2x^3 - 4 + \frac{1}{x^3} \quad +2 - \frac{4}{x^3} + \frac{1}{x^6} \\ \underline{+2 - \frac{4}{x^3} + \frac{1}{x^6}} \end{array}$$

Therefore,

$$\sqrt{x^6 - 4x^3 + 6 - \frac{4}{x^3} + \frac{1}{x^6}} = \sqrt{\left(x^3 - 2 + \frac{1}{x^3}\right)}$$

$$\begin{array}{l} \text{R.W} \\ \sqrt{x^6} = \sqrt{(x^3)^2} \\ x^3 \end{array}$$

$$\frac{2x^3}{2x^3} = -2$$

$$\begin{array}{l} -2(2x^3 - 2) \\ -4x^3 + 4 \end{array}$$

$$\frac{2}{2x^3} = \frac{1}{x^3}$$

$$\begin{array}{l} \frac{1}{x^3} (2x^3 - 4 + \frac{1}{x^3}) \\ 2 - \frac{4}{x^3} + \frac{1}{x^6} \end{array}$$



Question # 3 :

What should be added to $4x^4 + 4x^3 + 17x^2 + 8x + 9$ to make it Perfect square?

Solution:

$$\begin{array}{r}
 2x^2 + x + 4 \\
 2x^2 \quad | \quad 4x^4 + 4x^3 + 17x^2 + 8x + 9 \\
 \underline{2x^2} \\
 4x^2 + x \\
 + x \\
 \hline
 4x^2 + 2x + 4 \quad | \quad 4x^3 + 17x^2 + 8x + 9 \\
 \quad | \quad \underline{4x^3 + x^2} \\
 \quad | \quad 16x^2 + 8x + 9 \\
 \quad | \quad \underline{16x^2 + 8x + 16} \\
 \quad | \quad
 \end{array}$$

$$\begin{aligned} R.W \\ \sqrt{4x^4} &= \sqrt{(2x^2)^2} = 2x^2 \\ \frac{4x^3}{4x^2} &= x \\ x(4x^2 + x) \\ 4x^3 + x^2 \\ \frac{416x^2}{4x^2} &= 4 \\ 4(4x^2 + 2x + 4) \\ 16x^2 + 8x + 16 \end{aligned}$$

+7 should be added to the given expression to make it a perfect square.

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Question # 4:

What should be subtracted from $9x^6 - 12x^5 + 4x^4 - 18x^3 - 12x^2 + 18$ to make it a perfect square?

Solution:-

$$\begin{array}{r}
 3x^3 + 2x^2 - 3 \\
 3x^3 \quad 9x^6 - 12x^5 + 4x^4 - 18x^3 - 12x^2 + 18 \\
 + 3x^3 \quad - 9x^6 \\
 \hline
 6x^3 + 2x^2 \quad 12x^5 + 4x^4 - 18x^3 - 12x^2 + 18 \\
 + 2x^2 \quad - 12x^5 - 4x^4 \\
 \hline
 6x^3 + 4x^2 - 3 \quad - 18x^3 - 12x^2 + 18 \\
 \quad - 18x^3 - 12x^2 + 9 \\
 \quad + \quad \quad \quad - \\
 \quad \quad \quad 9
 \end{array}$$

R.W

$$\begin{aligned}
 \sqrt{9x^6} &= \sqrt{(3x^3)^2} \\
 3x^3 \\
 2 \times 3x^3 &= 2x^2 \\
 6x^3 \\
 2x^2(6x^3 + 2x^2) \\
 12x^5 + 4x^4 \\
 3 \times 18x^3 &= -3 \\
 6x^3 \\
 -3(6x^3 + 4x^2 - 3) \\
 -18x^3 - 12x^2 + 9
 \end{aligned}$$

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9 should be subtracted to the given expression to make it a perfect square.



Question #5:

For what value of 'm', $9x^4 + 12x^3 + 34x^2 + mx + 25$ will be the Perfect square?

Solution:

$$\begin{array}{r}
 3x^2 + 2x + 5 \\
 3x^2 \overline{) 9x^4 + 12x^3 + 34x^2 + mx + 25} \\
 \underline{9x^4} \\
 6x^3 + 2x \\
 \underline{6x^3 + 4x^2} \\
 6x^2 + 4x + 5 \\
 \underline{6x^2 + 4x + 5} \\
 mx - 20x \\
 \underline{mx - 20x} \\
 0
 \end{array}$$

$$\begin{aligned}
 m - 20 &= 0 \\
 m &= 20
 \end{aligned}$$

The value of m is 20, we should put $m=20$ to make it a perfect square.

R.W

$$\begin{aligned}
 \sqrt{9x^4} &= \sqrt{(3x^2)^2} = 3x \\
 \frac{12x^3}{6x^2} &= 2x \\
 2x(6x^2 + 2x) &= 12x^3 + 4x^2 \\
 \frac{30x^2}{6x^2} &= 5 \\
 5(6x^2 + 4x + 5) &= 30x^2 + 20x + 25
 \end{aligned}$$



Question # 6:

For what value of 'p' and 'q' the expression $x^4 + 8x^3 + 30x^2 + px + q$ will be the perfect square?

Solution:

	$x^2 + 4x + 7$	
x^2	$4x^4 + 8x^3 + 30x^2 + px + q$	
$+ x^2$	$\underline{-x^4}$	
$2x^2 + 4x$	$8x^3 + 30x^2 + px + q$	
$4x$	$\underline{-8x^3 + 16x^2}$	
$2x^2 + 8x + 7$	$14x^2 + px + q$	
	$\underline{-14x^2 + 56x + 49}$	
	$px - 56x + q - 49$	
	$q - 49 = 0$	
	$q = 49$	

$px - 56x = 0$
 $x(p - 56) = 0$
 $p - 56 = 0$
 $p = 56$

$p = 56$ and $q = 49$ should be
 add put in the given expression
 to make it a perfect square.

R.W

$$\sqrt{x^4} = (\sqrt{6x^2})^2$$

$$\frac{4 \cdot 8x^3}{2x^2} = 4x$$

$$4x(2x^2 + 4x)$$

$$8x^3 + 16x^2$$

$$\frac{14x^2}{2x^2} = 7$$

$$14x^2 + 56x + 49$$

$$q - 49 = 0$$

$$q = 49$$

$p = 56$ and $q = 49$ should be
 add put in the given expression
 to make it a perfect square.



Exercise # 6.1

* Linear Equations :

Example # 01: Solve $3x - 1 = 5$

Solution:

$$\Rightarrow 3x - 1 = 5$$

$$\Rightarrow 3x = 5 + 1$$

$$\Rightarrow 3x = 6$$

$$\Rightarrow x = \frac{6}{3}$$

$$\Rightarrow \boxed{x = 2} \text{ Ans}$$

Thus, the sol set is $\{2\}$ Ans

Example # 02: Solve $\frac{2}{3}(x+3) = 3 + \frac{5x}{9}$

Solution:

$$\Rightarrow \frac{2}{3}(x+3) = 3 + \frac{5x}{9}$$

$$\Rightarrow 2x+6 = 3\left(3 + \frac{5x}{9}\right)$$

$$\Rightarrow 2x+6 = 3\left(\frac{3(9)+5x}{9}\right)$$

$$\Rightarrow 3(2x+6) = 27 + 5x$$

$$\Rightarrow 6x+18 = 27+5x$$

$$\Rightarrow 6x-5x = 27-18$$

$$\Rightarrow \boxed{x = 9}$$

Thus, Solution set is $\{9\}$ Ans



Example # 03: Age of father is 13 times the age of his son. It will be only five times after four years. Find their present ages.

Solution:

Let the age of son is x years.
and the age of father is $13x$ years.
According to the given condition,

$$\Rightarrow 13x + 4 = 5(x + 4)$$

$$\Rightarrow 13x + 4 = 5x + 20$$

$$\Rightarrow 13x - 5x = 20 - 4$$

$$\Rightarrow 8x = 16$$

$$x = \frac{16}{8} = 2$$

$$\boxed{x = 2}$$

Hence age of son
and age of father

2 years.

is $13 \times 2 = 26$ years.

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Example # 04: when 16 is added to $\frac{1}{3}$ of number the result is $2\frac{1}{3}$ of the original number. Find the number?

Solution:

Let x be the number:

and 16 is added to $\frac{1}{3}$ of number:

$$16 + \frac{1}{3}x$$

The result is $2\frac{1}{3}$ of the original number
 $= 2\frac{1}{3}x$

According to the given conditions:

$$\Rightarrow 16 + \frac{1}{3}x = 2\frac{1}{3}x$$

$$\Rightarrow \frac{16 \times 3 + x}{3} = \frac{7x}{3}$$

$$\Rightarrow 48 + x = 3(7x)$$

$$\Rightarrow 48 + x = 21x$$

$$\Rightarrow 48 = 21x - x$$

$$\Rightarrow 48 = 20x$$

Thus, $x = 8$ be the number:

$$48 + x = 3\left(\frac{7x}{3}\right)$$

$$48 + x = 7x$$

$$48 = 7x - x$$

$$48 = 6x$$

$$x = \frac{48}{6}$$

$$x = 8$$



* Reduce Equations involving radicals to simple linear form and find their solutions:

Example # 01:

$$\text{Solve } \sqrt{2x+11} = \sqrt{3x+7}$$

Solution:

$$\Rightarrow \sqrt{2x+11} = \sqrt{3x+7}$$

Taking square on both sides:

$$\Rightarrow (\sqrt{2x+11})^2 = (\sqrt{3x+7})^2$$

$$\Rightarrow 2x+11 = 3x+7$$

$$\Rightarrow 2x-3x = 7-11$$

$$\Rightarrow -x = -4$$

$$\Rightarrow \boxed{x = 4}$$

Verification: Put $x=4$ in given equation.
then.

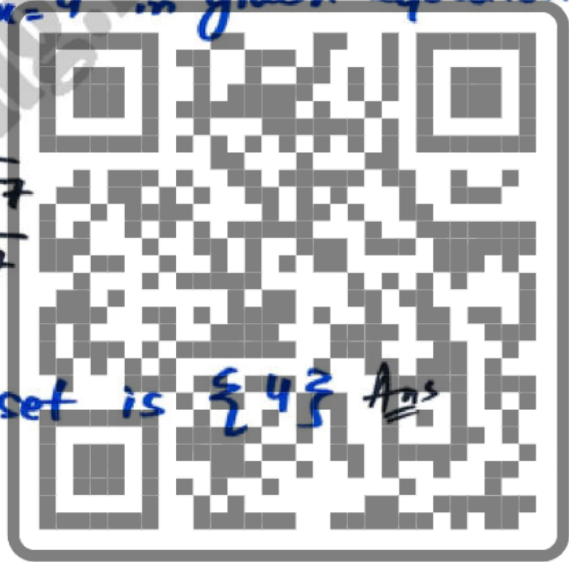
$$\Rightarrow \sqrt{2x+11} = \sqrt{3x+7}$$

$$\Rightarrow \sqrt{2(4)+11} = \sqrt{3(4)+7}$$

$$\Rightarrow \sqrt{8+11} = \sqrt{12+7}$$

$$\Rightarrow \sqrt{19} = \sqrt{19}$$

Thus, solution set is $\{4\}$ Ans



Exercise # 6.1

Class : 9th

Question # 01 :

Solve the following equations :

i. $\frac{1}{4}x = 5$

Solution:

$$\Rightarrow \frac{1}{4}x = 5$$

$$\Rightarrow \frac{x}{4} = 5$$

$$\Rightarrow x = 5 \times 4$$

$$\Rightarrow x = 20$$

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$$\boxed{x = 20} \text{ Ans}$$

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ii. $\frac{x}{4} = -3$

Solution:

$$\Rightarrow \frac{x}{4} = -3$$

$$\Rightarrow x = -3 \times 4$$

$$\Rightarrow x = -12$$

$$\boxed{x = -12} \text{ Ans}$$



$$\text{iii. } -5 = -\frac{x}{6}$$

Solution:

$$\Rightarrow -5 = -\frac{x}{6}$$

$$\Rightarrow -5 \times 6 = -x$$

$$\Rightarrow +30 = +x$$

$$\Rightarrow x = 30$$

$$\boxed{x = 30}$$

Ans

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$$\text{iv. } -\frac{x}{8} = -5$$

Solution:

$$\Rightarrow -\frac{x}{8} = -5$$

$$\Rightarrow -x = -5 \times 8$$

$$\Rightarrow +x = +40$$

$$\Rightarrow x = 40$$

$$\boxed{x = 40}$$

Ans



$$v. \quad y - \frac{2}{5} = -\frac{1}{3}$$

Solution:

$$\Rightarrow y - \frac{2}{5} = -\frac{1}{3}$$

$$\Rightarrow y = -\frac{1}{3} + \frac{2}{5}$$

$$\Rightarrow y = \frac{-1(5) + 2(3)}{15}$$

$$\Rightarrow y = \frac{-5 + 6}{15}$$

$$\Rightarrow y = \frac{1}{15}$$

$$\boxed{y = \frac{1}{15}} \quad \text{Ans}$$

$$vi. \quad 2y - \frac{3}{5} = \frac{1}{2}$$

Solution:

$$\Rightarrow 2y - \frac{3}{5} = \frac{1}{2}$$

$$\Rightarrow 2y = \frac{1}{2} + \frac{3}{5}$$

$$\Rightarrow 2y = \frac{1 \times 5 + 3 \times 2}{10}$$

$$\Rightarrow 2y = \frac{5 + 6}{10}$$

$$\Rightarrow 2y = \frac{11}{10}$$

$$\Rightarrow y = \frac{11}{10 \times 2}$$

$$\Rightarrow y = \frac{11}{20}$$

$$\boxed{y = \frac{11}{20}} \quad \text{Ans}$$



vii. $\frac{2x-4}{5} = \frac{5x-12}{4}$

Solution:

$$\Rightarrow \frac{2x-4}{5} = \frac{5x-12}{4}$$

$$\Rightarrow 4(2x-4) = 5(5x-12)$$

$$\Rightarrow 8x-16 = 25x-60$$

$$\Rightarrow 8x-25x = -60+16$$

$$\Rightarrow -17x = -44$$

$$\Rightarrow x = \frac{44}{17}$$

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$$x = \frac{44}{17}$$

Ans



viii- $\frac{3x}{5} + 7 = \frac{2x}{3}$

Solution:

$$\Rightarrow \frac{3x}{5} + 7 = \frac{2x}{3}$$

$$\Rightarrow \frac{3x}{5} = \frac{2x}{3} - 7$$

$$\Rightarrow \frac{3x}{5} = \frac{2x - 7(3)}{3}$$

$$\Rightarrow \frac{3x}{5} = \frac{2x - 21}{3}$$

$$\Rightarrow 3x \times 3 = 5(2x - 21)$$

$$\Rightarrow 9x = 10x - 105$$

$$\Rightarrow 9x - 10x = -105$$

$$\Rightarrow -x = -105$$

$$\Rightarrow x = 105$$

$$x = 105$$

Ans



$$\text{ix- } \frac{3x}{5} + 7 = \frac{2x}{3} + \frac{4x}{5}$$

Solution :

$$\Rightarrow \frac{3x}{5} + \frac{7}{1} = \frac{2x}{3} + \frac{4x}{5}$$

$$\Rightarrow \frac{3x(1) + 7(5)}{5} = \frac{2x(5) + 4x(3)}{15}$$

$$\Rightarrow \frac{3x + 35}{5} = \frac{10x + 12x}{15}$$

$$\Rightarrow 3 \times (3x + 35) = 10x + 12x$$

$$\Rightarrow 3(3x + 35) = 22x$$

$$\Rightarrow 9x + 105 = 22x$$

$$\Rightarrow 105 = 22x - 9x$$

$$\Rightarrow 105 = 13x$$

$$\Rightarrow \frac{105}{13} = x$$

$$\Rightarrow x = \frac{105}{13}$$

$$x = \frac{105}{13}$$



Ans



$$x - \frac{6}{2x-5} - \frac{4}{x-3} = 0$$

Solution: 1st method

$$\Rightarrow \frac{6}{2x-5} - \frac{4}{x-3} = 0$$

$$\Rightarrow \frac{6}{2x-5} = \frac{4}{x-3}$$

$$\Rightarrow 6(x-3) = 4(2x-5)$$

$$\Rightarrow 6x - 18 = 8x - 20$$

$$\Rightarrow 6x - 8x = -20 + 18$$

$$\Rightarrow -2x = -2$$

$$\Rightarrow x = \frac{-2}{-2}$$

$$\Rightarrow x = 1$$

$x = 1$
MORE!!!

2nd method:

$$\Rightarrow \frac{6}{2x-5} - \frac{4}{x-3} = 0$$

$$\Rightarrow \frac{6(x-3) - 4(2x-5)}{(2x-5)(x-3)} = 0$$

$$\Rightarrow 6x - 18 - 8x + 20 = 0 \times (2x-5)(x-3)$$

$$\Rightarrow -2x + 2 = 0$$

$$\Rightarrow -2x = -2$$

$$\Rightarrow x = \frac{-2}{-2}$$

$$\Rightarrow x = 1$$



xi- $\frac{7x-4}{15} = \frac{7x+4}{10}$

Solution:

$$\Rightarrow \frac{7x-4}{15} = \frac{7x+4}{10}$$

$$\Rightarrow 7x-4 = \cancel{15}^3 \times \frac{(7x+4)}{\cancel{10}_2}$$

$$\Rightarrow 7x-4 = 3 \times (7x+4)$$

$$\Rightarrow 2(7x-4) = 3(7x+4)$$

$$\Rightarrow 14x-8 = 21x+12$$

$$\Rightarrow 14x-21x = +12+8$$

$$\Rightarrow -7x = 20$$

$$\Rightarrow x = \frac{20}{-7}$$

$$\Rightarrow x = -\frac{20}{7}$$

$$x = -\frac{20}{7}$$



$$\text{xii- } \frac{3x-2}{10} = \frac{7x-3}{15} - 2$$

Solution:

$$\Rightarrow \frac{3x-2}{10} = \frac{7x-3}{15} - 2$$

$$\Rightarrow \frac{3x-2}{10} = \frac{7x-3-2(15)}{15}$$

$$\Rightarrow \frac{3x-2}{10} = \frac{7x-3-30}{15}$$

$$\Rightarrow \frac{3}{15} \times (3x-2) = 7x-33$$

$$\Rightarrow 3 \times \frac{(3x-2)}{2} = 7x-33$$

$$\Rightarrow 9x-6 = 2(7x-33)$$

$$\Rightarrow 9x-6 = 14x-66$$

$$\Rightarrow 9x-14x = -66+6$$

$$\Rightarrow -5x = -60$$

$$\Rightarrow x = \frac{-60}{-5}$$

$$\Rightarrow x = 12$$

$$\boxed{x = 12} \text{ Ans}$$



$$\text{xiii- } \frac{12x-3}{12} = \frac{12x+3}{8}$$

Solution:

$$\Rightarrow \frac{12x-3}{12} = \frac{12x+3}{8}$$

$$\Rightarrow 12x-3 = \cancel{12}^{\cancel{6}^3} \times \frac{(12x+3)}{\cancel{8}^2}$$

$$\Rightarrow 12x-3 = 3 \times (12x+3)$$

$$\Rightarrow 2(12x-3) = 3(12x+3)$$

$$\Rightarrow 24x-6 = 36x+9$$

$$\Rightarrow 24x-36x = 9+6$$

$$\Rightarrow -12x = 15$$

$$\Rightarrow x = \frac{15}{-12}$$

$$\Rightarrow x = -\frac{5}{4}$$

$$\boxed{x = -\frac{5}{4}}$$

Ans



$$\text{xiv. } \frac{1}{4}x + x = -3 + \frac{1}{2}x$$

Solution:

$$\Rightarrow \frac{1}{4}x + x = -3 + \frac{1}{2}x$$

$$\Rightarrow \frac{x + x(4)}{4} = \frac{-3(2) + x}{2}$$

$$\Rightarrow \frac{x + 4x}{4} = \frac{-6 + x}{2}$$

$$\Rightarrow x + 4x = \frac{2 \times (-6 + x)}{2}$$

$$\Rightarrow x + 4x = 2 \times (-6 + x)$$

$$\Rightarrow x + 4x = -12 + 2x$$

$$\Rightarrow 5x - 2x = -12$$

$$\Rightarrow 3x = -12$$

$$\Rightarrow x = \frac{-12}{3}$$

$$\Rightarrow x = -4$$

$$\boxed{x = -4} \text{ Ans}$$



xv. $\frac{1}{3} + 2m = m - \frac{3}{2}$

Solution:

$$\Rightarrow \frac{1}{3} + 2m = m - \frac{3}{2}$$

$$\Rightarrow \frac{1 + 2m(3)}{3} = \frac{2m - 3}{2}$$

$$\Rightarrow \frac{1 + 6m}{3} = \frac{2m - 3}{2}$$

$$\Rightarrow 2(1 + 6m) = 3(2m - 3)$$

$$\Rightarrow 2 + 12m = 6m - 9$$

$$\Rightarrow 12m - 6m = -9 - 2$$

$$\Rightarrow 6m = -11$$

$$\Rightarrow m = -\frac{11}{6}$$

$$\boxed{m = -\frac{11}{6}}$$



Exercise # 6.1

Q#2: When 25 added to a number, the result is halved, the answer is three times the original number. what is the number?

Solution:

Let x be the number:

When 25 is added to a number $x+25$.

The result is halved, $\frac{x+25}{2}$

the answer is 3-times the original number $3x$.

then according to the given condition:

$$\Rightarrow \frac{x+25}{2} = 3x$$

$$\Rightarrow x+25 = 3x(2)$$

$$\Rightarrow x+25 = 6x$$

$$\Rightarrow x-6x = -25$$

$$\Rightarrow -5x = -25$$

$$x = \frac{-25}{-5}$$

$$\boxed{x=5} \quad \text{Ans}$$



Q#3: When a number is added to 4, the result is equal to subtracting 10 from 3 times of it. What is the number?

Solution:

Let x be the number:

a number is added to 4, $x+4$

the result is equal to subtracting 10 from 3 times of it, $3x-10$

According to the given condition.

$$\Rightarrow x+4 = 3x-10$$

$$\Rightarrow x-3x = -10-4$$

$$\Rightarrow -2x = -14$$

$$\Rightarrow x = \frac{14}{2}$$

$$\Rightarrow \boxed{x = 7} \text{ Ans}$$

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Q#4: Bilal is 6 years old than Ali, five years from now the sum of their age will be 40. How old are both of them.

Solution:

Let (x) be the age of Ali and Bilal is six years old than Ali $(x+6)$,
After 5 years Ali's age will be $x+5$
and Bilal age will be $x+6+5$, $x+11$
and the sum of their ages are 40.

$$\Rightarrow x + 5 + x + 11 = 40$$

$$\Rightarrow 2x + 16 = 40$$

$$\Rightarrow 2x = 40 - 16$$

$$\Rightarrow 2x = 24$$

$$\Rightarrow x = \frac{24}{2} = 12$$

$$\Rightarrow x = 12$$

The Age of Ali is 12 years.

and the age of Bilal is $x+6=12+6$
the age of Bilal is 18 years.



Exercise # 6.1

Q#5: Find the solution set of the following equation and also verify the answer :

i. $6 + \sqrt{x} = 7$

Solution:

$$\Rightarrow 6 + \sqrt{x} = 7$$

$$\Rightarrow \sqrt{x} = 7 - 6$$

$$\Rightarrow \sqrt{x} = 1$$

Now, squaring on both

Sides:

$$\Rightarrow (\sqrt{x})^2 = (1)^2$$

$$\Rightarrow \boxed{x = 1}$$

Hence solution set is $\{1\}$ Ans

Verification:

$$\Rightarrow 6 + \sqrt{x} = 7$$

Put $x = 1$:

$$\Rightarrow 6 + \sqrt{1} = 7$$

$$\Rightarrow 6 + 1 = 7$$

$$\Rightarrow 7 = 7$$

ii. $\sqrt{x-9} = 1$

Solution:

$$\Rightarrow \sqrt{x-9} = 1$$

Taking square on both sides:

$$\Rightarrow (\sqrt{x-9})^2 = (1)^2$$

$$\Rightarrow x - 9 = 1$$

$$\Rightarrow x = 1 + 9$$

$$\Rightarrow \boxed{x = 10}$$

Verification:

$$\sqrt{x-9} = 1$$

Put $x = 10$:

$$\Rightarrow \sqrt{10-9} = 1$$

$$\Rightarrow \sqrt{1} = 1$$

$$\Rightarrow 1 = 1$$

Hence solution set is $\{10\}$ Ans



Q#5: Find the solution set of the following equation and also verify the answer :

iii- $\sqrt{\frac{y}{4}} - 2 = 3$

Solution:

$$\Rightarrow \sqrt{\frac{y}{4}} - 2 = 3$$

$$\Rightarrow \sqrt{\frac{y}{4}} = 3 + 2$$

$$\Rightarrow \sqrt{\frac{y}{4}} = 5$$

Squaring on both sides:

$$\Rightarrow \left(\sqrt{\frac{y}{4}}\right)^2 = (5)^2$$

$\Rightarrow$

$$\Rightarrow \frac{y}{4} = 25$$

$$\Rightarrow y = 25 \times 4$$

$$\Rightarrow \boxed{y = 100}$$

Verification:

$$\sqrt{\frac{y}{4}} - 2 = 3$$

$$\sqrt{\frac{100}{4}} - 2 = 3$$

$$\Rightarrow 5 - 2 = 3$$

$$\Rightarrow 3 = 3$$

Hence solution set is $\{100\}$

iv- $\sqrt{4x+5} = \sqrt{3x-7}$

Solution:

$$\Rightarrow \sqrt{4x+5} = \sqrt{3x-7}$$

Taking square on both sides:

$$\Rightarrow (\sqrt{4x+5})^2 = (\sqrt{3x-7})^2$$

$$\Rightarrow 4x+5 = 3x-7$$

$$\Rightarrow 4x-3x = -7-5$$

$$\Rightarrow \boxed{x = -12}$$

Verification:-

$$\Rightarrow \sqrt{4x+5} = \sqrt{3x-7}$$

$$\Rightarrow \sqrt{4(-12)+5} = \sqrt{3(-12)-7}$$

$$\Rightarrow \sqrt{-48+5} = \sqrt{-36-7}$$

$$\Rightarrow \sqrt{-43} = \sqrt{-43}$$

Hence solution set is $\{-12\}$ Ans



Q#5: Find the solution set of the following equations and also verify the answer:

v. $\sqrt[7]{3y+12} = 3$

Solution:

$$\Rightarrow \sqrt[7]{3y+12} = 3$$

$$\Rightarrow \sqrt[7]{3y+12} = 3 \times 7$$

$$\Rightarrow \sqrt[7]{3y+12} = 21$$

Taking square on both sides:

$$\Rightarrow (\sqrt[7]{3y+12})^2 = (21)^2$$

$$\Rightarrow 3y+12 = 441$$

$$\Rightarrow 3y = 441 - 12$$

$$\Rightarrow y = 429$$

$$\Rightarrow \boxed{y = 143}$$

Verification:

$$\Rightarrow \sqrt[7]{3y+12} = 3$$

$$\Rightarrow \sqrt[7]{3(143)+12} = 3$$

$$\Rightarrow \sqrt[7]{441} = 3$$

$$\Rightarrow \frac{21^3}{7} = 3$$

$$\Rightarrow \frac{7}{3} = 3$$

Hence solution set is $\{143\}$
Ans

vi. $\sqrt{x+9} = 7$

Solution:

$$\Rightarrow \sqrt{x+9} = 7-9$$

$$\Rightarrow \sqrt{x} = -2$$

Taking square on both sides:

$$\Rightarrow (\sqrt{x})^2 = (-2)^2$$

$$\Rightarrow \boxed{x = 4}$$

Verification:-

$$\Rightarrow \sqrt{x+9} = 7$$

$$\Rightarrow \sqrt{4+9} = 7$$

$$\Rightarrow 2+9 = 7$$

$$\Rightarrow 11 = 7$$

Hence root is extraneous root:



Q#5: Find the solution set of the following equations and also verify the answer:

vii. $\sqrt{25y-50} = \sqrt{y-2}$

Solution:

$$\sqrt{25y-50} = \sqrt{y-2}$$

Taking square on both sides:

$$\Rightarrow (\sqrt{25y-50})^2 = (\sqrt{y-2})^2$$

$$\Rightarrow 25y-50 = y-2$$

$$\Rightarrow 25y - y = -2 + 50$$

$$\Rightarrow 24y = +48$$

$$\Rightarrow y = \frac{48}{24}$$

$$\boxed{y = 2}$$

Verification:-

$$\Rightarrow \sqrt{25y-50} = \sqrt{y-2}$$

$$\Rightarrow \sqrt{25(2)-50} = \sqrt{2-2}$$

$$\Rightarrow \sqrt{50-50} = \sqrt{0}$$

$$\Rightarrow \sqrt{0} = \sqrt{0}$$

Hence solution set is $\{2\}$ Ans

viii. $\sqrt{x-8} = 1$

Solution:

$$\Rightarrow \sqrt{x-8} = 1$$

$$\Rightarrow \sqrt{x} = 1+8$$

$$\Rightarrow \sqrt{x} = 9$$

Taking square on both sides:

$$\Rightarrow (\sqrt{x})^2 = (9)^2$$

$$\Rightarrow \boxed{x = 81}$$

Verification:

$$\Rightarrow \sqrt{x-8} = 1$$

$$\Rightarrow \sqrt{81-8} = 1$$

$$\Rightarrow \sqrt{9^2-8} = 1$$

$$\Rightarrow 9-8 = 1$$

$$\Rightarrow 1 = 1$$

Hence solution set is $\{81\}$ Ans



Q#5: Find the solution set of the following equations and also verify the answer:

ix. $10\sqrt{x+20} = 100$

Solution:

$$\Rightarrow 10\sqrt{x+20} = 100$$

$$\Rightarrow \sqrt{x+20} = \frac{100}{10}$$

$$\Rightarrow \sqrt{x+20} = 10$$

Taking square on both

Sides:

$$\Rightarrow (\sqrt{x+20})^2 = (10)^2$$

$$\Rightarrow x+20 = 100$$

$$\Rightarrow x = 100 - 20$$

$$\Rightarrow \boxed{x = 80}$$

Verification:

$$\Rightarrow 10\sqrt{x+20} = 100$$

$$\Rightarrow 10\sqrt{80+20} = 100$$

$$\Rightarrow 10\sqrt{100} = 100$$

$$\Rightarrow 10\sqrt{10^2} = 100$$

$$\Rightarrow 10 \times 10 = 100$$

$$\Rightarrow 100 = 100$$

Hence, Solution set is $\{80\}$ Ans



Exercise # 6-2

Examples :

- * Solve the Equations involving absolute values in one variable :

Example # 01: Find the solution set of $|5x - 3| - 2 = 3$

Solution:

$$\Rightarrow |5x - 3| - 2 = 3$$

$$\Rightarrow |5x - 3| = 3 + 2$$

$$\Rightarrow |5x - 3| = 5$$

By the definition of modulus, we have.

$$\Rightarrow 5x - 3 = 5$$

or

$$\Rightarrow 5x - 3 = -5$$

$$\Rightarrow 5x = 5 + 3$$

or

$$\Rightarrow 5x = -5 + 3$$

$$\Rightarrow 5x = 8$$

or

$$\Rightarrow 5x = -2$$

$$\Rightarrow x = \frac{8}{5}$$

or

$$\Rightarrow x = -\frac{2}{5}$$

Thus, the solution set is $\left\{ \frac{8}{5}, -\frac{2}{5} \right\}$

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Example #02: Find the solution set of

$$|5x-3|+7=3$$

Solution:

$$\Rightarrow |5x-3|+7=3$$

$$\Rightarrow |5x-3|=3-7$$

$$\Rightarrow |5x-3|=-4$$

The modulus of a real number can never be negative.

Thus, solution set is $\{ \}$ Ans

Example #03: Solve $|5x-3|-2=3$ where, $x \in W$

Solution:

$$\Rightarrow |5x-3|-2=3$$

$$\Rightarrow |5x-3|=3+2$$

$$\Rightarrow |5x-3|=5$$

By definition of modulus we have,

$$\Rightarrow |5x-3|=5 \quad \text{on}$$

$$\Rightarrow 5x-3=5 \dots$$

$$\Rightarrow 5x=5+3$$

$$\Rightarrow x=\frac{8}{5}$$

$$x=\frac{8}{5} \text{ and } -\frac{2}{5} \notin W$$

Thus, solution set is $\{ \}$ Ans



Example # 04: Solve $|2y - 5| + 2 = 7$

Solution:

$$\Rightarrow |2y - 5| + 2 = 7$$

$$\Rightarrow |2y - 5| = 7 - 2$$

$$\Rightarrow |2y - 5| = 5$$

$\Rightarrow$ By the definition of modulus, we have.

$$\Rightarrow 2y - 5 = 5$$

or

$$2y - 5 = -5$$

$$\Rightarrow 2y = 5 + 5$$

$$\Rightarrow 2y = -5 + 5$$

$$\Rightarrow 2y = 10$$

$$\Rightarrow y = \frac{0}{2}$$

$$\Rightarrow y = \frac{10}{2}$$

$$y = 0$$

$$\Rightarrow y = 5$$

Thus, the solution set is $\{5, 0\}$ Ans

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Find the solution set of the following equation:

1. $|2x + 1| = 6$

Solution:

$$\Rightarrow |2x + 1| = 6$$

By the definition of modulus, we have.

$$\Rightarrow 2x + 1 = 6$$

or

$$\Rightarrow 2x + 1 = -6$$

$$\Rightarrow 2x = 6 - 1$$

$$\Rightarrow 2x = -6 - 1$$

$$\Rightarrow x = \frac{5}{2}$$

$$\Rightarrow x = -\frac{7}{2}$$

Hence, Solution set is $\{-\frac{7}{2}, \frac{5}{2}\}$ Ans

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2. $|5x - 12| = 7$ where $x \in W$

Solution:

$$\Rightarrow |5x - 12| = 7$$

By the definition of modulus, we have

$$\Rightarrow 5x - 12 = 7$$

$$\text{or } \Rightarrow 5x - 12 = -7$$

$$\Rightarrow 5x = 7 + 12$$

$$\Rightarrow 5x = -7 + 12$$

$$\Rightarrow 5x = 19$$

$$\Rightarrow 5x = 5$$

$$\Rightarrow x = \frac{19}{5}$$

$$\Rightarrow x = \frac{5}{5}$$

$$\Rightarrow x = 1$$

Thus, solution set is $\{1, \frac{19}{5}\}$ Ans



Find the solution set of the following equation:

3. $\left| \frac{2x}{7} \right| = 12$

Solution:

$\Rightarrow \left| \frac{2x}{7} \right| = 12$

By the definition of modulus, we have.

$\Rightarrow \frac{2x}{7} = 12$

or $\Rightarrow \frac{2x}{7} = -12$

$\Rightarrow 2x = 12 \times 7$

$\Rightarrow 2x = -12 \times 7$

$\Rightarrow 2x = 84$

$\Rightarrow 2x = -84$

$\Rightarrow x = \frac{84}{2}$

$\Rightarrow x = \frac{-84}{2}$

$\Rightarrow x = 42$

$\Rightarrow x = -42$

Thus, solution set is $\{-42, +42\}$ Ans

4. $\left| \frac{2x+1}{3} \right| = 8$

Solution:

$\Rightarrow \left| \frac{2x+1}{3} \right| = 8$

By the definition of modulus we have.

$\Rightarrow \frac{2x+1}{3} = 8$

or

$\Rightarrow \frac{2x+1}{3} = -8$

$\Rightarrow 2x+1 = 8 \times 3$

$\Rightarrow 2x+1 = -8 \times 3$

$\Rightarrow 2x+1 = 24$

$\Rightarrow 2x+1 = -24$

$\Rightarrow 2x = 24-1$

$\Rightarrow 2x = -24-1$

$\Rightarrow 2x = 23$

$\Rightarrow 2x = -25$

$\Rightarrow x = \frac{23}{2}$

$\Rightarrow x = -\frac{25}{2}$

Thus, solution set is $\{-\frac{25}{2}, \frac{23}{2}\}$ Ans



5. $|5x-3|-8=4$, where $x \in \mathbb{N}$

Solution:

$$\Rightarrow |5x-3|-8=4$$

$$\Rightarrow |5x-3|=4+8$$

$$\Rightarrow |5x-3|=12$$

By the definition of modulus we have

$$\Rightarrow 5x-3=12$$

or

$$\Rightarrow 5x-3=-12$$

$$\Rightarrow 5x=12+3$$

$$\Rightarrow 5x=-12+3$$

$$\Rightarrow 5x=15$$

$$\Rightarrow 5x=-9$$

$$\Rightarrow x = \frac{15}{5}$$

$$\Rightarrow x = -\frac{9}{5}$$

$$\Rightarrow x=3$$

Thus, the solution set is $\left\{-\frac{9}{5}, 3\right\}$ Ans

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6. $\left|\frac{5x+1}{7}\right|-3=8$

Solution:

$$\Rightarrow \left|\frac{5x+1}{7}\right|=8+3$$

$$\Rightarrow \left|\frac{5x+1}{7}\right|=11$$

By the definition of modulus we have,

$$\Rightarrow \frac{5x+1}{7}=11$$

or

$$\Rightarrow \frac{5x+1}{7}=-11$$

$$\Rightarrow 5x+1=11 \times 7$$

$$\Rightarrow 5x+1=-11 \times 7$$

$$\Rightarrow 5x+1=77$$

$$\Rightarrow 5x+1=-77$$

$$\Rightarrow 5x=77-1$$

$$\Rightarrow 5x=-77-1$$

$$\Rightarrow x = \frac{76}{5}$$

$$\Rightarrow x = -\frac{78}{5}$$

Thus, solution set is $\left\{-\frac{78}{5}, \frac{76}{5}\right\}$ Ans



$$7. \left| \frac{2x+3}{4} \right| + 2 = 7$$

Solution:

$$\Rightarrow \left| \frac{2x+3}{4} \right| = 7-2$$

$$\Rightarrow \left| \frac{2x+3}{4} \right| = 5$$

By definition of modulus we have,

$$\Rightarrow \frac{2x+3}{4} = 5$$

$$\text{or } \Rightarrow \frac{2x+3}{4} = -5$$

$$\Rightarrow 2x+3 = 5 \times 4$$

$$\Rightarrow 2x+3 = -5 \times 4$$

$$\Rightarrow 2x+3 = 20$$

$$\Rightarrow 2x+3 = -20$$

$$\Rightarrow 2x = 20-3$$

$$\Rightarrow 2x = -20-3$$

$$\Rightarrow x = \frac{17}{2}$$

$$\Rightarrow x = -\frac{23}{2}$$

Thus, Solution set is $\left\{ -\frac{23}{2}, \frac{17}{2} \right\}$ Ans

$$8. \left| \frac{3x+6}{12} \right| + 1 = 3, \text{ where } x \in \mathbb{Z}$$

Solution:

$$\Rightarrow \left| \frac{3x+6}{12} \right| = 3-1$$

$$\Rightarrow \left| \frac{3x+6}{12} \right| = 2$$

By definition of modulus we have

$$\Rightarrow \frac{3x+6}{12} = 2 \quad \text{or}$$

$$\Rightarrow \frac{3x+6}{12} = -2$$

$$\Rightarrow 3x+6 = -2 \times 12$$

$$\Rightarrow 3x+6 = 2 \times 12$$

$$\Rightarrow 3x+6 = -24$$

$$\Rightarrow 3x+6 = 24$$

$$\Rightarrow 3x = -24-6$$

$$\Rightarrow 3x = 24-6$$

$$\Rightarrow x = \frac{-30}{3}$$

$$\Rightarrow x = \frac{18-6}{3}$$

$$\Rightarrow x = -10$$

$$\Rightarrow x = 6$$

Thus, the solution set is $\{-10, 6\}$ Ans



$$9. \quad \frac{3}{2} = |7x + 8|$$

Solution:

$$\Rightarrow |7x + 8| = \frac{3}{2}$$

By definition of modulus we have,

$$\Rightarrow 7x + 8 = \frac{3}{2}$$

$$\Rightarrow 7x = \frac{3}{2} - 8$$

$$\Rightarrow 7x = \frac{3 - 8 \times 2}{2}$$

$$\Rightarrow 7x = \frac{3 - 16}{2}$$

$$\Rightarrow 7x = \frac{-13}{2}$$

$$\Rightarrow 7x = \frac{-13}{2}$$

$$\Rightarrow x = \frac{-13}{2 \times 7}$$

$$\Rightarrow x = \frac{-13}{14}$$

$$\text{or } \Rightarrow 7x + 8 = -\frac{3}{2}$$

$$\Rightarrow 7x = -\frac{3}{2} - 8$$

$$\Rightarrow 7x = \frac{-3 - 8 \times 2}{2}$$

$$\Rightarrow 7x = \frac{-3 - 16}{2}$$

$$\Rightarrow 7x = \frac{-19}{2}$$

$$\Rightarrow x = \frac{-19}{2 \times 7}$$

$$\Rightarrow x = \frac{-19}{14}$$

Thus, Solution set is $\left\{ \frac{-19}{14}, \frac{-13}{14} \right\}$ Ans

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$$10 - \left| \frac{2x-3}{5} \right| - 12 = 5$$

Solution:

$$\Rightarrow \left| \frac{2x-3}{5} \right| - 12 = 5$$

$$\Rightarrow \left| \frac{2x-3}{5} \right| = 5 + 12$$

$$\Rightarrow \left| \frac{2x-3}{5} \right| = 17$$

By definition of modulus we have,

$$\Rightarrow \frac{2x-3}{5} = 17 \quad \text{or} \quad \Rightarrow \frac{2x-3}{5} = -17$$

$$\Rightarrow 2x-3 = 17 \times 5$$

$$\Rightarrow 2x-3 = -17 \times 5$$

$$\Rightarrow 2x-3 = -85$$

$$\Rightarrow 2x = -85 + 3$$

$$\Rightarrow 2x = -82$$

$$\Rightarrow x = \frac{-82}{2}$$

$$\Rightarrow x = -41$$

$$\Rightarrow 2x-3 = 85$$

$$\Rightarrow 2x = 85 + 3$$

$$\Rightarrow x = \frac{88}{2}$$

$$\Rightarrow x = 44$$

Thus, solution

set is $\{-41, 44\}$ Ans

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Exercise # 6.3

Examples :

Solving linear inequalities with rational coefficients :

* Example : 01

Find the solution set of $3x+1 < 7 \quad \forall x \in W$ and show on the number line.

Solution :

$$\Rightarrow 3x+1 < 7 \quad \forall x \in W$$

$$\Rightarrow 3x < 7-1$$

$$\Rightarrow 3x < 6$$

$$\Rightarrow x < \frac{6}{3}$$

$$\Rightarrow x < 2$$

$$W = \{0, 1, 2, 3, 4, \dots\}$$

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Therefore, the solution set is $\{x | x \in W \wedge x < 2\}$

The solution set is represented $\{0, 1\}$ Ans
on the number line as under:



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Example : 02:

Find the solution set of $x-11 \leq 9-4x \quad \forall x \in \mathbb{Z}$ and show on the number line.

Solution:

$$\Rightarrow x-11 \leq 9-4x$$

$$\Rightarrow x+4x \leq 9+11$$

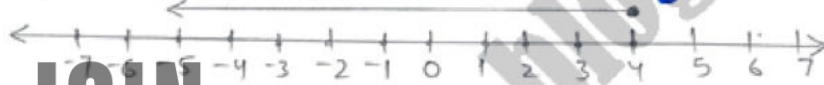
$$\Rightarrow 5x \leq 20$$

$$\Rightarrow x \leq \frac{20}{5} 4$$

$$\Rightarrow x \leq 4$$

Therefore, the solution set is $\{x | x \in \mathbb{Z} \wedge x \leq 4\}$
 $\{\dots, -3, -2, -1, 0, 1, 2, 3, 4\}$

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Example : 03:

Find the solution set of $2x+5 > 7 \quad x \in \mathbb{Z}$ also express it on the number line.

Solution:

$$\Rightarrow 2x+5 > 7$$

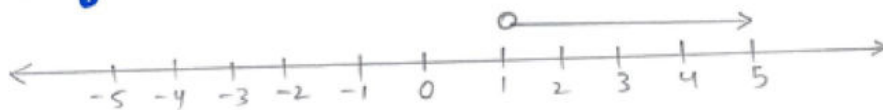
$$\Rightarrow 2x > 7-5$$

$$\Rightarrow 2x > 2$$

$$\Rightarrow x > \frac{2}{2}$$

$$\Rightarrow x > 1$$

Therefore, the solution set is $\{x | x \in \mathbb{Z} \wedge x > 1\}$



Example 03:

Find the solution of $-6 < 2x + 1 < 11, \forall x \in \mathbb{Z}$.
Also express it on number line.

Solution:

$$\Rightarrow -6 < 2x + 1 < 11, \forall x \in \mathbb{Z}$$

$$\Rightarrow -6 < 2x + 1 \text{ and } 2x + 1 < 11$$

$$\Rightarrow -6 - 1 < 2x \quad 2x < 11 - 1$$

$$\Rightarrow -\frac{7}{2} < x \quad x < \frac{10}{2}$$

$$\Rightarrow x > -\frac{7}{2} \quad x < 5$$

$$x > -3.5$$

Therefore, the solution set is $\{x | x \in \mathbb{Z}, -\frac{7}{2} < x < 5\}$
 $\{-3, -2, -1, 0, 1, 2, 3, 4\}$

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Example 04:

Ayesha scored 78, 72 and 86 on the first three out of four tests. What score must be recorded on the fourth test to have average at least of 80?

Solution: Let x be the number of 4th test.

$$\frac{78 + 72 + 86 + x}{4} \geq 80$$

$$\Rightarrow 236 + x \geq 80 \times 4$$

$$\Rightarrow x \geq 320 - 236$$

$$\Rightarrow x \geq 84$$

Ayesha must score 84 on the fourth test to maintain average of 80.



exercise # 6.5.

Q#1: Find the solution sets of the following inequalities and represent number line.

i. $2x - 7 > 6 + x \quad \forall x \in \mathbb{N}$

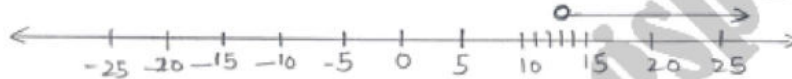
Solution:

$$\Rightarrow 2x - 7 > 6 + x$$

$$\Rightarrow 2x - x > 6 + 7$$

$$\Rightarrow x > 13$$

Therefore, the solution set is $\{x | x \in \mathbb{N}^+ x > 13\}$
 $\{14, 15, 16, \dots\}$



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ii. $7x - 6 > 3x + 10, \quad \forall x \in \mathbb{R}$

Solution:

$$7x - 6 > 3x + 10$$

$$\Rightarrow 7x - 3x > 10 + 6$$

$$\Rightarrow 4x > 16$$

$$\Rightarrow x > \frac{16}{4}$$

$$\Rightarrow x > 4$$

Therefore, the solution set is $\{x | x \in \mathbb{R}^+ x > 4\}$
 $\{5, 6, 7, 8, \dots\}$



iii. $\frac{y+5}{20} < \frac{25-4y}{10}, \forall y \in \mathbb{N}$

Solution:

$$\Rightarrow \frac{y+5}{20} < \frac{25-4y}{10} \quad \forall$$

$$\Rightarrow y+5 < 20 \cdot \frac{(25-4y)}{10}$$

$$\Rightarrow y+5 < 50 - 8y$$

$$\Rightarrow y+8y < 50-5$$

$$\Rightarrow 9y < 45$$

$$\Rightarrow y < \frac{45}{9}$$

$$\Rightarrow y < 5$$

Therefore, the solution set is $\{y | y \in \mathbb{N}^+ y < 5\}$
 $\{1, 2, 3, 4\}$

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iv. $|2x+3| < x+2, \forall x \in \mathbb{N}$

Solution:

$$\Rightarrow |2x+3| < x+2$$

By definition of modulus, we have,

$$\Rightarrow 2x+3 < -(x+2) \quad \text{and} \quad 2x+3 < x+2$$

$$\Rightarrow 2x+3 < -x-2$$

$$\Rightarrow 2x+x < -2-3$$

$$\Rightarrow 3x < -5$$

$$\Rightarrow x < -\frac{5}{3}$$

Therefore, the solution set is $\{$

$$\{x | x \in \mathbb{N}^+ x\}$$

$$\{x | x \in \mathbb{N}^+ -\frac{5}{3} < x < -1\}$$

again done in new pages-



v. $|2y+8| < 11, \forall y \in \mathbb{R}$

Solution:

$\Rightarrow |2y+8| < 11$

$\Rightarrow$ By the definition of modulus, we have.

$\Rightarrow 2y+8 < +11$

$2y+8 < -11$

$\Rightarrow 2y < 11-8$

$2y < -11-8$

$\Rightarrow 2y < 3$

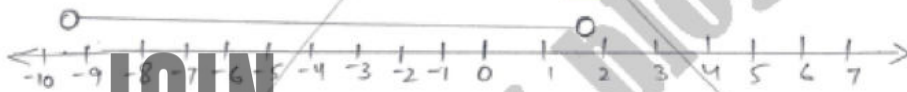
$2y < -19$

$\Rightarrow y < \frac{3}{2}$

$y < -\frac{19}{2}$

Therefore, the solution set is
 $\{y | y \in \mathbb{R} \wedge -\frac{19}{2} < y < \frac{3}{2}\}$

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again done in new page.

vi. $5(2y-3) > 6(y-8), \forall y \in \mathbb{R}$

Solution:

$\Rightarrow 5(2y-3) > 6(y-8)$

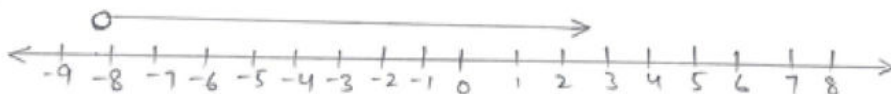
$\Rightarrow 10y-15 > 6y-48$

$\Rightarrow 10y-6y > -48+15$

$\Rightarrow 4y > -33$

$\Rightarrow y > -\frac{33}{4}$

Therefore, the solution set is
 $\{y | y \in \mathbb{R} \wedge y > -\frac{33}{4}\}$



iv. $|2x + 3| < x + 2, \forall x \in \mathbb{N}$

Solution:

$|2x + 3| < x + 2$

By the definition of modulus, we have,

$\Rightarrow 2x + 3 < x + 2 \quad \text{or} \quad 2x + 3 > -(x + 2)$

$\Rightarrow 2x - x < 2 - 3 \quad 2x + 3 > -x - 2$

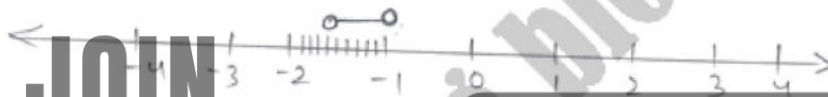
$\Rightarrow x < -1 \quad 2x + x > -2 - 3$

$3x > -5$

$x > -\frac{5}{3}$

Therefore, the solution set is $\{x | x \in \mathbb{N}, -\frac{5}{3} < x < -1\}$

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v. $|2y + 8| < 11, \forall y \in \mathbb{R}$

Solution:

$\Rightarrow |2y + 8| < 11$

By the modulus of definition of modulus we have,

$\Rightarrow 2y + 8 < 11$

$\Rightarrow 2y < 11 - 8$

$\Rightarrow y < \frac{3}{2}$

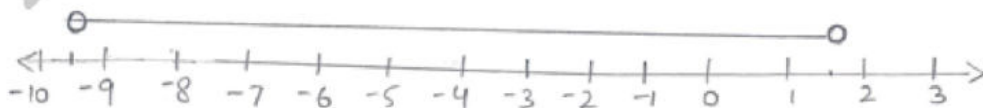
or $2y + 8 > -11$

$2y > -11 - 8$

$y > -\frac{19}{2}$

Therefore, the solution set $-\frac{19}{2} < y$

is $\{y | y \in \mathbb{R}, -\frac{19}{2} < y < \frac{3}{2}\}$



Q#2: Ali scored 66 and 72 marks respectively. For two tests, what is the lowest marks he must have scored for his third test. If an average score of at least 75 is required to qualify for a bonus prize.

Solution: Let x be the marks of third test.

$$\Rightarrow \frac{66 + 72 + x}{3} \geq 75$$

$$\Rightarrow \frac{138 + x}{3} \geq 75$$

$$\Rightarrow 138 + x \geq 75 \times 3$$

$$\Rightarrow x \geq 225 - 138$$

$$\Rightarrow x \geq 87$$

Ali has score at least 87 marks to get qualify for a bonus prize.

Q#3: Seven less than three times the sum of a number and 5 is at least 11, find all the number that satisfy this condition.

Solution:



MATHEMATICS (SINDH BOARD)

CLASS **9th**

CHAPTER **7**

EXERCISE **7.3**

Q#1 Read the given conversion graph between miles and Kilometer to approximately convert.

By Using given Scales:

Conversion graph between miles & Kilometer.

Scale: 5 small squares = 1 mile along x-axis.

5 small squares = 1 kilometer along y-axis.

i- 1 mile to Kilometers.

Solution:

By Reading the above as per given scale we can see 1 mile $\approx$ 1.6 km.

ii- 3 miles to Kilometers.

Solution:

By Reading the above graph as per given scale we can see

3 miles $\approx$ 4.8 km.

iii- 2 Kilometers to miles.

Solution:

By Reading the above graph as per given scale we can see

2 km $\approx$ 1.2 miles.

iv- 8 Kilometers to miles.

Solution:

By Reading the above graph as per given scale we can see

8 km $\approx$ 5 miles.

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Exercise # 8.1

Examples :

- * Solve a quadratic equation in one variable by :

- Method of factorization.
- method of completing the square.

(a) Method Of Factorization:

Example : 01:

Solve i- $x^2 + 2x - 15 = 0$ ii- $2x^2 - 5x = 12$

Solution:

$$\begin{aligned} \Rightarrow x^2 + 2x - 15 &= 0 \\ \Rightarrow x^2 + 5x - 3x - 15 &= 0 \\ \Rightarrow x(x+5) - 3(x+5) &= 0 \\ \Rightarrow (x-3)(x+5) &= 0 \end{aligned}$$

Either $x-3=0$ or $x+5=0$
 $x=3$ $x=-5$

Hence, the solution set is
 $\{-5, 3\}$ Ans

Solution:

$$\begin{aligned} \Rightarrow 2x^2 - 5x - 12 &= 0 \\ \Rightarrow 2x^2 - 8x + 3x - 12 &= 0 \\ \Rightarrow 2x(x-4) + 3(x-4) &= 0 \\ \Rightarrow (2x+3)(x-4) &= 0 \end{aligned}$$

Either $2x+3=0$ or $x-4=0$
 $2x=-3$ $x=4$
 $x=-\frac{3}{2}$

Hence, the solution set is
 $\{-\frac{3}{2}, 4\}$ Ans

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Example : 02

Solve the pure quadratic equation $4m^2 - 1 = 0$ form by factorization method :

Solution :

$$\Rightarrow 4m^2 - 1 = 0$$

$$\Rightarrow (2m)^2 - (1)^2 = 0$$

$$\Rightarrow (2m+1)(2m-1) = 0$$

$$\therefore (a^2 - b^2) = (a+b)(a-b)$$

Either

$$\Rightarrow 2m+1 = 0$$

$$\Rightarrow 2m = -1$$

$$m = -\frac{1}{2}$$

or

$$2m-1 = 0$$

$$2m = 1$$

$$m = \frac{1}{2}$$

Hence, the solution set is $\left\{-\frac{1}{2}, \frac{1}{2}\right\}$ Ans

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(b) Method Of Completing Square :

Example 01:

$$\text{Solve } 2x^2 + 8x - 1 = 0$$

Solution:

$$\Rightarrow 2x^2 + 8x - 1 = 0$$

Dividing by 2 on both sides:

$$\Rightarrow \frac{2x^2}{2} + \frac{8x}{2} - \frac{1}{2} = \frac{0}{2}$$

$$\Rightarrow x^2 + 4x - \frac{1}{2} = 0$$

$$\Rightarrow x^2 + 4x = \frac{1}{2}$$

Add $\left[\frac{4}{2}\right]^2$ in both sides:

$$\Rightarrow x^2 + 4x + \left[\frac{4}{2}\right]^2 = \frac{1}{2} + \left[\frac{4}{2}\right]^2$$

$$\Rightarrow x^2 + 4x + (2)^2 = \frac{1}{2} + (2)^2$$

$$\Rightarrow (x)^2 + 2(x)(2) + (2)^2 = \frac{1}{2} + 4$$

$\Rightarrow$

$$\Rightarrow (x+2)^2 = \frac{1+2 \times 4}{2}$$

$$\Rightarrow (x+2)^2 = \frac{1+8}{2}$$

$$\Rightarrow (x+2)^2 = \frac{9}{2}$$

Taking square root on both sides:

$$\Rightarrow \sqrt{(x+2)^2} = \sqrt{\frac{9}{2}}$$

$$\Rightarrow x+2 = \pm \frac{3}{\sqrt{2}}$$

$$x = \frac{3\sqrt{2}}{\sqrt{2}} - 2$$

$$x = \frac{3\sqrt{2}-4}{2}$$

Hence, solution set is $\left\{ -\frac{4+3\sqrt{2}}{2}, -\frac{4-3\sqrt{2}}{2} \right\}$

$\left(\frac{\text{Coefficient of } x}{2}\right)^2$

$$\left(\frac{4}{2}\right)^2$$

$$(2)^2$$

$$a^2 + 2ab + b^2 = (a+b)^2$$



$$\text{OR } x+2 = -\frac{3}{\sqrt{2}}$$

$$x+2 = \frac{-3\sqrt{2}}{\sqrt{2}}$$

$$x = \frac{-3\sqrt{2}}{\sqrt{2}} - 2$$

$$x = \frac{-3\sqrt{2}-4}{2}$$



Exercise # 8.1

Q#1: Solve the following quadratic equations by factorization method:

i- $x^2 + 5x + 6 = 0$

Solution:

$$\begin{aligned} \Rightarrow x^2 + 5x + 6 &= 0 \\ \Rightarrow x^2 + 2x + 3x + 6 &= 0 \\ \Rightarrow x(x+2) + 3(x+2) &= 0 \\ \Rightarrow (x+3)(x+2) &= 0 \end{aligned}$$

Either $x+3 = 0$

$$x = -3$$

OR $x+2 = 0$

$$x = -2$$

Hence, solution set is $\{-2, -3\}$

$$x^2 \times 6 = 6x^2 \quad \begin{array}{r} 2/6 \\ 3/3 \\ 1 \end{array}$$

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ii- $6x^2 - x - 1 = 0$

Solution:

$$\begin{aligned} \Rightarrow 6x^2 - x - 1 &= 0 \\ \Rightarrow 6x^2 - 3x + 2x - 1 &= 0 \\ \Rightarrow 3x(2x-1) + 1(2x-1) &= 0 \\ \Rightarrow (3x+1)(2x-1) &= 0 \end{aligned}$$

Either $3x+1 = 0$

$$3x = -1$$

$$x = -\frac{1}{3}$$

OR $2x-1 = 0$

$$2x = 1$$

$$x = \frac{1}{2}$$

Hence, solution set is $\{-\frac{1}{3}, \frac{1}{2}\}$ Ans



iii- $x^2 - 11x + 30 = 0$

Solution:

$\Rightarrow x^2 - 11x + 30 = 0$

$\Rightarrow x^2 - 6x - 5x + 30 = 0$

$\Rightarrow x(x-6) - 5(x-6) = 0$

$\Rightarrow (x-5)(x-6) = 0$

$x-5 = 0$

$x = 5$

$x-6 = 0$

$x = 6$

Thus, the solution set is $\{5, 6\}$

$x^2 \times 30 = 30x^2$

$$\begin{array}{r} 2 \overline{) 30} \\ 6 \overline{) 15} \\ 5 \overline{) 5} \\ 1 \end{array}$$

iv- $x^2 - 2x = 0$

Solution:

$\Rightarrow x^2 - 2x = 0$

$\Rightarrow x(x-2) = 0$

$x = 0$

$x-2 = 0$

$x = 2$

Thus, the solution set is $\{0, 2\}$ Ans

v- $x^2 - 2x - 15 = 0$

Solution:

$\Rightarrow x^2 - 2x - 15 = 0$

$\Rightarrow x^2 - 5x + 3x - 15 = 0$

$\Rightarrow x(x-5) + 3(x-5) = 0$

$\Rightarrow (x+3)(x-5) = 0$

$x+3 = 0$

$x = -3$

or

$x-5 = 0$

$x = 5$

Thus, the solution set is $\{5, -3\}$ Ans



vi- $12x^2 - 41x + 24 = 0$

Solution:

$\Rightarrow 12x^2 - 41x + 24 = 0$

$\Rightarrow 12x^2 - 32x - 9x + 24 = 0$

$\Rightarrow 4x(3x-8) - 3(3x-8) = 0$

$\Rightarrow (3x-8)(4x-3) = 0$

$\Rightarrow 3x-8 = 0$

$3x = 8$

$x = \frac{8}{3}$

OR

$4x-3 = 0$

$4x = 3$

$x = \frac{3}{4}$

Thus, the solution set is $\left\{ \frac{8}{3}, \frac{3}{4} \right\}$ Ans

$12x^2 \times 24 = 288$

2	288
2	144
2	72
32	2
2	36
9	2
3	18
3	9
	3
	1

vii- $(x-5)^2 - 9 = 0$

Solution:

$\Rightarrow (x-5)^2 - (3)^2 = 0$

$\Rightarrow (x-5+3)(x-5-3) = 0$

$\Rightarrow (x-2)(x-8) = 0$

$\Rightarrow x-2 = 0$

$\Rightarrow x = 2$

OR

$x-8 = 0$

$x = 8$

Thus, the solution set is $\{8, 2\}$ Ans

$x^2 - 4 = 0$

$\therefore a^2 - b^2 = (a+b)(a-b)$

viii- $(3x+4)^2 - 16 = 0$

Solution:

$\Rightarrow (3x+4)^2 - (4)^2 = 0$

$\Rightarrow (3x+4+4)(3x+4-4) = 0$

$\Rightarrow (3x+8)(3x) = 0$

$3x+8 = 0$

$3x = -8$

$x = -\frac{8}{3}$

OR

$3x = 0$

$x = \frac{0}{3}$

$x = 0$

Thus, the solution set is $\left\{ 0, -\frac{8}{3} \right\}$ Ans

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Q #2: Solve each of the following by completing the square.

i. $x^2 + 6x + 1 = 0$

Solution:

$\Rightarrow x^2 + 6x + 1 = 0$

$\Rightarrow x^2 + 6x = -1$

Add $\left[\frac{6}{2}\right]^2 [3]^2$ in both sides:

$\Rightarrow x^2 + 6x + (3)^2 = -1 + (3)^2$

$\Rightarrow x^2 + 2(x)(3) + (3)^2 = -1 + 9$

$\Rightarrow (x+3)^2 = 8$

Taking root on both sides:

$\Rightarrow \sqrt{(x+3)^2} = \sqrt{8}$

$\Rightarrow x+3 = \pm 2\sqrt{2}$

$x+3 = 2\sqrt{2}$

$\Rightarrow x = 2\sqrt{2} - 3$

Thus, solution set is $\{2\sqrt{2}-3, -2\sqrt{2}-3\}$ Ans

[Co-efficient of x]:

$\left[\frac{6}{2}\right]^2 = [3]^2$

$\therefore a^2 + 2ab + b^2 = (a+b)^2$

$\begin{array}{r|l} 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ & 1 \end{array}$

$\sqrt{2 \times 2 \times 2}$

OR $x+3 = -2\sqrt{2}$
 $x = -2\sqrt{2} - 3$



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$$\text{ii. } (3x+2)(x+2) = 6-2(x+1)$$

Solution:

$$\Rightarrow (3x+2)(x+2) = 6-2(x+1)$$

$$\Rightarrow 3x^2 + 6x + 2x + 4 = 6 - 2x - 2$$

$$\Rightarrow 3x^2 + 6x + 2x + 4 - 6 + 2x + 2 = 0$$

$$\Rightarrow 3x^2 + 10x = 0$$

Dividing by 3 on both Sides:

$$\Rightarrow \frac{3}{3}x^2 + \frac{10}{3}x = \frac{0}{3}$$

$$\Rightarrow x^2 + \frac{10}{3}x = 0$$

Add $\left[\frac{\text{co-efficient of } x}{2}\right]$ on both Sides:

Add $\left(\frac{5}{3}\right)^2$ on both Sides:

$$\Rightarrow x^2 + \frac{10}{3}x + \left(\frac{5}{3}\right)^2 = \left(\frac{5}{3}\right)^2$$

$$\Rightarrow x^2 + 2(x)\left(\frac{5}{3}\right) + \left(\frac{5}{3}\right)^2 = \frac{25}{9} \quad \therefore a^2 + 2ab + b^2 = (a+b)^2$$

$$\Rightarrow \left(x + \frac{5}{3}\right)^2 = \frac{25}{9}$$

Taking root on both Sides:

$$\Rightarrow \sqrt{\left(x + \frac{5}{3}\right)^2} = \sqrt{\frac{25}{9}}$$

$$\Rightarrow x + \frac{5}{3} = \pm \frac{5}{3}$$

$$\Rightarrow x + \frac{5}{3} = \frac{5}{3}$$

$$\Rightarrow x = \frac{5}{3} - \frac{5}{3}$$

$$\Rightarrow x = 0$$

or

$$x + \frac{5}{3} = -\frac{5}{3}$$

$$x = -\frac{5}{3} - \frac{5}{3}$$

$$x = \frac{-5-5}{3}$$

$$x = \frac{-10}{3}$$

Hence, Solution set is $\left\{0, -\frac{10}{3}\right\}$ Ans



iii. $3x^2 - 8x = -1$

Solution:

$\Rightarrow 3x^2 - 8x = -1$

Dividing by 3 on both Sides:

$\Rightarrow \frac{3x^2}{3} - \frac{8}{3}x = -\frac{1}{3}$

$\Rightarrow x^2 - \frac{8}{3}x = -\frac{1}{3}$

Add $\left(\frac{4}{3}\right)^2$ on both sides:

$\Rightarrow x^2 - \frac{8}{3}x + \left(\frac{4}{3}\right)^2 = -\frac{1}{3} + \left(\frac{4}{3}\right)^2$

$\therefore (a^2 + 2ab + b^2 = (a+b)^2)$

$\Rightarrow (x)^2 - 2(x)\left(\frac{4}{3}\right) + \left(\frac{4}{3}\right)^2 = -\frac{1}{3} + \frac{16}{9}$

$\Rightarrow \left(x - \frac{4}{3}\right)^2 = \frac{-3+16}{9}$

$\Rightarrow \left(x - \frac{4}{3}\right)^2 = \frac{13}{9}$

Taking root on both sides:

$\Rightarrow \sqrt{\left(x - \frac{4}{3}\right)^2} = \sqrt{\frac{13}{9}}$

$\Rightarrow x - \frac{4}{3} = \pm \frac{\sqrt{13}}{3}$

$\Rightarrow x - \frac{4}{3} = \frac{\sqrt{13}}{3}$

$\Rightarrow x = \frac{\sqrt{13}}{3} + \frac{4}{3}$

$\Rightarrow x = \frac{\sqrt{13} + 4}{3}$

$\Rightarrow x = \frac{4 + \sqrt{13}}{3}$

Thus, solution set is $\left\{ \frac{4 + \sqrt{13}}{3}, \frac{4 - \sqrt{13}}{3} \right\}$ Ans

$\left(\frac{\text{Coefficient of } x}{2}\right)^2$

$\left(\frac{\frac{8}{3}}{2}\right)^2$

$\left(\frac{8}{3} \div 2\right)^2$

$\left(\frac{8 \times 1}{3 \times 2}\right)^2$

$\left(\frac{4}{3}\right)^2$



OR $x - \frac{4}{3} = -\frac{\sqrt{13}}{3}$
 $x = \frac{-\sqrt{13}}{3} + \frac{4}{3}$
 $x = \frac{-\sqrt{13} + 4}{3}$
 $x = \frac{4 - \sqrt{13}}{3}$



$$\text{iv- } 24x^2 = -10x + 21$$

Solution:

$$\Rightarrow 24x^2 = -10x + 21$$

$$\Rightarrow 24x^2 + 10x = 21$$

Dividing by 24 on both Sides:

$$\Rightarrow \frac{24x^2}{24} + \frac{10x}{24} = \frac{21}{24}$$

$$\Rightarrow x^2 + \frac{5}{12}x = \frac{7}{8}$$

Add $(\frac{5}{24})^2$ on both Sides:

$$\Rightarrow x^2 + \frac{5}{12}x + (\frac{5}{24})^2 = \frac{7}{8} + (\frac{5}{24})^2$$

$$\Rightarrow x^2 + 2(x)(\frac{5}{24}) + (\frac{5}{24})^2 = \frac{7}{8} + \frac{25}{576}$$

$$\Rightarrow (x + \frac{5}{24})^2 = \frac{504 + 25}{576}$$

$$\Rightarrow (x + \frac{5}{24})^2 = \frac{529}{576}$$

Taking root on both Sides:

$$\sqrt{(x + \frac{5}{24})^2} = \sqrt{\frac{529}{576}}$$

$$x + \frac{5}{24} = \pm \frac{23}{24}$$

$$x + \frac{5}{24} = \frac{23}{24}$$

$$x = \frac{23}{24} - \frac{5}{24}$$

$$x = \frac{23-5}{24}$$

$$x = \frac{18}{24} = \frac{3}{4}$$

Thus, Solution set is $\{\frac{3}{4}, -\frac{7}{6}\}$ Ans

$$(\frac{\text{Coefficient of } x}{2})^2$$

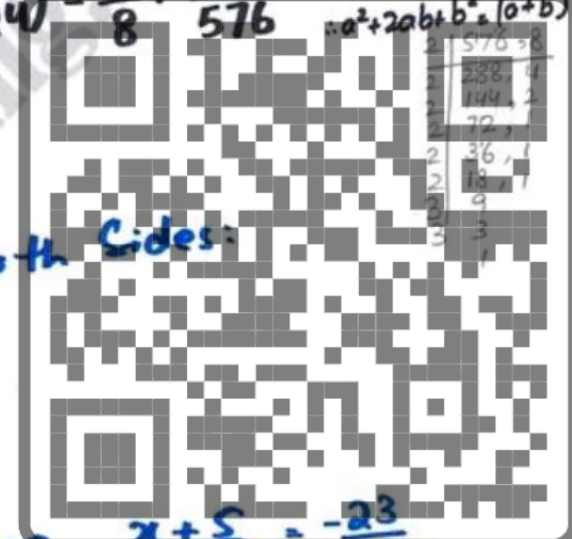
$$(\frac{\frac{5}{12}}{2})^2$$

$$(\frac{\frac{5}{12} \div 2}{2})^2$$

$$(\frac{\frac{5}{12} \times \frac{1}{2}}{2})^2$$

$$(\frac{5}{24})^2$$

$$a^2 + 2ab + b^2 = (a+b)^2$$



OR $x + \frac{5}{24} = -\frac{23}{24}$

$$x = -\frac{23}{24} - \frac{5}{24}$$

$$x = \frac{-23-5}{24}$$

$$x = \frac{-28}{24} = -\frac{7}{6}$$



$$v. 2(x^2-3) - 3x = 2(x+3)$$

Solution:

$$\Rightarrow 2(x^2-3) - 3x = 2(x+3)$$

$$\Rightarrow 2x^2 - 6 - 3x = 2x + 6$$

$$\Rightarrow 2x^2 - 6 - 3x - 2x - 6 = 0$$

$$\Rightarrow 2x^2 - 5x - 12 = 0$$

$$2x^2 - 5x = 12$$

Dividing by 2 on both sides:

$$\Rightarrow \frac{2}{2}x^2 - \frac{5}{2}x = \frac{12}{2}6$$

$$\Rightarrow x^2 - \frac{5}{2}x = 6$$

Adding $\left(\frac{5}{4}\right)^2$ on both sides:

$$\Rightarrow x^2 - \frac{5}{2}x + \left(\frac{5}{4}\right)^2 = 6 + \left(\frac{5}{4}\right)^2$$

$$\Rightarrow (x)^2 - 2(x)\left(\frac{5}{4}\right) + \left(\frac{5}{4}\right)^2 = 6 + \frac{25}{16}$$

$$\Rightarrow \left(x - \frac{5}{4}\right)^2 = \frac{96+25}{16}$$

$$\Rightarrow \left(x - \frac{5}{4}\right)^2 = \frac{121}{16}$$

Taking root on both sides:

$$\sqrt{\left(x - \frac{5}{4}\right)^2} = \sqrt{\frac{121}{16}}$$

$$\Rightarrow x - \frac{5}{4} = \pm \frac{11}{4}$$

$$\Rightarrow x - \frac{5}{4} = \frac{11}{4}$$

$$\Rightarrow x = \frac{11}{4} + \frac{5}{4}$$

$$\Rightarrow x = \frac{11+5}{4}$$

$$\Rightarrow x = \frac{16}{4}$$

$$\Rightarrow x = 4$$

Thus, solution set is $\{4, -\frac{3}{2}\}$ Ans

$$\left(\frac{\text{Coefficient of } x}{2}\right)^2$$

$$\left(\frac{5}{2} \div 2\right)^2$$

$$\left(\frac{5}{2} \times \frac{1}{2}\right)^2$$

$$\left(\frac{5}{4}\right)^2$$

$$\therefore a^2 + 2ab + b^2 = (a+b)^2$$



OR

$$x - \frac{5}{4} = -\frac{11}{4}$$

$$x = -\frac{11}{4} + \frac{5}{4}$$

$$x = \frac{-11+5}{4}$$

$$x = \frac{-6}{4}$$

$$x = \frac{-3}{2}$$



$$\text{vi- } 2x^2 + 4x - 1 = 0$$

Solution:

$$\Rightarrow 2x^2 + 4x - 1 = 0$$

$$\Rightarrow 2x^2 + 4x = 1$$

Dividing by 2 on both Sides:

$$\Rightarrow \frac{2}{2}x^2 + \frac{4}{2}x = \frac{1}{2}$$

$$\Rightarrow x^2 + 2x = \frac{1}{2}$$

Adding $(1)^2$ on both Sides:

$$\Rightarrow x^2 + 2x + (1)^2 = \frac{1}{2} + (1)^2$$

$$\Rightarrow (x)^2 + 2(x)(1) + (1)^2 = \frac{1+2}{2}$$

$$\Rightarrow (x+1)^2 = \frac{3}{2}$$

Taking root on both Sides:

$$\Rightarrow \sqrt{(x+1)^2} = \sqrt{\frac{3}{2}}$$

$$\Rightarrow x+1 = \pm \sqrt{\frac{3}{2}}$$

$$\Rightarrow x+1 = \pm \sqrt{\frac{3}{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

$$x+1 = \pm \frac{\sqrt{6}}{2}$$

$$x = -1 + \frac{\sqrt{6}}{2}$$

$$x = \frac{-2 + \sqrt{6}}{2}$$

$$\begin{aligned} & \left(\frac{\text{Co-efficient of } x}{2} \right)^2 \\ & \left(\frac{2}{2} \right)^2 \\ & (1)^2 \end{aligned}$$

$$\therefore (a^2 + 2ab + b^2 = (a+b)^2$$



$$\begin{aligned} \text{OR } x+1 &= -\frac{\sqrt{3}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} \\ x+1 &= -\frac{\sqrt{6}}{2} \\ x &= -1 - \frac{\sqrt{6}}{2} \\ x &= \frac{-2 - \sqrt{6}}{2} \end{aligned}$$

Thus, the solution set is $\left\{ \frac{-2 + \sqrt{6}}{2}, \frac{-2 - \sqrt{6}}{2} \right\}$



Q#3: The equation $3x^2 + bx - 8 = 0$ has 2 as one of its roots:

- What is the value of b ?
- What is the other root of the equation?

Solution:

$$\Rightarrow 3x^2 + bx - 8 = 0$$

$$\Rightarrow 3x^2 + bx = 8$$

Dividing by 3 on both sides:

$$\Rightarrow \frac{3x^2}{3} + \frac{b}{3}x = \frac{8}{3}$$

$$\Rightarrow x^2 + \frac{b}{3}x = \frac{8}{3}$$

Adding $\left(\frac{b}{6}\right)^2$ on both sides:

$$\Rightarrow x^2 + \frac{b}{3}x + \left(\frac{b}{6}\right)^2 = \frac{8}{3} + \left(\frac{b}{6}\right)^2$$

$$\Rightarrow (x)^2 + 2(x)\left(\frac{b}{6}\right) + \left(\frac{b}{6}\right)^2 = \frac{8}{3} + \frac{b^2}{36}$$

$$\Rightarrow \left(x + \frac{b}{6}\right)^2 = \frac{96 + b^2}{36}$$

Taking root on both sides:

$$\Rightarrow \sqrt{\left(x + \frac{b}{6}\right)^2} = \sqrt{\frac{96 + b^2}{36}}$$

$$\Rightarrow x + \frac{b}{6} = \pm \frac{\sqrt{96 + b^2}}{6}$$

$$x + \frac{b}{6} = \frac{\sqrt{96 + b^2}}{6}$$

$$x = \frac{\sqrt{96 + b^2}}{6} - \frac{b}{6}$$

$$x = \frac{\sqrt{96 + b^2} - b}{6} \rightarrow \textcircled{1}$$

[Coefficient of x]²
 $\left(\frac{\frac{b}{3}}{2}\right)^2 = \frac{b}{3} \div 2$
 $\frac{b}{3} \times \frac{1}{2} = \frac{b}{6}$



OR

$$x + \frac{b}{6} = -\frac{\sqrt{96 + b^2}}{6}$$

$$x = -\frac{\sqrt{96 + b^2}}{6} - \frac{b}{6}$$

$$x = \frac{-\sqrt{96 + b^2} - b}{6} \rightarrow \textcircled{2}$$



Now, we find b , we use given condition that is 2 as one of its root.

$$2 = \frac{\sqrt{96+b^2} - b}{6}$$

$$2 \times 6 = \sqrt{96+b^2} - b$$

$$12 + b = \sqrt{96+b^2}$$

Taking square on both sides:

$$\Rightarrow (12+b)^2 = (\sqrt{96+b^2})^2$$

$$\Rightarrow (12+b)^2 = 96+b^2 \quad \because (a+b)^2 = a^2 + 2ab + b^2$$

$$\Rightarrow (12)^2 + 2(12)(b) + (b)^2 = 96+b^2$$

$$\Rightarrow 144 + 24b + b^2 = 96+b^2$$

$$\Rightarrow 144 + 24b + b^2 - 96 - b^2 = 0$$

$$\Rightarrow 24b + 48 = 0$$

$$\Rightarrow 24b = -48$$

$$\Rightarrow b = \frac{-48}{24}$$

$$\Rightarrow b = -2$$

The value of b is -2 .

Now, we find other roots, so put the value of b in eqn (1) and (2)

$$x = \frac{\sqrt{96+(-2)^2} - (-2)}{6}$$

$$x = \frac{\sqrt{96+4} + 2}{6}$$

$$x = \frac{\sqrt{100} + 2}{6}$$

$$x = \frac{10+2}{6}$$

$$x = \frac{12}{6} = 2$$

$$x = \frac{\sqrt{96+(-2)^2} - (-2)}{6}$$

$$x = \frac{\sqrt{96+4} + 2}{6}$$

$$x = \frac{\sqrt{100} + 2}{6}$$

$$x = \frac{-10+2}{6}$$

$$x = \frac{-8}{6}$$

$$x = \frac{-4}{3}$$

Thus, the solution set is $\{2, -\frac{4}{3}\}$ Ans



Exercise # 8.2

Examples :

* Quadratic formula :

$$ax^2 + bx + c = 0 \quad a \neq 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

* Use method of Completing the square to drive the Quadratic Formula :

Write the Quadratic equation in standard form :

$$ax^2 + bx + c = 0 \rightarrow \textcircled{i}$$

By dividing 'a' on both Sides :

$$\Rightarrow \frac{ax^2}{a} + \frac{bx}{a} + \frac{c}{a} = \frac{0}{a}$$

$$\Rightarrow x^2 + \frac{b}{a}x + \frac{c}{a} = 0$$

By Shifting constant term $\frac{c}{a}$ to R.H.S :

$$\Rightarrow x^2 + \frac{b}{a}x = -\frac{c}{a}$$

By adding $\left(\frac{b}{2a}\right)^2$ on both Sides :

$$\Rightarrow x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$$

$$\Rightarrow (x)^2 + 2(x)\left(\frac{b}{2a}\right) + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \frac{b^2}{4a^2}$$

$$\Rightarrow \left(x + \frac{b}{2a}\right)^2 = \frac{-4ac + b^2}{4a^2}$$

Taking root on both

$$\Rightarrow \sqrt{\left(x + \frac{b}{2a}\right)^2} = \sqrt{\frac{-4ac + b^2}{4a^2}}$$

$$\Rightarrow x + \frac{b}{2a} = \pm \frac{\sqrt{b^2 - 4ac}}{2a}$$

Either $x = \frac{\sqrt{b^2 - 4ac} - \frac{b}{2a}}{2a}$

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

OR

$$x = \frac{-\sqrt{b^2 - 4ac} - \frac{b}{2a}}{2a}$$

$$x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

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* Use of Quadratic Formula to Solve Quadratic Equation:

Example 01: Solve by using quadratic formula:

i. $2x^2 - 5x - 3 = 0$

ii. $x^2 + x + 1 = 0$

i. $2x^2 - 5x - 3 = 0$

Solution:

$$2x^2 - 5x - 3 = 0$$

Here, $a = 2$, $b = -5$, $c = -3$

By Using Quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Putting all the values in above formula:

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-3)}}{2(2)}$$

$$x = \frac{5 \pm \sqrt{25 + 24}}{4}$$

$$x = \frac{5 \pm \sqrt{49}}{4}$$

$$x = \frac{5 \pm 7}{4}$$

Either $x = \frac{5+7}{4}$

$$x = \frac{12}{4}$$

$$x = 3$$

So, the roots are 3 and $-\frac{1}{2}$

Thus, the solution set is $\{3, -\frac{1}{2}\}$ Ans



OR $x = \frac{5-7}{4}$

$$x = \frac{-2}{4}$$

$$x = -\frac{1}{2}$$



ii. $x^2 + x + 1 = 0$

Solution:

$$x^2 + x + 1 = 0$$

Here, $a = 1$, $b = 1$, $c = 1$

By Using Quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Put all the values in above formula:

$$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(1)(1)}}{2(1)}$$

$$x = \frac{-1 \pm \sqrt{1-4}}{2}$$

$$x = \frac{-1 \pm \sqrt{-3}}{2}$$

Either

$$x = \frac{-1 + \sqrt{-3}}{2}$$

$$x = \frac{-1 + \sqrt{3}i}{2}$$

(Hence, solution set is

$\left\{ \frac{-1 \pm i\sqrt{3}}{2} \right\}$ Ans



Exercise : 8.2

Solve the following equations by using the Quadratic formula:

i. $x^2 - 2x = 15$

Solution:

$$\Rightarrow x^2 - 2x = 15$$

$$\Rightarrow x^2 - 2x - 15 = 0$$

Here, $a = 1$, $b = -2$, $c = -15$

By Using Quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

By putting all the values in above equation:

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-15)}}{2(1)}$$

$$x = \frac{2 \pm \sqrt{4 + 60}}{2}$$

$$x = \frac{2 \pm \sqrt{64}}{2}$$

$$x = \frac{2 \pm 8}{2}$$

Either, $x = \frac{2+8}{2}$

$$x = \frac{10}{2}$$

$$x = 5$$

Thus, the solution

OR $x = \frac{2-8}{2}$

$$x = \frac{-6}{2}$$

$$x = -3$$

set is $\{5, -3\}$ Ans



ii. $10x^2 + 19x - 15 = 0$

Solution:

$$10x^2 + 19x - 15 = 0$$

Here, $a = 10$, $b = 19$, $c = -15$

By using Quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

By putting all the values in above equation: formula:

$$x = \frac{-(19) \pm \sqrt{(19)^2 - 4(10)(-15)}}{2(10)}$$

$$x = \frac{-19 \pm \sqrt{361 + 600}}{20}$$

$$x = \frac{-19 \pm \sqrt{961}}{20}$$

$$x = \frac{-19 \pm 31}{20}$$

Either,

$$x = \frac{-19 + 31}{20}$$

$$x = \frac{12}{20} = \frac{3}{5}$$

$$x = \frac{3}{5}$$

Thus, the solution

OR

$$x = \frac{-19 - 31}{20}$$

$$x = \frac{-50}{20} = -\frac{5}{2}$$

set is $\left\{ \frac{3}{5}, -\frac{5}{2} \right\}$ Ans



iii. $x^2 = -x + 1$

Solution:

$\Rightarrow x^2 = -x + 1$

$\Rightarrow x^2 + x - 1 = 0$

Here, $a = 1$, $b = 1$, $c = -1$

By Using Quadratic formula:

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

By putting all the values in above formula:

$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-1)}}{2(1)}$

$x = \frac{-1 \pm \sqrt{1+4}}{2}$

$x = \frac{-1 \pm \sqrt{5}}{2}$

Either

$x = \frac{-1 + \sqrt{5}}{2}$

Thus, the solution

OR

$x = \frac{-1 - \sqrt{5}}{2}$

set is $\left\{ \frac{-1 + \sqrt{5}}{2}, \frac{-1 - \sqrt{5}}{2} \right\}$ Ans

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iv. $2x = 9 - 3x^2$

Solution:

$$\Rightarrow 2x = 9 - 3x^2$$

$$\Rightarrow 3x^2 + 2x - 9 = 0$$

Here, $a = 3$, $b = 2$, $c = -9$

By Using Quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

By putting all the values in above formula

$$x = \frac{-(2) \pm \sqrt{(2)^2 - 4(3)(-9)}}{2(3)}$$

$$x = \frac{-2 \pm \sqrt{4 + 108}}{6}$$

$$x = \frac{-2 \pm \sqrt{112}}{6}$$

$$x = \frac{-2 \pm 4\sqrt{7}}{6}$$

Either

$$x = \frac{-2 + 4\sqrt{7}}{6}$$

$$x = \frac{2(-1 + 2\sqrt{7})}{6}$$

$$x = \frac{-1 + 2\sqrt{7}}{3}$$

Thus, the Sol. set is $\left\{ \frac{-1 + 2\sqrt{7}}{3}, \frac{-1 - 2\sqrt{7}}{3} \right\}$ Ans

$$\begin{array}{r} 2 \overline{) 112} \\ 2 \overline{) 56} \\ 2 \overline{) 28} \\ 2 \overline{) 14} \\ 7 \overline{) 7} \\ 1 \end{array}$$

$$\sqrt{2 \times 2 \times 2 \times 2 \times 7}$$

$$2 \times 2 \sqrt{7}$$

$$4\sqrt{7}$$

OR

$$x = \frac{-2 - 4\sqrt{7}}{6}$$

$$x = \frac{2(-1 - 2\sqrt{7})}{6}$$

$$x = \frac{-1 - 2\sqrt{7}}{3}$$



$$v. \quad 9x^2 = 12x - 49$$

Solution :

$$\Rightarrow 9x^2 = 12x - 49$$

$$\Rightarrow 9x^2 - 12x + 49 = 0$$

Here, $a = 9$, $b = -12$, $c = 49$

Using quadratic formula :

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Putting all the values in above formula :

$$x = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(9)(49)}}{2(9)}$$

$$x = \frac{12 \pm \sqrt{144 - 1764}}{18}$$

$$x = \frac{12 \pm \sqrt{-1620}}{18}$$

$$x = \frac{12 \pm 18\sqrt{5}}{18}$$

$$x = \frac{12 \pm 18\sqrt{5}i}{18}$$

$$x = \frac{12 \pm 18\sqrt{5}i}{18}$$

Either

$$x = \frac{12 + 18\sqrt{5}i}{18}$$

$$x = \frac{6(2 + 3\sqrt{5}i)}{18}$$

$$x = \frac{6(2 + 3\sqrt{5}i)}{18}$$

$$x = \frac{2 + 3\sqrt{5}i}{3}$$

Hence, solution set is $\left\{ \frac{2 + 3i\sqrt{5}}{3}, \frac{2 - 3i\sqrt{5}}{3} \right\}$ Ans

$$\begin{array}{r|rrrr} 2 & 16 & 20 & & \\ 2 & 8 & 10 & & \\ 3 & 4 & 0 & 5 & \\ 3 & 1 & 3 & 5 & \\ 3 & 4 & 5 & & \\ 3 & 1 & 5 & & \\ 3 & 0 & 5 & & \end{array}$$



$$x = \frac{12 - 18\sqrt{5}i}{18}$$

$$x = \frac{6(2 - 3\sqrt{5}i)}{18}$$

$$x = \frac{2 - 3\sqrt{5}i}{3}$$



$$\text{vi- } \frac{1}{2}x^2 + \frac{3}{4}x - 1 = 0$$

Solution:

$$\frac{1}{2}x^2 + \frac{3}{4}x - 1 = 0$$

Multiplying by 4:

$$\Rightarrow \frac{4}{2}x^2 + \frac{3 \times 4}{4}x - 4 \times 1 = 0 \times 4$$

$$\Rightarrow 2x^2 + 3x - 4 = 0$$

Using quadratic formula:-

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\text{Here, } a = 2, b = 3, c = -4$$

$$x = \frac{-(3) \pm \sqrt{(3)^2 - 4(2)(-4)}}{2(2)}$$

$$x = \frac{-3 \pm \sqrt{9 + 32}}{4}$$

$$x = \frac{-3 \pm \sqrt{41}}{4}$$

Either

$$x = \frac{-3 + \sqrt{41}}{4}$$

Hence, the solution

OR

$$x = \frac{-3 - \sqrt{41}}{4}$$

set is $\left\{ \frac{-3 + \sqrt{41}}{4}, \frac{-3 - \sqrt{41}}{4} \right\}$



vii- $3x^2 - 2x + 2 = 0$

Solution:

$$3x^2 - 2x + 2 = 0$$

Here, $a = 3$, $b = -2$, $c = 2$.

Now, Using Quadratic formula:-

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Putting all the values in above formula:

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(2)}}{2(3)}$$

$$x = \frac{2 \pm \sqrt{4 - 24}}{6}$$

$$x = \frac{2 \pm \sqrt{-20}}{6}$$

$$x = \frac{2 \pm 2\sqrt{-5}}{6}$$

Either

$$x = \frac{2 + 2\sqrt{-5}}{6}$$

$$x = \frac{2 + 2i\sqrt{5}}{6}$$

$$x = \frac{2(1 + i\sqrt{5})}{6}$$

$$x = \frac{1 + i\sqrt{5}}{3}$$

$$x = \frac{1 + i\sqrt{5}}{3}$$

Hence, Solution set is $\left\{ \frac{1 + i\sqrt{5}}{3}, \frac{1 - i\sqrt{5}}{3} \right\}$ Ans

$$\begin{array}{r} 2 \overline{) 20} \\ 2 \overline{) 10} \\ 5 \overline{) 5} \\ 1 \end{array}$$

$$\sqrt{2 \times 2 \times 5}$$

$$2\sqrt{5}$$

OR

$$x = \frac{2 - 2\sqrt{-5}}{6}$$

$$x = \frac{2 - 2\sqrt{-5}}{6}$$

$$x = \frac{2(1 - i\sqrt{5})}{6}$$

$$x = \frac{1 - i\sqrt{5}}{3}$$



viii. $6x^2 - x - 1 = 0$

Solution:

$$6x^2 - x - 1 = 0$$

Here, $a = 6$, $b = -1$, $c = -1$

Now, Using Quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(6)(-1)}}{2(6)}$$

$$x = \frac{1 \pm \sqrt{1 + 24}}{12}$$

$$x = \frac{1 \pm \sqrt{25}}{12}$$

$$x = \frac{1 \pm 5}{12}$$

Either

$$x = \frac{1+5}{12}$$

$$x = \frac{6}{12}$$

$$x = \frac{1}{2}$$

or

$$x = \frac{1-5}{12}$$

$$x = \frac{-4}{12}$$

$$x = -\frac{1}{3}$$

(Hence, solution set is $\left\{\frac{1}{2}, -\frac{1}{3}\right\}$ Ans)



ix. $4x^2 - 10x = 0$

Solution:

$$4x^2 - 10x = 0$$

Here, $a = 4$, $b = -10$, $c = 0$

Using Quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Putting all the values in above formula:

$$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(4)(0)}}{2(4)}$$

$$x = \frac{10 \pm \sqrt{100 - 0}}{8}$$

$$x = \frac{10 \pm \sqrt{100}}{8}$$

$$x = \frac{10 \pm 10}{8}$$

Either,

$$x = \frac{10 + 10}{8}$$

$$x = \frac{20}{8}$$

$$x = \frac{5}{2}$$

(Hence, Solution set is $\{\frac{5}{2}, 0\}$ Ans)

$$\sqrt{100} = \sqrt{10^2} = 10$$



$$x^2 - 1 = 0$$

Solution:

$$x^2 - 1 = 0$$

Here, $a=1$, $b=0$, $c=-1$

Using Quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Putting all the values in above formula:

$$x = \frac{-0 \pm \sqrt{0^2 - 4(1)(-1)}}{2(1)}$$

$$x = \frac{\pm \sqrt{0+4}}{2}$$

$$x = \frac{\pm \sqrt{4}}{2}$$

$$x = \frac{\pm 2}{2}$$

Either

$$x = \frac{+2}{2}$$

$$x = 1$$

$$\sqrt{4} = \sqrt{2^2} = 2$$

OR

$$x = \frac{-2}{2}$$

$$x = -1$$

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Hence, the solution set is $\{1, -1\}$ Ans



xi- $x^2 - 6x + 9 = 0$

Solution:

$$x^2 - 6x + 9 = 0$$

Here, $a = 1$, $b = -6$, $c = 9$

By Using Quadratic formula:-

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

By Putting all the values in above formula:-

$$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(9)}}{2(1)}$$

$$x = \frac{6 \pm \sqrt{36 - 36}}{2}$$

$$x = \frac{6 \pm \sqrt{0}}{2}$$

$$x = \frac{6 \pm 0}{2}$$

Either
 $x = \frac{6+0}{2}$

$$x = \frac{6}{2}$$

$$x = 3$$



OR

$$x = \frac{6-0}{2}$$

$$x = \frac{6}{2}$$

$$x = 3$$

Thus, the solution set is $\{3, 3\}$ Ans



$$\text{xii. } \frac{1}{x+4} - \frac{1}{x-4} = 4$$

Solution:

$$\Rightarrow \frac{1}{x+4} - \frac{1}{x-4} = 4$$

Multiplying by $(x+4)(x-4)$ in above equation:

$$\Rightarrow \frac{(x+4)(x-4)}{(x+4)} - \frac{(x+4)(x-4)}{(x-4)} = 4(x+4)(x-4)$$

$$\therefore (a-b)(a+b) = a^2 - b^2$$

$$\Rightarrow (x-4) - (x+4) = 4(x^2 - 4^2)$$

$$\Rightarrow (x-4) - (x+4) = 4(x^2 - 16)$$

$$\Rightarrow x-4-x-4 = 4x^2 - 64$$

$$\Rightarrow -8 = 4x^2 - 64$$

$$\Rightarrow 4x^2 - 64 + 8 = 0$$

$$\Rightarrow 4x^2 - 56 = 0$$

$$\text{Here, } a = 4, b = 0, c = -56$$

Using quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Putting all the values in above formula:-

$$x = \frac{-0 \pm \sqrt{0^2 - 4(4)(-56)}}{2(4)}$$

$$x = \frac{\pm \sqrt{0 + 896}}{8}$$

$$x = \pm \frac{\sqrt{896}}{8}$$

$$x = \pm \frac{8\sqrt{14}}{8}$$



$$\begin{array}{r} 2 \overline{) 896} \\ 2 \overline{) 448} \\ 2 \overline{) 224} \\ 2 \overline{) 112} \\ 2 \overline{) 56} \\ 2 \overline{) 28} \\ 2 \overline{) 14} \\ 7 \overline{) 7} \\ 1 \end{array}$$

$$\sqrt{2^7 \times 2^2 \times 2^1 \times 2 \times 7}$$

$$2 \times 2 \times 2 \sqrt{14}$$

$$8\sqrt{14}$$



(xii)

Either

$$x = \frac{+8\sqrt{14}}{8}$$

$$x = \sqrt{14}$$

OR

$$x = -\frac{8\sqrt{14}}{8}$$

$$x = -\sqrt{14}$$

Thus, the solution set is $\{\sqrt{14}, -\sqrt{14}\}$

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Exercise #8.3

Equations Reducible to Quadratic form :

$$ax^4 + bx^2 + c = 0, a \neq 0$$

quartic or bi-quadratic Equation :

Example # 01 :

Solve the quartic Equation

$$4x^4 - 25x^2 + 36 = 0$$

$$ax^4 + bx^2 + c = 0$$

$$y = x^2$$

$$ay^2 + by + c = 0$$

Solution :

$$4x^4 - 25x^2 + 36 = 0$$

This equation can be written as.

$$4(x^2)^2 - 25x^2 + 36 = 0$$

By putting $y = x^2$ in above equation :

$$4y^2 - 25y + 36 = 0$$

Now, Using Quadratic formula :

$$\text{Here, } a = 4, b = -25, c = 36$$

$$y = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$y = \frac{-(-25) \pm \sqrt{(-25)^2 - 4(4)(36)}}{2(4)}$$

$$y = \frac{25 \pm \sqrt{625 - 576}}{8}$$

$$y = \frac{25 \pm \sqrt{49}}{8}$$

$$y = \frac{25 \pm 7}{8}$$

Either

$$y = \frac{25+7}{8}$$

$$y = \frac{32}{8}$$

$$y = 4$$

OR

$$y = \frac{25-7}{8}$$

$$y = \frac{18}{8}$$

$$y = \frac{9}{4}$$



but,

$$y = x^2$$

$$x^2 = 4$$

Taking root on both sides

$$\sqrt{x^2} = \sqrt{4}$$

$$x = \pm 2$$

Thus, solution set is $\{\pm 2, \pm \frac{3}{2}\}$ Ans

but,

$$y = x^2$$

$$x^2 = \frac{9}{4}$$

Taking root on both sides

$$\sqrt{x^2} = \sqrt{\frac{9}{4}}$$

$$x = \pm \frac{3}{2}$$

$$\sqrt{\frac{9}{4}}$$

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Exercise # 8.3

- * Solve Equation of the type $ap(x) + \frac{b}{p(x)} = c$
 where a, b and c are real numbers, $a \neq 0$,
 where $P(x)$ is an algebraic expression:

Example # 01 :

Solve $8\sqrt{x+3} - \frac{1}{\sqrt{x+3}} = 2$

Solution :

$$\Rightarrow 8\sqrt{x+3} - \frac{1}{\sqrt{x+3}} = 2$$

Let $P(x) = \sqrt{x+3} = y$, Put this value in above equation

$$\Rightarrow 8y - \frac{1}{y} = 2$$

$$\Rightarrow 8y \times y - \frac{1}{y} = 2 \times y$$

$$\Rightarrow 8y^2 - 1 = 2y$$

$$\Rightarrow 8y^2 - 2y - 1 = 0$$

$$\Rightarrow 8y^2 - 4y + 2y - 1 = 0$$

$$\Rightarrow 4y(2y-1) + 1(2y-1) = 0$$

$$\Rightarrow (4y+1)(2y-1) = 0$$

Either, $4y+1=0$

$$4y = -1$$

$$y = -\frac{1}{4}$$

when $y = -\frac{1}{4}$

then

$$y = \sqrt{x+3}$$

$$\sqrt{x+3} = -\frac{1}{4}$$



when $y = \frac{1}{2}$

then

$$y = \sqrt{x+3}$$

$$\sqrt{x+3} = \frac{1}{2}$$



Squaring on both sides:

$$(\sqrt{x+3})^2 = \left(-\frac{1}{4}\right)^2$$

$$x+3 = \frac{1}{16}$$

$$x = \frac{1}{16} - 3$$

$$x = \frac{1 - 3 \times 16}{16}$$

$$x = \frac{1 - 48}{16}$$

$$x = -\frac{47}{16}$$

Verification:

$$8\sqrt{x+3} - \frac{1}{\sqrt{x+3}} = 2$$

By Putting $x = -\frac{47}{16}$

$$\Rightarrow 8\sqrt{-\frac{47}{16}+3} - \frac{1}{\sqrt{-\frac{47}{16}+3}} = 2$$

$$\Rightarrow 8\sqrt{\frac{-47+3 \times 16}{16}} - \frac{1}{\sqrt{\frac{-47+3 \times 16}{16}}} = 2$$

$$\Rightarrow 8\sqrt{\frac{-47+48}{16}} - \frac{1}{\sqrt{\frac{-47+48}{16}}} = 2$$

$$\Rightarrow 8\sqrt{\frac{1}{16}} - \frac{1}{\sqrt{\frac{1}{16}}} = 2$$

$$\Rightarrow 8 \times \frac{1}{4} - \frac{1}{1/4} = 2$$

$$\Rightarrow 2 - 4 = 2$$

$$\Rightarrow -2 = 2$$

Thus, the solution set is $\{-\frac{11}{4}\}$ Ans

Squaring on both sides:

$$\Rightarrow (\sqrt{x+3})^2 = \left(\frac{1}{2}\right)^2$$

$$\Rightarrow x+3 = \left(\frac{1}{2}\right)$$

$$\Rightarrow x = \frac{1}{2} - 3$$

$$x = \frac{1 - 3 \times 2}{2}$$

$$x = \frac{1 - 12}{2}$$

$$x = -\frac{11}{2}$$

By putting $x = -\frac{11}{2}$

$$8\sqrt{-\frac{11}{2}+3} - \frac{1}{\sqrt{-\frac{11}{2}+3}} = 2$$

$$8\sqrt{\frac{-11+3 \times 2}{2}} - \frac{1}{\sqrt{\frac{-11+3 \times 2}{2}}} = 2$$

$$8\sqrt{\frac{-11+6}{2}} - \frac{1}{\sqrt{\frac{-11+6}{2}}} = 2$$

$$8\sqrt{\frac{-5}{2}} - \frac{1}{\sqrt{\frac{-5}{2}}} = 2$$

$$8 \times \frac{1}{2} - \frac{1}{1/2} = 2$$

$$\Rightarrow 4 - 2 = 2$$

$$\Rightarrow 2 = 2$$



Exercise #8.3

- * Solve of reciprocal equation of the type $a\left(x^2 + \frac{1}{x^2}\right) + b\left(x + \frac{1}{x}\right) + c = 0$, where a, b and c are rational numbers:

Example # 1:

Solve: $2\left(x^2 + \frac{1}{x^2}\right) - 9\left(x + \frac{1}{x}\right) + 14 = 0$

Solution: $2\left(x^2 + \frac{1}{x^2}\right) - 9\left(x + \frac{1}{x}\right) + 14 = 0 \rightarrow (i)$

Let $x + \frac{1}{x} = y$ then $x^2 + \frac{1}{x^2} = y^2 - 2$

So equation (i) becomes,

$\Rightarrow 2(y^2 - 2) - 9(y) + 14 = 0$

$\Rightarrow 2y^2 - 4 - 9y + 14 = 0$

$\Rightarrow 2y^2 - 9y + 10 = 0$

$\Rightarrow 2y^2 - 4y - 5y + 10 = 0$

$\Rightarrow 2y(y - 2) - 5(y - 2) = 0$

$\Rightarrow (2y - 5)(y - 2) = 0$

Either

$2y - 5 = 0$

$2y = 5$

$y = \frac{5}{2}$

when $y = x + \frac{1}{x}$

then we get

$\Rightarrow x + \frac{1}{x} = \frac{5}{2}$

$\Rightarrow \frac{x^2 + 1}{x} = \frac{5}{2}$

$\Rightarrow 2(x^2 + 1) = 5x$

$x + \frac{1}{x} = y$

S.O.B.S.

$\left(x + \frac{1}{x}\right)^2 = (y)^2$

$x^2 + 2x \cdot \frac{1}{x} + \frac{1}{x^2} = y^2$

$x^2 + \frac{1}{x^2} = y^2 - 2$



$y - 2 = 0$

$y = 2$

when $y = x + \frac{1}{x}$

then we get

$x + \frac{1}{x} = 2$

$\frac{x^2 + 1}{x} = 2$

$x^2 + 1 = 2x$

$x^2 - 2x + 1 = 0$



$$\Rightarrow 2x^2 + 2 = 5x$$

$$\Rightarrow 2x^2 - 5x + 2 = 0$$

$$\Rightarrow 2x^2 - 4x - x + 2 = 0$$

$$\Rightarrow 2x(x-2) - 1(x-2) = 0$$

$$\Rightarrow (2x-1)(x-2) = 0$$

Either

$$2x-1=0$$

$$2x=1$$

$$x = \frac{1}{2}$$

OR

$$x-2=0$$

$$x=2$$

$$\Rightarrow x^2 - 2x + 1 = 0$$

$$\Rightarrow x^2 - x - x + 1 = 0$$

$$\Rightarrow x(x-1) - 1(x-1) = 0$$

$$\Rightarrow (x-1)(x-1) = 0$$

Either

$$x-1=0$$

$$x=1$$

OR

$$x-1=0$$

$$x=1$$

Thus the solution set is $\left\{\frac{1}{2}, 2, 1, 1\right\}$ Ans

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Exercise # 8.3

Solve the Exponential Equations in which the variables occurs in Exponents :

Example # 01 :

$$\text{Solve } 7^{1+x} + 7^{1-x} = 50$$

Solution :

$$= 7^{1+x} + 7^{1-x} = 50$$

$$= 7 \cdot 7^x + 7 \cdot 7^{-x} = 50 \quad (\text{splitting powers})$$

$$= 7 \cdot 7^x + \frac{7}{7^x} = 50 \rightarrow (i)$$

Let, $y = 7^x$ Put it in above equation, equation reduce as under,

$$7y + \frac{7}{y} = 50$$

Multiplying by y on both sides:

$$\Rightarrow 7y \times y + \frac{7y}{y} = 50y$$

$$\Rightarrow 7y^2 + 7 = 50y$$

$$\Rightarrow 7y^2 - 50y + 7 = 0$$

$$\Rightarrow 7y^2 - 49y - y + 7 = 0$$

$$\Rightarrow 7y(y-7) - 1(y-7) = 0$$

$$\Rightarrow (7y-1)(y-7) = 0$$

Either

$$7y-1=0$$

$$7y=1$$

$$y = \frac{1}{7}$$

we put $y = 7^x$

then

$$7^x = \frac{1}{7}$$

$$7^x = 7^{-1} \quad \boxed{x = -1}$$



(factorizing)

OR

$$y-7=0$$

$$y=7$$

we put $y = 7^x$

then, $7^x = 7^1$

$$\boxed{x = 1}$$

Thus, the solution set is

$$\{-1, 1\} \text{ Ans}$$



Exercise # 8.3

Solve the Equations Of the type $(x+a)(x+b)(x+c)(x+d) = K$, where $a+b = c+d$ and the constant $K \neq 0$.

Example # 1: $(x+1)(x+2)(x+3)(x+4) = 48$

Solution:

$$(x+1)(x+2)(x+3)(x+4) = 48$$

By Rearranging:

$$\Rightarrow (x+1)(x+4)(x+2)(x+3) = 48$$

$$\Rightarrow (x^2 + 4x + x + 4)(x^2 + 3x + 2x + 6) = 48$$

$$\Rightarrow (x^2 + 5x + 4)(x^2 + 5x + 6) = 48 \rightarrow \textcircled{1}$$

Let $x^2 + 5x = y$, substitute in eqn $\textcircled{1}$

$$\Rightarrow (y+4)(y+6) = 48$$

$$\Rightarrow y^2 + 6y + 4y + 24 = 48$$

$$\Rightarrow y^2 + 10y + 24 - 48 = 0$$

$$\Rightarrow y^2 + 10y - 24 = 0$$

$$\Rightarrow y^2 + 12y - 2y - 24 = 0$$

$$\Rightarrow y(y+12) - 2(y+12) = 0$$

$$\Rightarrow (y+12)(y-2) = 0$$

Either

$$y+12=0$$

$$y = -12$$

We put $y = x^2 + 5x$

then we get,

$$x^2 + 5x = -12$$

$$x^2 + 5x + 12 = 0$$

Now, Using Quadratic formula: -

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\text{Here, } a=1, b=5, c=12$$

OR

$$y-2=0$$

$$y=2$$

we put $y = x^2 + 5x$

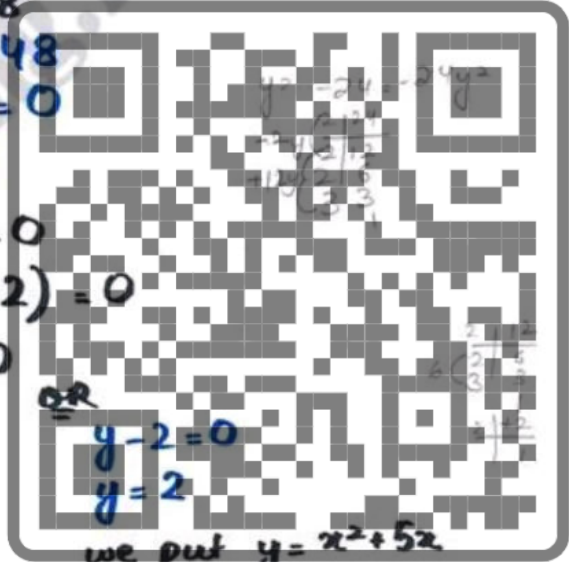
then, we get,

$$x^2 + 5x = 2$$

$$x^2 + 5x - 2 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\text{Here, } a=1, b=5, c=-2$$



$$x = \frac{-(5) \pm \sqrt{(5)^2 - 4(1)(12)}}{2(1)}$$

$$x = \frac{-5 \pm \sqrt{25 - 48}}{2}$$

$$x = \frac{-5 \pm \sqrt{-23}}{2}$$

$$x = \frac{-5 \pm \sqrt{23}i}{2}$$

$$x = \frac{-5 \pm i\sqrt{23}}{2}$$

Thus, solution set is $\left\{ \frac{-5 \pm i\sqrt{23}}{2}, \frac{-5 \pm \sqrt{33}}{2} \right\}$

$$x = \frac{-5 \pm \sqrt{(5)^2 - 4(1)(-2)}}{2(1)}$$

$$x = \frac{-5 \pm \sqrt{25 + 8}}{2}$$

$$x = \frac{-5 \pm \sqrt{33}}{2}$$

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Exercise # 8.3

Solve the following equations:

1. $x^4 - 8x^2 - 9 = 0$

Solution:

$$\Rightarrow x^4 - 8x^2 - 9 = 0$$

$$\Rightarrow (x^2)^2 - 8x^2 - 9 = 0$$

By putting $x^2 = y$ in above equation, we get.

$$\Rightarrow (y)^2 - 8y - 9 = 0$$

$$\Rightarrow y^2 - 8y - 9 = 0$$

$$\Rightarrow y^2 - 9y + y - 9 = 0$$

$$\Rightarrow y(y-9) + 1(y-9) = 0$$

$$\Rightarrow (y+1)(y-9) = 0$$

Either

$$y+1=0$$

$$y = -1$$

We put $x^2 = y$
then we get,

$$x^2 = -1$$

$$\sqrt{x^2} = \sqrt{-1}$$

$$x = \pm i$$

OR

$$y-9=0$$

$$y = 9$$

we put $x^2 = y$
then we get,

$$x^2 = 9$$

$$\sqrt{x^2} = \sqrt{9}$$

$$x = \pm 3$$

Thus, solution set is $\{ \pm i, \pm 3 \}$ Ans

$$y^2 - 8y - 9 = -9y^2$$

$$-9 \left(\begin{array}{r|l} 3 & 9 \\ 3 & 3 \\ +1 & 1 \end{array} \right)$$

$$\therefore F1 = i$$



$$2- x^4 - 3x^2 - 4 = 0$$

Solution:

$$x^4 - 3x^2 - 4 = 0$$

The equation can be written as.

$$\Rightarrow (x^2)^2 - 3x^2 - 4 = 0 \rightarrow \textcircled{1}$$

By putting $y = x^2$ in equation $\textcircled{1}$

$$\Rightarrow (y)^2 - 3y - 4 = 0$$

$$\Rightarrow y^2 - 3y - 4 = 0$$

$$\Rightarrow y^2 - 4y + y - 4 = 0$$

$$\Rightarrow y(y-4) + 1(y-4) = 0$$

$$(y-4)(y+1) = 0$$

Either

$$y-4 = 0$$

$$y = 4$$

We put $y = x^2$

then we get

$$x^2 = 4$$

$$\sqrt{x^2} = \sqrt{4}$$

$$x = \pm 2$$

Hence, Solution

OR

$$y+1 = 0$$

$$y = -1$$

We put $y = x^2$

then we get

$$x^2 = -1$$

$$\sqrt{x^2} = \sqrt{-1}$$

$$x = \pm i$$

set is $\{ \pm 2, \pm i \}$

$$y^2 - 3y - 4 = 0$$

$$(2 \mid 4)$$

$$4 = 1 \times 4$$



$$3- 12x^4 - 11x^2 + 2 = 0$$

Solution:

$$\Rightarrow 12x^4 - 11x^2 + 2 = 0$$

$$\Rightarrow 12(x^2)^2 - 11x^2 + 2 = 0$$

By putting $x^2 = y$ in above equation, we get,

$$\Rightarrow 12y^2 - 11y + 2 = 0$$

$$\Rightarrow 12y^2 - 8y - 3y + 2 = 0$$

$$\Rightarrow 4y(3y-2) - 1(3y-2) = 0$$

$$\Rightarrow (4y-1)(3y-2) = 0$$

Either

$$4y-1=0$$

$$4y=1$$

$$y = \frac{1}{4}$$

We put $x^2 = y$
then we get,

$$x^2 = \frac{1}{4}$$

$$\sqrt{x^2} = \sqrt{\frac{1}{4}}$$

$$x = \pm \frac{1}{2}$$

OR

$$3y-2=0$$

$$3y=2$$

$$y = \frac{2}{3}$$

We put $x^2 = y$
then we get,

$$x^2 = \frac{2}{3}$$

$$\sqrt{x^2} = \sqrt{\frac{2}{3}}$$

$$x = \sqrt{\frac{2}{3}}$$

$$x = \frac{\sqrt{2}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$x = \pm \frac{\sqrt{6}}{3}$$

Thus, the solution set is $\left\{ \pm \frac{1}{2}, \pm \frac{\sqrt{6}}{3} \right\}$ Ans

$$12 \times 2 = 24$$

$$\begin{array}{r} 2 \overline{) 24} \\ \underline{4} \\ 20 \\ \underline{16} \\ 40 \\ \underline{36} \\ 40 \\ \underline{36} \\ 40 \\ \underline{36} \\ 40 \end{array}$$



$$4. \frac{2x+3}{x+1} + 6 \left(\frac{x+1}{2x+3} \right) = 7$$

Solution:

$$\frac{2x+3}{x+1} + 6 \left(\frac{x+1}{2x+3} \right) = 7 \rightarrow \textcircled{1}$$

⇒ By Putting $\frac{2x+3}{x+1} = y$ and $\frac{x+1}{2x+3} = \frac{1}{y}$
in equation $\textcircled{1}$

$$\Rightarrow y + 6 \left(\frac{1}{y} \right) = 7$$

$$\Rightarrow y^2 + \frac{6y}{y} = 7y$$

$$y^2 - 7y + 6 = 0$$

$$\Rightarrow y^2 - 6y - y + 6 = 0$$

$$\Rightarrow y(y-6) - 1(y-6) = 0$$

$$\Rightarrow (y-6)(y-1) = 0$$

Either $y-6=0$

$$y=6$$

OR

$$y-1=0$$

$$y=1$$

we put $y = \frac{2x+3}{x+1}$

we get,

$$\Rightarrow \frac{2x+3}{x+1} = 1$$

$$\Rightarrow 2x+3 = x+1$$

$$\Rightarrow 2x-x = 1-3$$

$$\Rightarrow x = -2$$

we get,

$$y = \frac{2x+3}{x+1} = 6$$

$$\Rightarrow 2x+3 = 6(x+1)$$

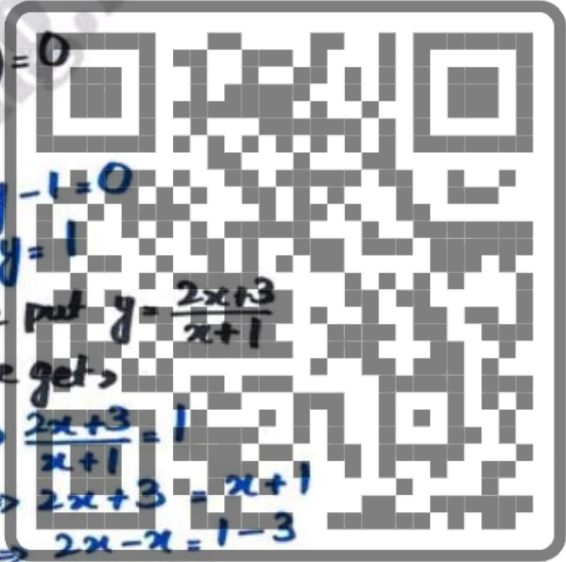
$$\Rightarrow 2x+3 = 6x+6$$

$$\Rightarrow 6x-2x = 3-6$$

$$\Rightarrow 4x = -3$$

$$\Rightarrow x = -\frac{3}{4}$$

Thus, the solution set is $\left\{ -\frac{3}{4}, -2 \right\}$



$$5 - \sqrt{\frac{2x^2+1}{x^2+1}} + 6\sqrt{\frac{x^2+1}{2x^2+1}} = 5$$

Solution:

$$\sqrt{\frac{2x^2+1}{x^2+1}} + 6\sqrt{\frac{x^2+1}{2x^2+1}} = 5 \rightarrow \textcircled{1}$$

By putting $\sqrt{\frac{2x^2+1}{x^2+1}} = y$ in equation $\textcircled{1}$

$$\sqrt{\frac{x^2+1}{2x^2+1}} = \frac{1}{y}$$

$$\Rightarrow y + 6 \times \frac{1}{y} = 5$$

$$\Rightarrow y^2 + \frac{6}{y} = 5y$$

$$\Rightarrow y^2 - 5y + 6 = 0$$

$$\Rightarrow y^2 - 2y - 3y + 6 = 0$$

$$\Rightarrow y(y-2) - 3(y-2) = 0$$

$$\Rightarrow (y-2)(y-3) = 0$$

Either

$$y-2=0$$

$$y=2$$

we put $y = \sqrt{\frac{2x^2+1}{x^2+1}}$

we get,

$$\sqrt{\frac{2x^2+1}{x^2+1}} = 2$$

Squaring both sides:

$$\Rightarrow \left(\sqrt{\frac{2x^2+1}{x^2+1}}\right)^2 = (2)^2$$

$$\Rightarrow \frac{2x^2+1}{x^2+1} = 4$$

$$\Rightarrow 2x^2+1 = 4(x^2+1)$$

$$\Rightarrow 2x^2+1 = 4x^2+4$$

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$$y^2x+6 = 6y^2 \quad \begin{array}{r} 2 \ 6 \\ 3 \ 3 \\ 1 \end{array}$$



$$y-3=0$$

$$y=3$$

we put $y = \sqrt{\frac{2x^2+1}{x^2+1}}$

we get,

$$\sqrt{\frac{2x^2+1}{x^2+1}} = 3$$

Squaring on both sides:



$$\Rightarrow \left(\sqrt{\frac{2x^2+1}{x^2+1}} \right)^x = (2)^2$$

$$\Rightarrow \frac{2x^2+1}{x^2+1} = 4$$

$$\Rightarrow 2x^2+1 = 4(x^2+1)$$

$$\Rightarrow 2x^2+1 = 4x^2+4$$

$$\Rightarrow 4x^2 - 2x^2 + 4 - 1 = 0$$

$$\Rightarrow 2x^2 + 3 = 0$$

$$\Rightarrow 2x^2 = -3$$

$$\Rightarrow x^2 = -\frac{3}{2}$$

Taking Root on both sides:

$$\Rightarrow \sqrt{x^2} = \sqrt{-\frac{3}{2}}$$

$$\Rightarrow x = \sqrt{\frac{3x-1}{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

$$\Rightarrow x = \pm i \frac{\sqrt{6}}{2}$$

Hence, solution

$$\Rightarrow \left(\sqrt{\frac{2x^2+1}{x^2+1}} \right)^x = (3)^2$$

$$\Rightarrow \frac{2x^2+1}{x^2+1} = 9$$

$$\Rightarrow 2x^2+1 = 9(x^2+1)$$

$$\Rightarrow 2x^2+1 = 9x^2+9$$

$$\Rightarrow 9x^2 - 2x^2 + 9 - 1 = 0$$

$$\Rightarrow 7x^2 + 8 = 0$$

$$\Rightarrow 7x^2 = -8$$

$$\Rightarrow x^2 = -\frac{8}{7}$$

Taking Root on both sides:

$$\sqrt{x^2} = \sqrt{-\frac{8}{7}}$$

$$x = \sqrt{\frac{8x-1}{7}} \times \frac{\sqrt{7}}{\sqrt{7}}$$

$$x = \pm i \frac{\sqrt{56}}{7}$$

set is $\left\{ \frac{\pm i \sqrt{6}}{2}, \frac{\pm i \sqrt{56}}{7} \right\}$



$$6. \quad 5^{x+1} + 5^{2-x} = 5^3 + 1$$

Solution :

$$\Rightarrow 5^{x+1} + 5^{2-x} = 5^3 + 1$$

$$\Rightarrow 5^1 \cdot 5^x + 5^2 \cdot 5^{-x} = 125 + 1 \quad (\text{splitting powers})$$

$$\Rightarrow 5 \cdot 5^x + \frac{5^2}{5^x} = 126 \rightarrow \textcircled{1}$$

Let, $5^x = y$ in equation $\textcircled{1}$

$$\Rightarrow 5y + \frac{25}{y} = 126$$

$$\Rightarrow 5y^2 + \frac{25y}{y} = 126y$$

$$\Rightarrow 5y^2 - 126y + 25 = 0$$

$$\Rightarrow 5y^2 - 125y - y + 25 = 0$$

$$\Rightarrow 5y(y-25) - 1(y-25) = 0$$

$$\Rightarrow (y-25)(5y-1) = 0$$

Either

$$y - 25 = 0$$

$$y = 25$$

We put $5^x = y$
then we get,

$$\Rightarrow 5^x = 25$$

$$\Rightarrow 5^x = 5^2$$

$$\Rightarrow \boxed{x = 2}$$

OR

$$5y - 1 = 0$$

$$5y = 1$$

$$y = \frac{1}{5}$$

we put $5^x = y$
then we get,

$$5^x = \frac{1}{5}$$

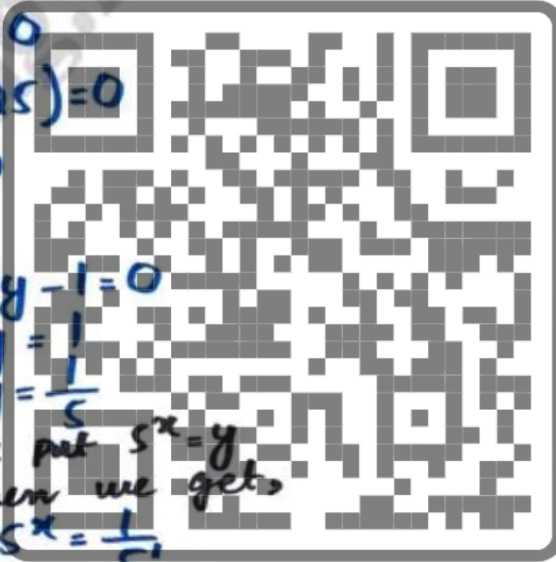
$$5^x = 5^{-1}$$

$$\boxed{x = -1}$$

Hence, solution set is $\{-1, 2\}$ Ans

$$5y^2 \times 25 = 125y^2$$

$$\begin{array}{r} 5 \overline{) 125} \\ 5 \overline{) 125} \\ \hline 5 \overline{) 5} \\ \hline 1 \end{array}$$



$$7. \quad 5^{2x} - 5^{x+3} + 125 = 5^x$$

Solution:

$$= 5^{2x} - 5^{x+3} + 125 = 5^x$$

$$= (5^x)^2 - 5^x \cdot 5^3 + 125 = (5^x) \quad \therefore 5^{x \times 2}$$

= Let $5^x = y$. Put it in above equation:

$$= y^2 - y \cdot 5^3 + 125 = y$$

$$= y^2 - 125y - y + 125 = 0$$

$$= y^2 - 126y + 125 = 0$$

$$= y^2 - 125y - y + 125 = 0$$

$$= y(y - 125) - 1(y - 125) = 0$$

$$= (y - 1)(y - 125) = 0$$

Either, or

$$y - 1 = 0$$

$$y = 1$$

We put $y = 5^x$

then we get

$$y = 1$$

$$5^x = 1$$

$$5^x = 5^0$$

$$(x = 0)$$

$$y - 125 = 0$$

$$y = 125$$

We put $y = 5^x$

then we get

$$y = 125$$

$$5^x = 125$$

$$5^x = 5^3$$

$$x = 3$$

(Hence, Solution set is $\{0, 3\}$ Ans)

$$y^2 \times 125 = 125y^2$$

$$\begin{array}{r} 5 \overline{) 125} \\ 5 \overline{) 25} \\ 5 \overline{) 5} \\ \textcircled{1} \end{array}$$

$$125 + 1 = 126$$



$$8. \quad 2\left(\frac{x}{x+1}\right)^2 - 5\left(\frac{x}{x+1}\right) + 2 = x \neq -1$$

Solution:
 $2\left(\frac{x}{x+1}\right)^2 - 5\left(\frac{x}{x+1}\right) + 2 \rightarrow \textcircled{1}$

Let $\frac{x}{x+1} = y$, we put it in equation $\textcircled{1}$

$$\begin{aligned} &= 2(y)^2 - 5(y) + 2 \\ \Rightarrow &2y^2 - 5y + 2 = 0 \\ \Rightarrow &2y^2 - 4y - y + 2 = 0 \\ \Rightarrow &2y(y-2) - 1(y-2) = 0 \\ \Rightarrow &(2y-1)(y-2) = 0 \end{aligned}$$

Either $2y-1=0$
 $2y=1$
 $y=\frac{1}{2}$

We put $\frac{x}{x+1} = y$
 we get $y = \frac{1}{2}$

then
 $\Rightarrow \frac{x}{x+1} = \frac{1}{2}$
 $\Rightarrow 2x = x+1$
 $\Rightarrow 2x - x = 1$
 $\Rightarrow x = 1$

or

$$\begin{aligned} y-2 &= 0 \\ y &= 2 \end{aligned}$$

We put $\frac{x}{x+1} = y$

we get $y = 2$

then,

$$\begin{aligned} \Rightarrow \frac{x}{x+1} &= 2 \\ \Rightarrow x &= 2(x+1) \\ \Rightarrow x &= 2x+2 \\ \Rightarrow x-2x &= 2 \\ \Rightarrow -x &= 2 \end{aligned}$$

$$\Rightarrow x = -2$$

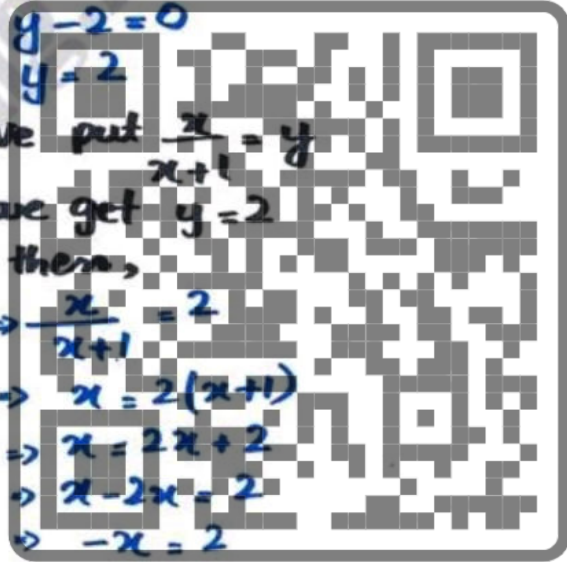
Thus, the solution set is $\{1, -2\}$ Ans

$$2y^2 \times 2 = 4y^2$$

$$\begin{array}{r} 2 \overline{)4} \\ 2 \overline{)2} \\ \textcircled{1} \end{array}$$

$$2 \times 2 = 4$$

$$4+1=5$$



$$9. \quad 2\left(\frac{x}{x-1}\right)^2 - 4\left(\frac{x}{x-1}\right) + 4 = 0$$

Solution:

$$\Rightarrow 2\left(\frac{x}{x-1}\right)^2 - 4\left(\frac{x}{x-1}\right) + 4 = 0$$

Let $\frac{x}{x-1} = y$ we put it in above equation:

$$\Rightarrow 2(y)^2 - 4(y) + 4 = 0$$

$$\Rightarrow 2y^2 - 4y + 4 = 0$$

$$\Rightarrow 2(y^2 - 2y + 2) = 0$$

Using Quadratic formula:

$$y = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Here, $a = 2$, $b = -4$, $c = 4$

$$y = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(4)}}{2(2)}$$

$$y = \frac{4 \pm \sqrt{16 - 32}}{4}$$

$$y = \frac{4 \pm \sqrt{-16}}{4}$$

$$y = \frac{4 \pm \sqrt{4^2 \times -1}}{4}$$

$$y = \frac{4 \pm 4\sqrt{-1}}{4}$$

$$y = \frac{4(1 \pm \sqrt{-1})}{4}$$

$$y = 1 \pm i$$

Either

$$y = 1 + i$$

we put $\frac{x}{x-1} = y$

then, we get

$$y = 1 + i$$

$$y = 1 - i$$

we put $\frac{x}{x-1} = y$

we get $y = 1 - i$

then,



$$\Rightarrow \frac{x}{x-1} = y$$

$$\Rightarrow \frac{x}{x-1} = 1+i$$

$$\Rightarrow x = (1+i)(x-1)$$

$$\Rightarrow x = x-1+x i-i$$

$$\Rightarrow \cancel{x}-\cancel{x}+1+i = x i$$

$$\Rightarrow x i = 1+i$$

$$\Rightarrow x = \frac{1+i}{i}$$

$$x = \frac{1+i}{i} \times \frac{i}{i}$$

$$x = \frac{i+i^2}{i^2}$$

$$x = \frac{i-1}{-1}$$

$$x = -\frac{(i-1)}{-1}$$

$$x = 1-i$$

$$x = 1-i$$

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Thus, solution, set is $\{1-i, 1+i\}$ Ans

$$\frac{x}{x-1} = y$$

$$\frac{x}{x-1} = 1-i$$

$$x = (1-i)(x-1)$$

$$x = x-1-x i+i$$

$$\cancel{x}-\cancel{x} = -1-x i+i$$

$$x i = i-1$$

$$x = \frac{i-1}{i}$$

$$x = \frac{i-1}{i} \times \frac{i}{i}$$

$$x = \frac{i^2-i}{i^2}$$

$$x = \frac{-1-i}{-1}$$

$$x = -\frac{(-1-i)}{-1}$$

$$x = 1+i$$

$$x = 1+i$$

$$x = 1+i$$

$$x = 1+i$$

$$x = 1+i$$

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$$x = 1+i$$

$$x = 1+i$$

$$x = 1+i$$

$$x = 1+i$$



$$10. 9^{x+2} - 6 \cdot 3^{x+1} + 1 = 0$$

Solution:-

$$\Rightarrow 9^{x+2} - 6 \cdot 3^{x+1} + 1 = 0$$

$$\Rightarrow 3^{2(x+2)} - 6 \cdot 3^x \cdot 3^1 + 1 = 0$$

$$\Rightarrow 3^{2x+4} - 6 \cdot 3^x \cdot 3 + 1 = 0$$

$$\Rightarrow 3^{2x} \cdot 3^4 - 18 \cdot 3^x + 1 = 0$$

$$\Rightarrow (3^x)^2 \cdot 81 - 18 \cdot 3^x + 1 = 0$$

Let $3^x = y$, Now, substitute:

$$\Rightarrow y^2 \cdot 81 - 18 \cdot y + 1 = 0$$

$$\Rightarrow 81y^2 - 18y + 1 = 0$$

$$\Rightarrow 81y^2 - 9y - 9y + 1 = 0$$

$$\Rightarrow 9y(9y-1) - 1(9y-1) = 0$$

$$\Rightarrow (9y-1)(9y-1) = 0$$

Either

$$9y-1=0$$

$$9y=1$$

$$y=\frac{1}{9}$$

We put $y = 3^x$

then we get

$$y = \frac{1}{9}$$

$$3^x = \frac{1}{9}$$

$$3^x = \frac{1}{3^2}$$

$$3^x = 3^{-2}$$

$$\boxed{x = -2}$$

$$3 \times 3 \times 3 \times 3 = 81$$

$$81y^2 \times 1 = 81$$

$$\begin{array}{r|l} 3 & 81 \\ \hline 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ & 1 \end{array}$$

$$9y-1=0$$

$$9y=1$$

$$y=\frac{1}{9}$$

we put $y = 3^x$

we get $y = \frac{1}{9}$

then

$$3^x = \frac{1}{9}$$

$$3^x = \frac{1}{3^2}$$

$$3^x = 3^{-2}$$

$$\boxed{x = -2}$$

Thus, the solution set is $\{-2\}$ Ans



$$11. 2x^2 + 2^{-x+6} - 20 = 0$$

Solution:

$$\Rightarrow 2x^2 + 2^{-x+6} - 20 = 0$$

$$\Rightarrow 2x^2 + 2^{-x} \cdot 2^6 - 20 = 0$$

$$\Rightarrow 2x^2 + \frac{2^6}{2^x} - 20 = 0$$

Not possible, No solution:

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$$12. (x-1)(x+5)(x+8)(x+2) = 880$$

Solution:

$$\Rightarrow (x-1)(x+5)(x+8)(x+2) = 880$$

$$\Rightarrow (x-1)(x+8)(x+5)(x+2) = 880$$

$$\Rightarrow (x^2+8x-x-8)(x^2+2x+5x+10) = 880$$

$$\Rightarrow (x^2+7x-8)(x^2+7x+10) = 880 \rightarrow \textcircled{i}$$

$$\Rightarrow \text{Let } x^2+7x = y \rightarrow \textcircled{ii}$$

By substituting in equation $\textcircled{i}$

$$\Rightarrow (y-8)(y+10) - 880 = 0$$

$$\Rightarrow y^2+10y-8y-80-880=0$$

$$\Rightarrow y^2+2y-960=0$$

$$\Rightarrow y^2+32y-30y-960=0$$

$$\Rightarrow y(y+32)-30(y+32)=0$$

$$\Rightarrow (y+32)(y-30)=0$$

$$\text{Either } y+32=0$$

$$y=-32$$

Substituting in equation $\textcircled{ii}$

$$x^2+7x=y$$

$$x^2+7x=-32$$

$$x^2+7x+32$$

Here, we use quadratic formula:-

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$\text{Here, } a=1, b=7, c=32$$

$$x = \frac{-(7) \pm \sqrt{(7)^2-4(1)(32)}}{2(1)}$$

$$x = \frac{-7 \pm \sqrt{49-128}}{2}$$

$$x = \frac{-7 \pm \sqrt{-79}}{2}$$

$$\begin{array}{r} 2 \overline{) 960} \\ 2 \overline{) 480} \\ 2 \overline{) 240} \\ 2 \overline{) 120} \\ 2 \overline{) 60} \\ 2 \overline{) 30} \\ 2 \overline{) 15} \\ 5 \end{array}$$

$$y-30=0$$

$$y=30$$

Now, substitute in equation $\textcircled{ii}$

$$x^2+7x=y$$

$$x^2+7x=30$$

$$x^2+7x-30=0$$

$$x^2+10x-3x-30=0$$

$$x(x+10)-3(x+10)=0$$

$$(x+10)(x-3)=0$$

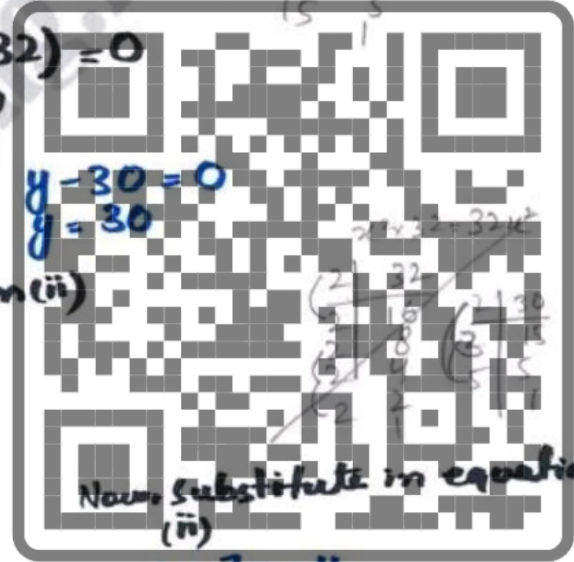
$$\text{either } x+10=0$$

$$x=-10$$

OR

$$x-3=0$$

$$x=3$$



$$x = \frac{-7 \pm \sqrt{79}i}{2}$$

$$x = \frac{-7 \pm \sqrt{79}i}{2}$$

Thus, Solution set is $\{-10, 3, \frac{-7 \pm \sqrt{79}i}{2}\}$

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13- $(x-1)(x+2)(x+3)(x+4) = 120$

Solution:

Solution Not possible:

$$\Rightarrow (x+1)(x+2)(x+3)(x+4) = 120$$

$$\Rightarrow (x+1)(x+4)(x+2)(x+3) = 120$$

$$\Rightarrow (x^2 + 4x + x + 4)(x^2 + 3x + 2x + 6) = 120$$

$$\Rightarrow (x^2 + 5x + 4)(x^2 + 5x + 6) = 120$$

$$\text{Let } x^2 + 5x = y$$

$$\Rightarrow (y+4)(y+6) = 120$$

$$\Rightarrow y^2 + 6y + 4y + 24 - 120 = 0$$

$$\Rightarrow y^2 + 10y - 96 = 0$$

$$\Rightarrow y^2 + 16y - 6y - 96 = 0$$

$$\Rightarrow y(y+16) - 6(y+16) = 0$$

$$\Rightarrow (y+16)(y-6) = 0$$

Either

$$y+16 = 0$$

$$y = -16$$

Now, put $x^2 + 5x = y$

then, we get,

$$x^2 + 5x = -16$$

$$x^2 + 5x + 16 = 0$$

Hence, we use quadratic formula. $a=1, b=5, c=16$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(5) \pm \sqrt{(5)^2 - 4(1)(16)}}{2(1)}$$

$$x = \frac{-5 \pm \sqrt{25 - 64}}{2}$$

$$x = \frac{-5 \pm \sqrt{39}}{2}$$

$$a+b = c+d$$

$$y^2 + 10y - 96 = 0$$

$$\begin{array}{r|l} 2 & 96 \\ \hline 2 & 48 \\ 2 & 24 \\ 2 & 12 \\ 2 & 6 \\ 2 & 3 \end{array}$$

$$y-6 = 0$$

$$y = 6$$

Now, put $x^2 + 5x = y$

then, we get,

$$x^2 + 5x = 6$$

$$x^2 + 5x - 6 = 0$$

$$x^2 + 6x + x - 6 = 0$$

$$x(x+6) + 1(x-6) = 0$$

$$x(x+6) - 1(x-6) = 0$$

$$(x-1)(x+6) = 0$$

$$x-1=0 \quad x+6=0$$

$$\boxed{x=1} \quad x=-6$$

Thus, the solution set is

$$\left\{ \frac{-5 \pm \sqrt{39}}{2}, -6, 1 \right\} \text{ Ans}$$



$$14. \quad 7^{1+x} + 7^{1-x} = 50$$

Solution:

$$\Rightarrow 7^{1+x} + 7^{1-x} = 50$$

$$\Rightarrow 7^1 \cdot 7^x + 7^1 \cdot 7^{-x} = 50$$

$$\Rightarrow 7 \cdot 7^x + \frac{7}{7^x} = 50 \rightarrow (i)$$

Let $7^x = y$ Now, substitute the value in equation (i)

$$\Rightarrow 7 \cdot y + \frac{7}{y} = 50$$

$$\Rightarrow 7y \times y + \frac{7y}{y} = 50y$$

$$\Rightarrow 7y^2 - 50y + 7 = 0$$

$$\Rightarrow 7y^2 - 49y - y + 7 = 0$$

$$\Rightarrow 7y(y-7) - 1(y-7) = 0$$

$$(7y-1)(y-7) = 0$$

$$\text{Either } 7y-1 = 0$$

$$7y = 1$$

$$y = \frac{1}{7}$$

Now, we put

$$7^x = y$$

then, we get.

$$7^x = \frac{1}{7}$$

$$7^x = 7^{-1}$$

$$x = -1$$

Thus, the solution set is $\{-1, 1\}$ Ans

$$7y^2 - 50y + 7 = 0$$

$$7y^2 - 49y - y + 7 = 0$$

$$7y(y-7) - 1(y-7) = 0$$

$$(7y-1)(y-7) = 0$$

$$7y-1 = 0$$

$$7y = 1$$

$$y = \frac{1}{7}$$

$$7^x = \frac{1}{7}$$

$$7^x = 7^{-1}$$

$$x = -1$$

$$\text{or } y-7=0$$

$$y = 7$$

we put $7^x = y$
then we get,

$$7^x = 7^1$$

$$x = 1$$



15. $(x-2)(x+1)(x+3)(x-4) = 24$

Solution:

$$\Rightarrow (x-2)(x+1)(x+3)(x-4) = 24$$

$$\Rightarrow (x^2+x-2x-2)(x^2+4x+3x-12) = 24$$

$$\Rightarrow (x^2-x-2)(x^2-x-12) = 24 \rightarrow \textcircled{1}$$

Let $x^2-x = y$. Now, substitute the value in equation $\textcircled{1}$

$$\Rightarrow (y-2)(y-12) = 24$$

$$\Rightarrow y^2-12y-2y+24-24 = 0$$

$$\Rightarrow y^2-14y = 0$$

$$\Rightarrow y(y-14) = 0$$

either

$$y = 0$$

We put $x^2-x = y$
then we get

$$x^2-x = 0$$

$$x(x-1) = 0$$

either

$$x = 0$$

$$x-1=0$$

$$x = 1$$

or

$$y-14=0$$

$$y = 14$$

We put $x^2-x = y$
we get $x^2-x = 14$

$$x^2-x-14=0$$

Hence, we use quadratic formula

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$a=1, b=-1, c=-14$$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2-4(1)(-14)}}{2(1)}$$

$$x = \frac{1 \pm \sqrt{1+56}}{2}$$

$$x = \frac{1 \pm \sqrt{57}}{2}$$

Thus, the solution set

$$\text{is } \left\{ 0, 1, \frac{1 \pm \sqrt{57}}{2} \right\} \text{ Ans}$$



* Radical Equations:

Type (i) : $\sqrt{ax+b} = cx+d$ Example # Solve $\sqrt{217-x} = x-7$

Solution:

$$\Rightarrow \sqrt{217-x} = x-7$$

$$\Rightarrow \text{Squaring on both sides:}$$

$$\Rightarrow (\sqrt{217-x})^2 = (x-7)^2 \quad \therefore (a-b)^2 = a^2 - 2ab + b^2$$

$$\Rightarrow 217-x = x^2 - 2(x)(7) + (7)^2$$

$$\Rightarrow 217-x = x^2 - 14x + 49$$

$$\Rightarrow x^2 - 14x + x + 49 - 217 = 0$$

$$\Rightarrow x^2 - 13x - 168 = 0$$

$$\Rightarrow x^2 - 21x + 8x - 168 = 0$$

$$\Rightarrow x(x-21) + 8(x-21) = 0$$

$$\Rightarrow (x-21)(x+8) = 0$$

$$\text{Either } x-21=0$$

$$x=21$$

Verification:

$$\Rightarrow \sqrt{217-x} = x-7$$

$$\Rightarrow \sqrt{217-21} = 21-7$$

$$\Rightarrow \sqrt{196} = 14$$

$$\Rightarrow \sqrt{14^2} = 14$$

$$\Rightarrow 14 = 14$$

Verified

$$\text{or } x+8=0$$

$$x=-8$$

Verification:-

$$\sqrt{217-x} = x-7$$

$$\Rightarrow \sqrt{217-(-8)} = -8-7$$

$$\Rightarrow \sqrt{217+8} = -15$$

$$\Rightarrow \sqrt{225} = -15$$

$$\Rightarrow \sqrt{15^2} = -15$$

$$\Rightarrow 15 \neq -15$$

not verified.

Thus, the solution set is $\{21\}$ Ans

$$x^2 - 13x - 168 = -168x^2$$

$$\begin{array}{r} 2 \overline{) 168} \\ 2 \overline{) 84} \\ 2 \overline{) 42} \\ 2 \overline{) 21} \\ 2 \overline{) 7} \end{array}$$



Type (iii) $\sqrt{x^2+px+m} + \sqrt{x^2+px+n} = q$

Example # 01:

Solve: $\sqrt{x^2-3x+21} - \sqrt{x^2-3x+5} = 2$

Solution:

$$\Rightarrow \sqrt{x^2-3x+21} - \sqrt{x^2-3x+5} = 2$$

Let $y = x^2 - 3x$ in the given equation, we have.

$$\Rightarrow \sqrt{y+21} - \sqrt{y+5} = 2$$

$$\Rightarrow \sqrt{y+21} = 2 + \sqrt{y+5}$$

Squaring on both sides:

$$\Rightarrow (\sqrt{y+21})^2 = (2 + \sqrt{y+5})^2 \quad : (a-b)^2 = a^2 - 2ab + b^2$$

$$\Rightarrow y+21 = (2)^2 + 2(2)(\sqrt{y+5}) + (\sqrt{y+5})^2$$

$$\Rightarrow y+21 = 4 + 4\sqrt{y+5} + y+5$$

$$\Rightarrow y+21 = 9 + y + 4\sqrt{y+5}$$

$$\Rightarrow -4\sqrt{y+5} = 9 - 21 + y - y$$

$$\Rightarrow -4\sqrt{y+5} = -12$$

$$\Rightarrow 4\sqrt{y+5} = 12$$

$$\Rightarrow \sqrt{y+5} = \frac{12}{4} = 3$$

$$\Rightarrow \sqrt{y+5} = 3$$

Squaring on both sides:

$$\Rightarrow (\sqrt{y+5})^2 = (3)^2$$

$$\Rightarrow y+5 = 9$$

$$\Rightarrow y = 9 - 5$$

$$\Rightarrow \boxed{y = 4}$$

Put $y = 4$ in $y = x^2 - 3x$ and we have.

$$\Rightarrow x^2 - 3x = 4$$

$$\Rightarrow x^2 - 3x - 4 = 0$$

$$\Rightarrow x^2 - 4x + x - 4 = 0$$

$$\Rightarrow x(x-4) + 1(x-4) = 0$$



$$\Rightarrow (x-4)(x+1) = 0$$

either $x-4=0$
 $x=4$

Verification:

$$\sqrt{x^2-3x+21} - \sqrt{x^2-3x+5} = 2$$

Put $x=4$

$$\Rightarrow \sqrt{(4)^2-3(4)+21} - \sqrt{(4)^2-3(4)+5} = 2$$

$$\Rightarrow \sqrt{16-12+21} - \sqrt{16-12+5} = 2$$

$$\Rightarrow \sqrt{25} - \sqrt{9} = 2$$

$$\Rightarrow 5 - 3 = 2$$

$$\Rightarrow 2 = 2$$

Verified.

Hence, both the roots satisfied the given equation
 thus, the solution set is $\{4, -1\}$ Ans

OR $x+1=0$
 $x=-1$

Verification:

$$\sqrt{x^2-3x+21} - \sqrt{x^2-3x+5} = 2$$

Put $x=-1$

$$\Rightarrow \sqrt{(-1)^2-3(-1)+21} - \sqrt{(-1)^2-3(-1)+5} = 2$$

$$\Rightarrow \sqrt{1+3+21} - \sqrt{1+3+5} = 2$$

$$\Rightarrow \sqrt{25} - \sqrt{9} = 2$$

$$\Rightarrow 5 - 3 = 2$$

$$\Rightarrow 2 = 2$$

Verified.



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Exercise # 8.4

Solve the following equations:

1. $x + \sqrt{x+5} = 7$

Solution:

$$\Rightarrow x + \sqrt{x+5} = 7$$

$$\Rightarrow \sqrt{x+5} = 7 - x$$

Squaring on both sides:

$$\Rightarrow (\sqrt{x+5})^2 = (7-x)^2 \quad \therefore (a-b)^2 = a^2 - 2ab + b^2$$

$$\Rightarrow x+5 = (7)^2 - 2(7)(x) + (x)^2$$

$$\Rightarrow x+5 = 49 - 14x + x^2$$

$$\Rightarrow x^2 - 14x + 49 - x - 5 = 0$$

$$\Rightarrow x^2 - 15x + 44 = 0$$

$$\Rightarrow x^2 - 11x - 4x + 44 = 0$$

$$\Rightarrow x(x-11) - 4(x-11) = 0$$

$$\Rightarrow (x-11)(x-4) = 0$$

Either

$$x-11=0$$

$$x=11$$

Verification:

$$x + \sqrt{x+5} = 7$$

$$\Rightarrow (11) + \sqrt{11+5} = 7$$

$$\Rightarrow 11 + \sqrt{16} = 7$$

$$\Rightarrow 11 + 4 = 7$$

$$\Rightarrow 15 \neq 7$$

Not verified

Thus, the solution set is $\{4\}$ Ans

$$x^2 \times 44 = 44x^2$$

$$4 \begin{array}{r} 2 \overline{) 44} \\ 4 \\ \hline 0 \\ 2 \\ \hline 0 \\ 1 \\ \hline 1 \\ \hline 0 \end{array}$$

$$x-4=0$$

$$x=4$$

Verification:

$$x + \sqrt{x+5} = 7$$

$$\Rightarrow 4 + \sqrt{4+5} = 7$$

$$\Rightarrow 4 + \sqrt{9} = 7$$

$$\Rightarrow 4 + 3 = 7$$

$$\Rightarrow 7 = 7$$

Verified.



$$2. \sqrt{x-2} = 8-x$$

Solution:

$$\Rightarrow \sqrt{x-2} = 8-x$$

Squaring on both sides:

$$\Rightarrow (\sqrt{x-2})^2 = (8-x)^2 \quad \therefore (a-b)^2 = a^2 - 2ab + b^2$$

$$\Rightarrow x-2 = (8)^2 - 2(8)(x) + (x)^2$$

$$\Rightarrow x-2 = 64 - 16x + x^2$$

$$\Rightarrow 0 = x^2 - 16x + 64 - x + 2$$

$$\Rightarrow x^2 - 17x + 66 = 0$$

$$\Rightarrow x^2 - 11x - 6x + 66 = 0$$

$$\Rightarrow x(x-11) - 6(x-11) = 0$$

$$\Rightarrow (x-11)(x-6) = 0$$

Either $x-11=0$

 $x = 11$

Verification:

$$\rightarrow \sqrt{x-2} = 8-x$$

$$\Rightarrow \sqrt{11-2} = 8-11$$

$$\Rightarrow \sqrt{9} = -3$$

$$\Rightarrow 3 \neq -3$$

Not Verified.

Thus, the solution

$$x - 6 = 0$$

x. 6

Verification:

$$\sqrt{x-2} = 8-x$$

$$\sqrt{6-2} = 8-6$$

$$\Rightarrow \sqrt{4} = 2$$

$$= 2 = 2$$

Verified

set is $\{6\}$ Ans



$$3. \sqrt{7-5x} + \sqrt{13-5x} = 3\sqrt{4-2x}$$

Solution:

$$\Rightarrow \sqrt{7-5x} + \sqrt{13-5x} = 3\sqrt{4-2x}$$

Squaring on both sides:

$$(\sqrt{7-5x} + \sqrt{13-5x})^2 = (3\sqrt{4-2x})^2$$

$$\therefore (a+b)^2 = a^2 + 2ab + b^2$$

$$\Rightarrow (\sqrt{7-5x})^2 + 2(\sqrt{7-5x})(\sqrt{13-5x}) + (\sqrt{13-5x})^2 = 9(4-2x)$$

$$\Rightarrow 7-5x + 2\sqrt{(7-5x)(13-5x)} + 13-5x = 36-18x$$

$$\Rightarrow 2\sqrt{(7-5x)(13-5x)} - 10x + 20 = 36-18x$$

$$\Rightarrow 2\sqrt{(7-5x)(13-5x)} = 36-18x+10x-20$$

$$\Rightarrow 2\sqrt{(7-5x)(13-5x)} = -8x+16$$

$$\Rightarrow \sqrt{91-35x-65x+25x^2} = \frac{-4x+8}{2}$$

$$\Rightarrow \sqrt{25x^2-100x+91} = -4x+8$$

Again Squaring on both sides:

$$\Rightarrow (\sqrt{25x^2-100x+91})^2 = (-4x+8)^2$$

$$\Rightarrow (\sqrt{25x^2-100x+91})^2 = (8-4x)^2 \quad (a-b)^2 = a^2 - 2ab + b^2$$

$$\Rightarrow 25x^2 - 100x + 91 = (8)^2 - 2(8)(4x) + (4x)^2$$

$$\Rightarrow 25x^2 - 100x + 91 = 64 - 64x + 16x^2$$

$$\Rightarrow 25x^2 - 16x^2 - 100x + 64x + 91 - 64 = 0$$

$$\Rightarrow 9x^2 - 36x + 27 = 0$$

$$\Rightarrow 9x^2 - 27x - 9x + 27 = 0$$

$$\Rightarrow 9x(x-3) - 9(x-3) = 0$$

$$\Rightarrow (9x-9)(x-3) = 0 \quad \text{or}$$

Either $9x-9=0$

$$x = \frac{9}{9} \quad \boxed{x=1}$$

$$x-3=0$$

$$\boxed{x=3}$$

$$\begin{array}{r|l} 3 & 243 \\ \hline 81 & \\ 27 & \\ 9 & \\ 3 & \\ 1 & \end{array}$$

$$\begin{array}{r|l} 2 & 96 \\ \hline 4 & \\ 2 & \\ 2 & \\ 1 & \end{array}$$

$$\sqrt{2 \times 2 \times 2} = 2\sqrt{2}$$



Verification

$$\sqrt{7-5x} + \sqrt{13-5x} = 3\sqrt{4-2x}$$

Put $x = 1$

$$\Rightarrow \sqrt{7-5(1)} + \sqrt{13-5(1)} = 3\sqrt{4-2(1)}$$

$$\Rightarrow \sqrt{7-5} + \sqrt{13-5} = 3\sqrt{4-2}$$

$$\Rightarrow \sqrt{2} + \sqrt{8} = 3\sqrt{2}$$

$$\Rightarrow \sqrt{2} + 2\sqrt{2} = 3\sqrt{2}$$

$$\Rightarrow \sqrt{2}(1+2) = 3\sqrt{2}$$

$$\Rightarrow 3\sqrt{2} = 3\sqrt{2}$$

Verified.

Thus, Solution set is $\{1, 3\}$

Verification

$$\sqrt{7-5x} + \sqrt{13-5x} = 3\sqrt{4-2x}$$

Put $x = 3$

$$\Rightarrow \sqrt{7-5(3)} + \sqrt{13-5(3)} = 3\sqrt{4-2(3)}$$

$$\Rightarrow \sqrt{7-15} + \sqrt{13-15} = 3\sqrt{4-6}$$

$$\Rightarrow \sqrt{-8} + \sqrt{-2} = 3\sqrt{-2}$$

$$\Rightarrow 2\sqrt{-2} + \sqrt{-2} = 3\sqrt{-2}$$

$$\Rightarrow \sqrt{-2}(2+1) = 3\sqrt{-2}$$

$$\Rightarrow \sqrt{-2}(3) = 3\sqrt{-2}$$

$$3\sqrt{-2} = 3\sqrt{-2}$$

Verified.

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$$4 \quad \sqrt{x+2} + \sqrt{x+7} = \sqrt{6x+13}$$

Solution:

$$\Rightarrow \sqrt{x+2} + \sqrt{x+7} = \sqrt{6x+13}$$

Squaring on both sides:

$$\Rightarrow (\sqrt{x+2} + \sqrt{x+7})^2 = (\sqrt{6x+13})^2 \quad \because (a+b)^2 = a^2 + 2ab + b^2$$

$$\Rightarrow (\sqrt{x+2})^2 + 2(\sqrt{x+2})(\sqrt{x+7}) + (\sqrt{x+7})^2 = 6x+13$$

$$\Rightarrow x+2 + 2\sqrt{(x+2)(x+7)} + x+7 = 6x+13$$

$$\Rightarrow 2x+9 + 2\sqrt{x^2+7x+2x+14} = 6x+13$$

$$\Rightarrow 2\sqrt{x^2+9x+14} = 6x+13-2x-9$$

$$\Rightarrow 2\sqrt{x^2+9x+14} = 4x+4$$

$$\Rightarrow \sqrt{x^2+9x+14} = \underline{2(2x+2)}$$

Again taking square on both sides:

$$\Rightarrow (\sqrt{x^2+9x+14})^2 = (2x+2)^2 \quad \because (a+b)^2 = a^2 + 2ab + b^2$$

$$\Rightarrow x^2+9x+14 = (2x)^2 + 2(2x)(2) + (2)^2$$

$$\Rightarrow x^2+9x+14 = 4x^2+8x+4$$

$$\Rightarrow 4x^2+8x+4 - x^2 - 9x - 14 = 0$$

$$\Rightarrow 3x^2 - x - 10 = 0$$

$$\Rightarrow 3x^2 - 6x + 5x - 10 = 0$$

$$\Rightarrow 3x(x-2) + 5(x-2) = 0$$

$$\Rightarrow (3x+5)(x-2) = 0$$

Either

$$3x+5=0$$

$$3x=-5$$

$$x = -\frac{5}{3}$$

or

$$x-2=0$$

$$x=2$$



Verification:

$$\sqrt{x+2} + \sqrt{x+7} = \sqrt{6x+13}$$

$$\text{Put } x = -\frac{5}{3}$$

$$\Rightarrow \sqrt{-\frac{5}{3}+2} + \sqrt{-\frac{5}{3}+7} = \sqrt{6\left(-\frac{5}{3}\right)+13}$$

$$\Rightarrow \sqrt{-\frac{5+6}{3}} + \sqrt{-\frac{5+21}{3}} = \sqrt{-10+13}$$

$$\Rightarrow \sqrt{\frac{1}{3}} + \sqrt{\frac{16}{3}} = \sqrt{3}$$

$$\Rightarrow \frac{1}{\sqrt{3}} + \frac{4}{\sqrt{3}} = \sqrt{3}$$

$$\Rightarrow \frac{1+4}{\sqrt{3}} = \sqrt{3}$$

$$\Rightarrow \frac{5}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \sqrt{3}$$

$$\Rightarrow \frac{5\sqrt{3}}{3} = \sqrt{3}$$

Not Verified.

Thus, Solution set is $\{2\}$ Ans

Verification:

$$\sqrt{x+2} + \sqrt{x+7} = \sqrt{6x+13}$$

$$\text{Put } x = 2$$

$$\sqrt{2+2} + \sqrt{2+7} = \sqrt{6(2)+13}$$

$$\sqrt{4} + \sqrt{9} = \sqrt{12+13}$$

$$2 + 3 = \sqrt{25}$$

$$5 = 5$$

Verified.



$$5. \sqrt{x^2-3x+36} - \sqrt{x^2-3x+9} = 3$$

Solution:

$$\sqrt{x^2-3x+36} - \sqrt{x^2-3x+9} = 3$$

Let $y = x^2 - 3x$, put it in above equation:

$$\Rightarrow \sqrt{y+36} - \sqrt{y+9} = 3$$

$$\Rightarrow \sqrt{y+36} = 3 + \sqrt{y+9}$$

Now, squaring on both sides:

$$\Rightarrow (\sqrt{y+36})^2 = (3 + \sqrt{y+9})^2 \quad \therefore (a+b)^2 = a^2 + 2ab + b^2$$

$$\Rightarrow y+36 = (3)^2 + 2(3)(\sqrt{y+9}) + (\sqrt{y+9})^2$$

$$\Rightarrow y+36 = 9 + 6\sqrt{y+9} + y+9$$

$$\Rightarrow y+36 = y+18 + 6\sqrt{y+9}$$

$$\Rightarrow y+36-18 = 6\sqrt{y+9}$$

$$\Rightarrow \frac{18}{6} = \sqrt{y+9}$$

$$\Rightarrow \sqrt{y+9} = 3$$

Now, again squaring on both sides:

$$\Rightarrow (\sqrt{y+9})^2 = (3)^2$$

$$\Rightarrow y+9 = 9$$

$$\Rightarrow y = 9-9$$

$$\Rightarrow y = 0$$

Put $y = 0$ in the substitution $y = x^2 - 3x$, we have

$$\Rightarrow x^2 - 3x = 0$$

$$\Rightarrow x(x-3) = 0$$

Either $x = 0$

OR $x-3 = 0$
 $x = 3$



Verification :

$$\sqrt{x^2 - 3x + 36} - \sqrt{x^2 - 3x + 9} = 3$$

Put $x = 0$

$$\Rightarrow \sqrt{0^2 - 3(0) + 36} - \sqrt{0^2 - 3(0) + 9} = 3$$

$$\Rightarrow \sqrt{0 - 0 + 36} - \sqrt{0 - 0 + 9} = 3$$

$$\Rightarrow \sqrt{36} - \sqrt{9} = 3$$

$$\Rightarrow 6 - 3 = 3$$

$$\Rightarrow 3 = 3$$

Verified.

Verification :

$$\sqrt{x^2 - 3x + 36} - \sqrt{x^2 - 3x + 9} = 3$$

Put $x = 3$

$$\Rightarrow \sqrt{3^2 - 3(3) + 36} - \sqrt{3^2 - 3(3) + 9} = 3$$

$$\Rightarrow \sqrt{9 - 9 + 36} - \sqrt{9 - 9 + 9} = 3$$

$$\Rightarrow \sqrt{36} - \sqrt{9} = 3$$

$$\Rightarrow 6 - 3 = 3$$

$$\Rightarrow 3 = 3$$

Verified.

Thus, the solution set is $\{0, 3\}$ Ans

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$$6. \sqrt{x^2+3x+32} + \sqrt{x^2+3x+5} = 9$$

Solution:

$$\Rightarrow \sqrt{x^2+3x+32} + \sqrt{x^2+3x+5} = 9$$

Let $y = x^2+3x$

$$\Rightarrow \sqrt{y+32} + \sqrt{y+5} = 9$$

$$\Rightarrow \sqrt{y+32} = 9 - \sqrt{y+5}$$

squaring on both sides:

$$\Rightarrow (\sqrt{y+32})^2 = (9 - \sqrt{y+5})^2 \quad \therefore (a-b)^2 = a^2 - 2ab + b^2$$

$$\Rightarrow y+32 = (9)^2 - 2(9)(\sqrt{y+5}) + (\sqrt{y+5})^2$$

$$\Rightarrow y+32 = 81 - 18\sqrt{y+5} + y+5$$

$$\Rightarrow y+32 = 86 + y - 18\sqrt{y+5}$$

$$\Rightarrow \cancel{y} - \cancel{y} + 32 - 86 = -18\sqrt{y+5}$$

$$\Rightarrow -54 = -18\sqrt{y+5}$$

$$\Rightarrow \frac{-54}{-18} = \sqrt{y+5}$$

$$\Rightarrow \sqrt{y+5} = 3$$

Again squaring both sides:

$$\Rightarrow (\sqrt{y+5})^2 = (3)^2$$

$$\Rightarrow y+5 = 9$$

$$\Rightarrow y = 9-5$$

$$\Rightarrow y = 4$$

Put $y=4$ in the substitution $y=x^2+3x$, we have

$$\Rightarrow x^2+3x = 4$$

$$\Rightarrow x^2+3x-4 = 0$$



$$\Rightarrow x^2 + 4x - x - 4 = 0$$

$$\Rightarrow x(x+4) - 1(x+4) = 0$$

$$\Rightarrow (x+4)(x-1) = 0$$

Either

$$x+4=0$$

$$x = -4$$

OR

$$x-1=0$$

$$x = 1$$

Verification

$$\sqrt{x^2+3x+32} + \sqrt{x^2+3x+5} = 9$$

Put $x = -4$

$$\sqrt{(-4)^2+3(-4)+32} + \sqrt{(-4)^2+3(-4)+5} = 9$$

$$\Rightarrow \sqrt{16-12+32} + \sqrt{16-12+5} = 9$$

$$\Rightarrow \sqrt{36} + \sqrt{9} = 9$$

$$\Rightarrow 6 + 3 = 9$$

$$\Rightarrow 9 = 9$$

Verified

Thus, Solution set is $\{-4\}$

$$x^2 - 4 = -4x^2$$

$$\begin{array}{r} 2 \overline{) 4} \\ 4 \\ \hline 0 \end{array}$$

Verification:

$$\Rightarrow \sqrt{x^2+3x+32} + \sqrt{x^2+3x+5} = 9$$

Put $x = 1$

$$\Rightarrow \sqrt{1^2+3(1)+32} + \sqrt{1^2+3(1)+5} = 9$$

$$\Rightarrow \sqrt{1+3+32} + \sqrt{1+3+5} = 9$$

$$\Rightarrow \sqrt{36} + \sqrt{9} = 9$$

$$\Rightarrow 6 + 3 = 9$$

$$\Rightarrow 9 = 9$$

Verified

Thus, Solution set is $\{1, -4\}$



Type (iii) $\sqrt{x+a} + \sqrt{x+b} = \sqrt{x+c}$

Example # Solve: $\sqrt{x+7} + \sqrt{x+2} = \sqrt{6x+13}$

Solution:

$$\Rightarrow \sqrt{x+7} + \sqrt{x+2} = \sqrt{6x+13}$$

Squaring on both sides:

$$\Rightarrow (\sqrt{x+7} + \sqrt{x+2})^2 = (\sqrt{6x+13})^2 \quad \therefore (a+b)^2 = a^2 + 2ab + b^2$$

$$\Rightarrow (\sqrt{x+7})^2 + 2(\sqrt{x+7})(\sqrt{x+2}) + (\sqrt{x+2})^2 = 6x+13$$

$$\Rightarrow x+7 + 2\sqrt{(x+7)(x+2)} + x+2 = 6x+13$$

$$\Rightarrow 2x+9 + 2\sqrt{x^2+2x+7x+14} = 6x+13$$

$$\Rightarrow 2\sqrt{x^2+9x+14} = 6x-2x+13-9$$

$$\Rightarrow 2\sqrt{x^2+9x+14} = 4x+4$$

$$\Rightarrow \sqrt{x^2+9x+14} = \frac{2(2x+2)}{2}$$

$$\Rightarrow \sqrt{x^2+9x+14} = 2x+2$$

Again squaring on both sides:

$$\Rightarrow (\sqrt{x^2+9x+14})^2 = (2x+2)^2 \quad (a^2+b)^2 = (a^2+2ab+b^2)$$

$$\Rightarrow x^2+9x+14 = (2x)^2 + 2(2x)(2) + (2)^2$$

$$\Rightarrow x^2+9x+14 = 4x^2+8x+4$$

$$\Rightarrow 4x^2-x^2+8x-9x+4-14=0$$

$$\Rightarrow 3x^2-x-10=0$$

$$\Rightarrow 3x^2-6x+5x-10=0$$

$$\Rightarrow 3x(x-2)+5(x-2)=0$$

$$\Rightarrow (3x+5)(x-2)=0$$

Either $3x+5=0$

$$3x=-5$$

$$x=-\frac{5}{3}$$

Verification:

$$\Rightarrow \sqrt{x+7} + \sqrt{x+2} = \sqrt{6x+13}$$

Put $x = -\frac{5}{3}$

$$\Rightarrow \sqrt{-\frac{5}{3}+7} + \sqrt{-\frac{5}{3}+2} = \sqrt{-\frac{5}{3} \times 6 + 13}$$

$$\Rightarrow \sqrt{\frac{-5+21}{3}} + \sqrt{\frac{-5+6}{3}} = \sqrt{\frac{30+39}{3}}$$

$$\Rightarrow \sqrt{\frac{16}{3}} + \sqrt{\frac{1}{3}} = \sqrt{\frac{69}{3}}$$

$$\Rightarrow \frac{4}{\sqrt{3}} + \frac{1}{\sqrt{3}} = \sqrt{23}$$



or $x-2=0$

$$x=2$$

Verification:

$$\sqrt{x+7} + \sqrt{x+2} = \sqrt{6x+13}$$

Put $x=2$

$$\sqrt{2+7} + \sqrt{2+2} = \sqrt{6 \times 2 + 13}$$

$$\sqrt{9} + \sqrt{4} = \sqrt{12+13}$$

$$3+2 = \sqrt{25}$$

$$5 = 5$$

Verified:



Exercise # 7.3

Q#2: Read the given conversion graph between Hectares and Acres to approximately convert.

Conversion graph between hectares and Acres:

Scales: 5 small squares = 1 hectares along x-axis;
2 small squares = 1 acres along y-axis.

i. 2 hectares to acres.

Solution:

By Reading the above graph as per given scale we can see

$$2 \text{ hectares} \cong 5 \text{ acres.}$$

ii. 5 hectares to acres.

Solution:

By Reading the above graph as per given scale we can see

$$5 \text{ hectares} \cong 12.5 \text{ acres.}$$

iii. 5 acres to hectares.

Solution:

By Reading the above graph as per given scale we can see

$$5 \text{ acres} \cong 2 \text{ hectares}$$

iv. 15 acres to hectares.

Solution:

By Reading the above graph as per given scale we can see

$$15 \text{ acres} \cong 6 \text{ hectares.}$$

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Exercise # 7.3

Q#3: Read the given conversion graph between Celsius and Fahrenheit to approximately convert
Conversion graph between Celsius and Fahrenheit:

Scale: 5 small squares = 1 Celsius along x-axis.
5 small squares = 1 Fahrenheit along y-axis.

i. 2° Celsius to Fahrenheit.

Solution:

By Reading the graph as per given scale we can see $2^{\circ}\text{C} \cong 35.4^{\circ}\text{F}$

ii. 1.80° Celsius to Fahrenheit.

Solution:

By Reading the graph as per given scale we can see $1.80^{\circ}\text{C} \cong 35.3^{\circ}\text{F}$

iii. 32° Fahrenheit to Celsius.

Solution:

By Reading the graph as per given scale we can see $32^{\circ}\text{F} \cong 0^{\circ}\text{C}$

iv. 36.4° Fahrenheit to Celsius

Solution:

By Reading the graph as per given scale we can see $36.4^{\circ}\text{F} \cong 2.4^{\circ}\text{C}$



Exercise # 7.3

Q#4: Read the given conversion graph Saudi Riyal and Pakistani Rupees (Rs.) to approximately convert.

Conversion graph between Saudi Riyal to Pakistani Rupees (Rs.)

Scale: 5 small squares = 1 Saudi Riyal along x-axis.

5 small squares = 30 Rs. along y-axis.

i. 3 Saudi Riyal to Rs.

Solution:

By Reading the graph
the as per given value we
can see 3 Saudi Riyal $\cong$ 90 Rs.

In Book the value of
Rs. 90 is given but
the calculation errors
are according Rs. 44

ii. 5.2 Saudi Riyal to Rs.

Solution:

By Reading the graph as per given value
we can see 5.2 Saudi Riyal $\cong$ 158 Rs.

iii. 150 Rs to Saudi Riyal.

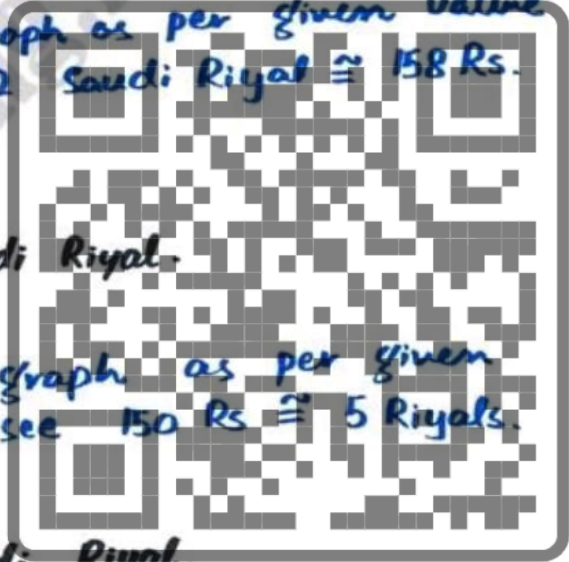
Solution:

By Reading the graph as per given
value we can see 150 Rs $\cong$ 5 Riyals.

iv. 78 Rs to Saudi Riyal.

Solution:

By Reading the graph as per given
value we can see 78 Rs. $\cong$ 2.6 Riyals



Exercise # 7.3

Q#5: Solve the following simultaneous equations by graphical method:

$3x - 11 = y$; $x - 3y = 9$
 Solution: Solution:

X	-3	-2	-1	0	1	2	3
Y	-20	-17	-14	-11	-8	-5	-2

X	-3	-2	-1	0	1	2	3
Y	-4	$-\frac{11}{3}$	$-\frac{10}{3}$	-3	$-\frac{8}{3}$	$-\frac{7}{3}$	-2

$\Rightarrow 3x - 11 = y$
 $\Rightarrow y = 3x - 11 \rightarrow \textcircled{1}$
 Put $x = -3$
 $\Rightarrow y = 3(-3) - 11$
 $y = -9 - 11$
 $y = -20$ $(x, y) = (-3, -20)$
 Put $x = -2$
 $y = 3(-2) - 11$
 $y = -6 - 11$
 $y = -17$ $(x, y) = (-2, -17)$
 Put $x = -1$
 $y = 3(-1) - 11$
 $y = -3 - 11$
 $y = -14$ $(x, y) = (-1, -14)$
 Put $x = 0$
 $y = 3(0) - 11$
 $y = 0 - 11$
 $y = -11$ $(x, y) = (0, -11)$
 Put $x = 1$
 $y = 3(1) - 11$
 $y = 3 - 11$
 $y = -8$ $(x, y) = (1, -8)$
 Put $x = 2$
 $y = 3(2) - 11$
 $y = 6 - 11$
 $y = -5$ $(x, y) = (2, -5)$
 Put $x = 3$
 $y = 3(3) - 11$
 $y = 9 - 11$
 $y = -2$ $(x, y) = (3, -2)$

$\Rightarrow x - 3y = 9$
 $\Rightarrow x - 9 = 3y$
 $\Rightarrow y = \frac{x - 9}{3}$
 Put $x = -3$
 $y = \frac{-3 - 9}{3} = \frac{-12}{3} = -4$ $(x, y) = (-3, -4)$
 Put $x = -2$
 $y = \frac{-2 - 9}{3} = \frac{-11}{3} = -3.66$ $(x, y) = (-2, -\frac{11}{3})$
 Put $x = -1$
 $y = \frac{-1 - 9}{3} = \frac{-10}{3} = -3.33$ $(x, y) = (-1, -\frac{10}{3})$
 Put $x = 0$
 $y = \frac{0 - 9}{3} = \frac{-9}{3} = -3$ $(x, y) = (0, -3)$
 Put $x = 1$
 $y = \frac{1 - 9}{3} = \frac{-8}{3} = -2.66$ $(x, y) = (1, -\frac{8}{3})$
 Put $x = 2$
 $y = \frac{2 - 9}{3} = \frac{-7}{3} = -2.33$ $(x, y) = (2, -2.33)$
 Put $x = 3$
 $y = \frac{3 - 9}{3} = \frac{-6}{3} = -2$ $(x, y) = (3, -2)$
 Hence sol. set is $\{(3, -2)\}$



Q#5 (i)

Scale: 10 small square = 1 unit on x-axis
2 small square = 1 unit on y-axis



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MORE!!!



ii. $x + y = 4$;
Solution :-

x	-3	-2	-1	0	1	2	3
y	7	6	5	4	3	2	1

$$x + y = 4$$

$$y = 4 - x \rightarrow (1)$$

Put $x = -3$

$$y = 4 - (-3)$$

$$y = 4 + 3$$

$$y = 7$$

$$(-3, 7)$$

Put $x = -2$

$$y = 4 - (-2)$$

$$y = 4 + 2$$

$$y = 6$$

$$(-2, 6)$$

Put $x = -1$

$$y = 4 - (-1)$$

$$y = 4 + 1$$

$$y = 5$$

$$(-1, 5)$$

Put $x = 0$

$$y = 4 - (0)$$

$$y = 4$$

$$(0, 4)$$

Put $x = 1$

$$y = 4 - 1$$

$$y = 3$$

$$(1, 3)$$

Put $x = 2$

$$y = 4 - 2$$

$$y = 2$$

$$(2, 2)$$

Put $x = 3$

$$y = 4 - 3$$

$$y = 1$$

$$(3, 1)$$

Hence Sol. set

$2x - 1 = 5y$
Solution :-

x	-3	-2	-1	0	1	2	3
y	$-\frac{7}{5}$	-1	$-\frac{3}{5}$	$-\frac{1}{5}$	$\frac{1}{5}$	$\frac{3}{5}$	1

$$2x - 1 = 5y$$

$$5y = 2x - 1$$

$$y = \frac{2x - 1}{5} \rightarrow (2)$$

Put $x = -3$

$$y = \frac{2(-3) - 1}{5} = \frac{-6 - 1}{5} = \frac{-7}{5} = -1.4$$

$$(-3, -\frac{7}{5})$$

Put $x = -2$

$$y = \frac{2(-2) - 1}{5} = \frac{-4 - 1}{5} = \frac{-5}{5} = -1$$

$$(-2, -1)$$

Put $x = -1$

$$y = \frac{2(-1) - 1}{5} = \frac{-2 - 1}{5} = \frac{-3}{5} = -0.6$$

$$(-1, -\frac{3}{5})$$

Put $x = 0$

$$y = \frac{2(0) - 1}{5} = \frac{-1}{5}$$

$$(0, -\frac{1}{5})$$

Put $x = 1$

$$y = \frac{2(1) - 1}{5} = \frac{2 - 1}{5} = \frac{1}{5} = 0.2$$

$$(1, \frac{1}{5})$$

Put $x = 2$

$$y = \frac{2(2) - 1}{5} = \frac{4 - 1}{5} = \frac{3}{5} = 0.6$$

$$(2, \frac{3}{5})$$

Put $x = 3$

$$y = \frac{2(3) - 1}{5} = \frac{6 - 1}{5} = \frac{5}{5} = 1$$

$$(3, 1)$$

is $\{3, 1\}$
Ans



Q #5 (ii)

Scale: 10 small squares = 1 unit on x-axis	+y-axis
5 small squares = 1 unit on y-axis	

Scale: 10 small squares = 1 unit on x-axis
5 small squares = 1 unit on y-axis



Exercise # 7.3

iii. $2x = y + 5$
Solution:-

$x = 2y + 1$
Solution:-

X	-3	-2	-1	0	1	2	3
Y	-11	-9	-7	-5	-3	-1	1

$$2x = y + 5$$

$$2x - 5 = y$$

$$y = 2x - 5 \rightarrow \textcircled{1}$$

Put $x = -3$

$$y = 2(-3) - 5$$

$$y = -6 - 5$$

$$y = -11$$

$$(-3, -11)$$

Put $x = -2$

$$y = 2(-2) - 5$$

$$y = -4 - 5$$

$$y = -9$$

$$(-2, -9)$$

Put $x = -1$

$$y = 2(-1) - 5$$

$$y = -2 - 5$$

$$y = -7$$

$$(-1, -7)$$

Put $x = 0$

$$y = 2(0) - 5$$

$$y = 0 - 5$$

$$y = -5$$

$$(0, -5)$$

Put $x = 1$

$$y = 2(1) - 5$$

$$y = 2 - 5$$

$$y = -3$$

$$(1, -3)$$

Put $x = 2$

$$y = 2(2) - 5$$

$$y = 4 - 5$$

$$y = -1$$

$$(2, -1)$$

Put $x = 3$

$$y = 2(3) - 5$$

$$y = 6 - 5$$

$$y = 1$$

$$(3, 1)$$

X	-3	-2	-1	0	1	2	3
Y	-2	$-\frac{3}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1

$$x = 2y + 1$$

$$2y = x - 1$$

$$y = \frac{x-1}{2} \rightarrow \textcircled{2}$$

Put $x = -3$

$$y = \frac{-3-1}{2} = \frac{-4}{2} = -2$$

$$(-3, -2)$$

Put $x = -2$

$$y = \frac{-2-1}{2} = \frac{-3}{2}$$

$$(-2, -\frac{3}{2})$$

Put $x = -1$

$$y = \frac{-1-1}{2} = \frac{-2}{2} = -1$$

$$(-1, -1)$$

Put $x = 0$

$$y = \frac{0-1}{2} = \frac{-1}{2}$$

$$(0, -\frac{1}{2})$$

Put $x = 1$

$$y = \frac{1-1}{2} = \frac{0}{2} = 0$$

$$(1, 0)$$

Put $x = 2$

$$y = \frac{2-1}{2} = \frac{1}{2}$$

$$(2, \frac{1}{2})$$

Put $x = 3$

$$y = \frac{3-1}{2} = \frac{2}{2} = 1$$

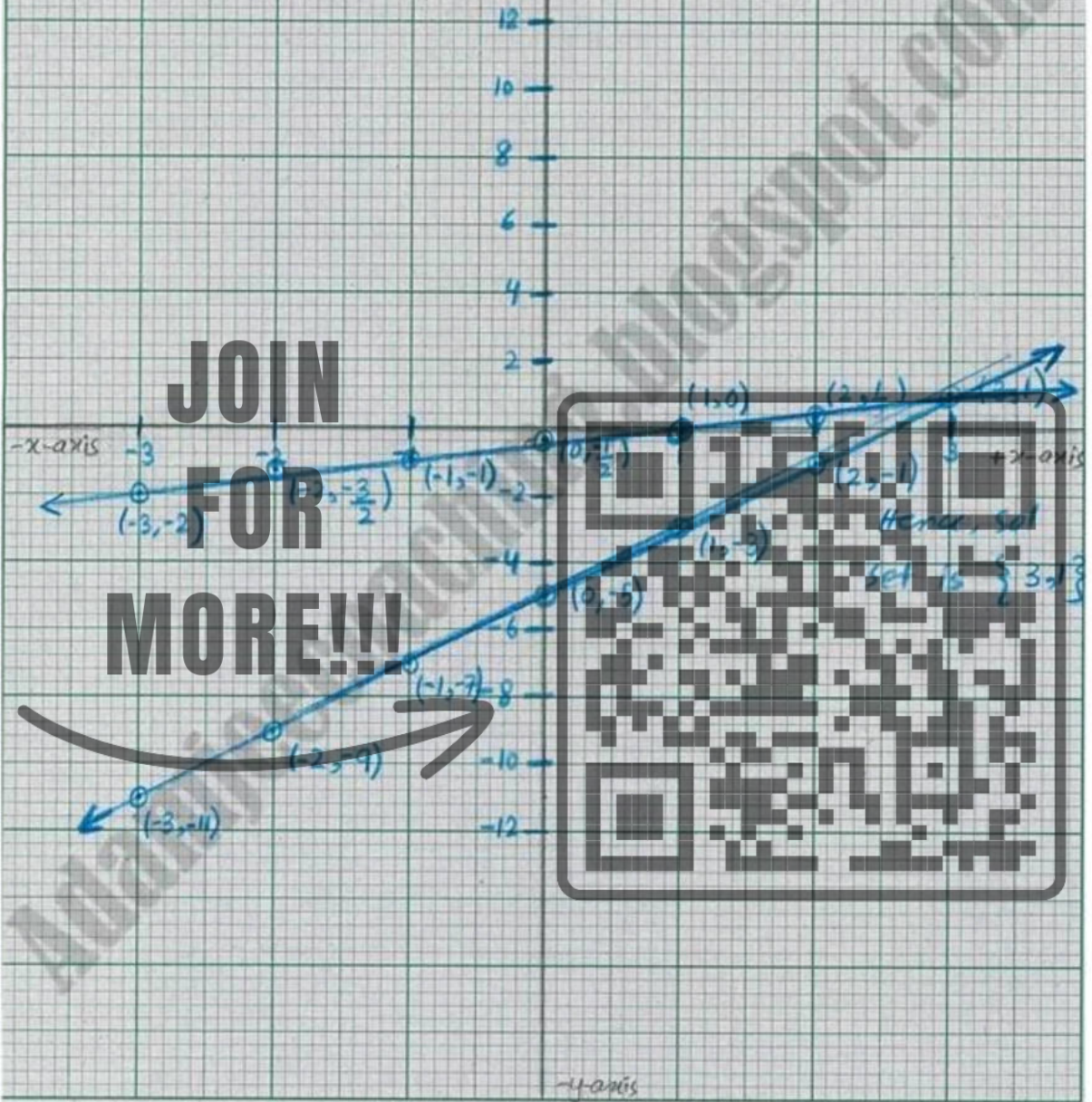
$$(3, 1)$$

Hence, Sol. set is $\{3, 1\}$
Ans



Q# 5 (iii)

Scale: 10 small squares = 1 unit on x-axis
5 small squares = 2 unit on y-axis



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MORE!!!



iv. $y = 3x - 5$

Solution:

x	-2	-1	0	1	2	3	4
y	-11	-8	-5	-2	1	4	7

$y = 3x - 5 \rightarrow (0)$

Put $x = -2$

$y = 3(-2) - 5$

$y = -6 - 5$

$y = -11$

$(-2, -11)$

Put $x = -1$

$y = 3(-1) - 5$

$y = -3 - 5$

$y = -8$

$(-1, -8)$

Put $x = 0$

$y = 3(0) - 5$

$y = 0 - 5$

$y = -5$

$(0, -5)$

Put $x = 1$

$y = 3(1) - 5$

$y = 3 - 5$

$y = -2$

$(1, -2)$

Put $x = 2$

$y = 3(2) - 5$

$y = 6 - 5$

$y = 1$

$(2, 1)$

Put $x = 3$

$y = 3(3) - 5$

$y = 9 - 5$

$y = 4$

$(3, 4)$

Put $x = 4$

$y = 3(4) - 5$

$y = 12 - 5$

$y = 7$

$(4, 7)$

$x + y = 11$

Solution:

x	-2	-1	0	1	2	3	4
y	13	12	11	10	9	8	7

$x + y = 11$

$y = 11 - x$

Put $x = -2$

$y = 11 - (-2)$

$y = 11 + 2$

$y = 13$

$(-2, 13)$

Put $x = -1$

$y = 11 - (-1)$

$y = 11 + 1$

$y = 12$

$(-1, 12)$

Put $x = 0$

$y = 11 - (0)$

$y = 11$

$(0, 11)$

Put $x = 1$

$y = 11 - 1$

$y = 10$

$(1, 10)$

Put $x = 2$

$y = 11 - 2$

$y = 9$

$(2, 9)$

Put $x = 3$

$y = 11 - 3$

$y = 8$

$(3, 8)$

Put $x = 4$

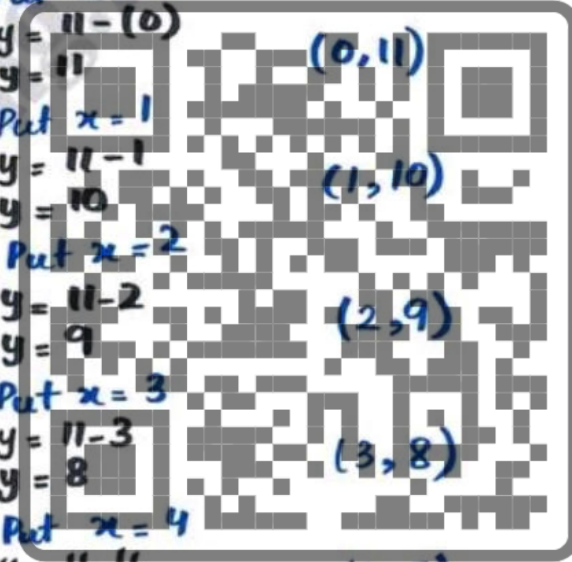
$y = 11 - 4$

$y = 7$

$(4, 7)$

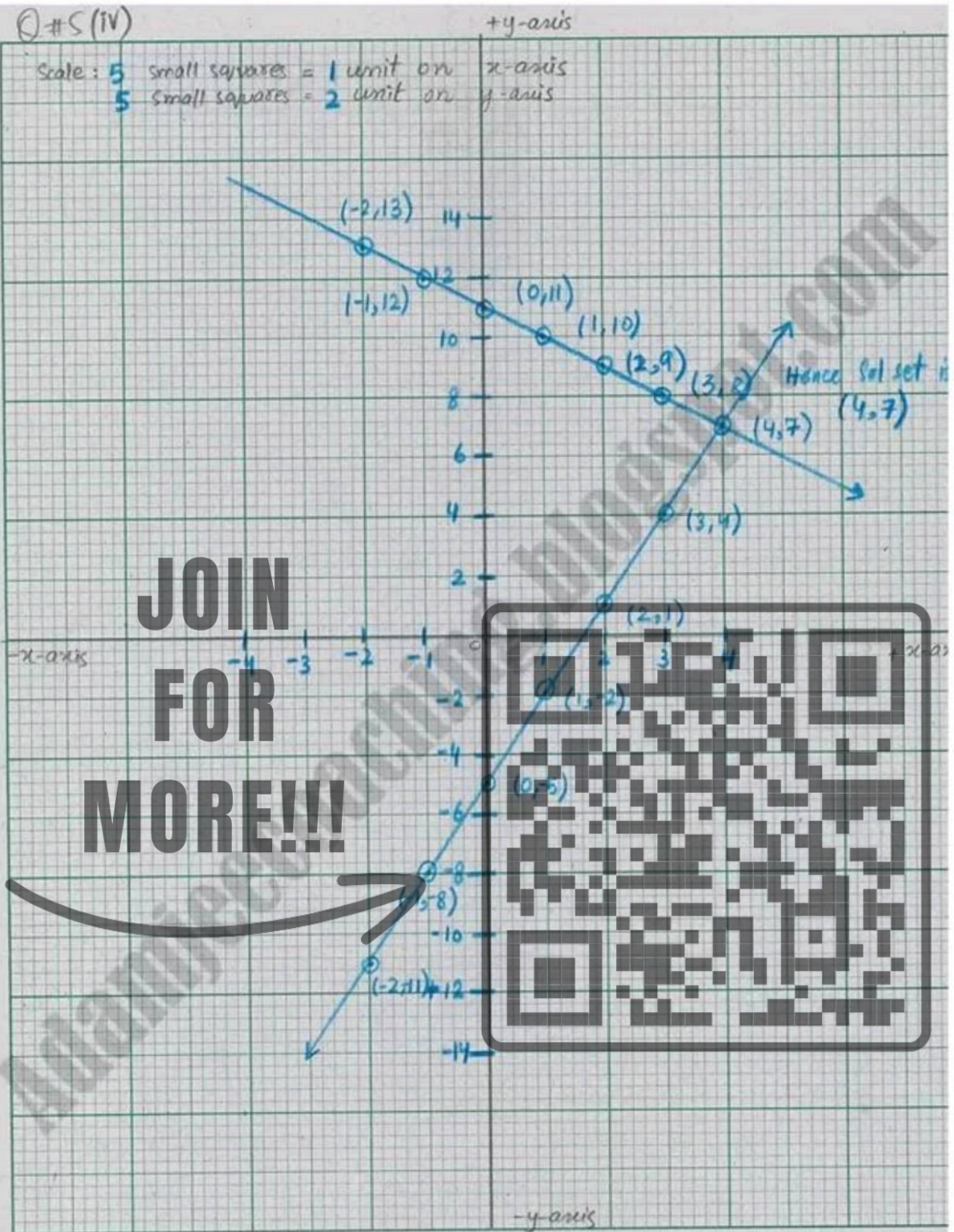
Hence Solution set is $\{4, 7\}$

JOIN
FOR
MORE!!!



Q-#5 (IV)

Scale : 5 small squares = 1 unit on x-axis
5 small squares = 2 unit on y-axis



JOIN
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MORE!!!



$$\vee \quad 2x + y = 3$$

Solution:

x	-3	-2	-1	0	1	2	3
y	9	7	5	3	1	-1	-3

$$\circ \quad 2x + y = 3$$

$$\circ \quad y = 3 - 2x \rightarrow (1)$$

$$\text{Put } x = -3$$

$$y = 3 - 2(-3)$$

$$y = 3 + 6$$

$$y = 9$$

$$\text{Put } x = -2$$

$$y = 3 - 2(-2)$$

$$y = 3 + 4$$

$$y = 7$$

$$\text{Put } x = -1$$

$$y = 3 - 2(-1)$$

$$y = 3 + 2$$

$$y = 5$$

$$\text{Put } x = 0$$

$$y = 3 - 2(0)$$

$$y = 3 - 0$$

$$y = 3$$

$$\text{Put } x = 1$$

$$y = 3 - 2(1)$$

$$y = 3 - 2$$

$$y = 1$$

$$\text{Put } x = 2$$

$$y = 3 - 2(2)$$

$$y = 3 - 4$$

$$y = -1$$

$$\text{Put } x = 3$$

$$y = 3 - 2(3)$$

$$y = 3 - 6$$

$$y = -3$$

$$; \quad x - y = 0$$

Solution:

x	-3	-2	-1	0	1	2	3
y	-3	-2	-1	0	1	2	3

$$x - y = 0$$

$$x = y$$

$$y = x \rightarrow (2)$$

$$\text{Put } x = -3$$

$$y = -3$$

$$\text{Put } x = -2$$

$$y = -2$$

$$\text{Put } x = -1$$

$$y = -1$$

$$\text{Put } x = 0$$

$$y = 0$$

$$\text{Put } x = 1$$

$$y = 1$$

$$\text{Put } x = 2$$

$$y = 2$$

$$\text{Put } x = 3$$

$$y = 3$$

Hence, Solution set is

$\{1, 1\}$ Ans



Q #5 (v)

Scale: 10 small squares = 1 unit on x-axis
5 small squares = 1 unit on y-axis

$(-3, 9)$

$(-2, 7)$

$(-1, 5)$

$(0, 3)$

$(1, 1)$

$(2, 2)$

$(3, 3)$

Sol set is $\{1, 1\}$

-x-axis

**JOIN
FOR
MORE!!!**

$(-1, 1)$

$(-2, -1)$

$(0, 0)$

$(1, -1)$

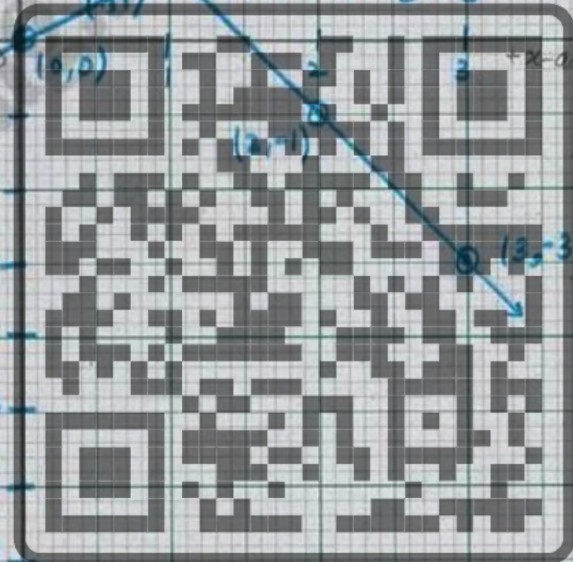
+x-axis

$(2, -1)$

$(3, -3)$

-y-axis

all in blue



vi- $2x + 2 = y$
Solution:

x	-3	-2	-1	0	1	2	3
y	-4	-2	0	2	4	6	8

$y = 2x + 2 \rightarrow \textcircled{1}$

Put $x = -3$
 $y = 2(-3) + 2$
 $y = -6 + 2$
 $y = -4$

Put $x = -2$
 $y = 2(-2) + 2$
 $y = -4 + 2$
 $y = -2$

Put $x = -1$
 $y = 2(-1) + 2$
 $y = -2 + 2$
 $y = 0$

Put $x = 0$
 $y = 2(0) + 2$
 $y = 0 + 2$
 $y = 2$

Put $x = 1$
 $y = 2(1) + 2$
 $y = 2 + 2$
 $y = 4$

Put $x = 2$
 $y = 2(2) + 2$
 $y = 4 + 2$
 $y = 6$

Put $x = 3$
 $y = 2(3) + 2$
 $y = 6 + 2$
 $y = 8$

$y = x - 1$
Solution:

x	-3	-2	-1	0	1	2	3
y	-4	-3	-2	-1	0	1	2

$y = x - 1 \rightarrow \textcircled{2}$

Put $x = -3$
 $y = -3 - 1$
 $y = -4$

Put $x = -2$
 $y = -2 - 1$
 $y = -3$

Put $x = -1$
 $y = -1 - 1$
 $y = -2$

Put $x = 0$
 $y = 0 - 1$
 $y = -1$

Put $x = 1$
 $y = 1 - 1$
 $y = 0$

Put $x = 2$
 $y = 2 - 1$
 $y = 1$

Put $x = 3$
 $y = 3 - 1$
 $y = 2$

Hence, solution set is
 $\{-3, -4\}$ Ans



Q #5 (vi)

Scale: 10 small squares = 1 unit on x-axis
5 small squares = 1 unit on y-axis



JOIN
FOR
MORE!!!

Sol. set is $\{-3, -4\}$



vii. $5 = x + 4y$
Solution:

x	-3	-2	-1	0	1	2	3
y	2	$\frac{7}{4}$	$\frac{3}{2}$	$\frac{5}{4}$	1	$\frac{3}{4}$	$\frac{1}{2}$

$$5 = x + 4y$$

$$5 - x = 4y$$

$$y = \frac{5-x}{4} \rightarrow \textcircled{1}$$

Put $x = -3$

$$y = \frac{5 - (-3)}{4} = \frac{5+3}{4} = \frac{8}{4} = 2$$

$$y = 2$$

Put $x = -2$

$$y = \frac{5 - (-2)}{4} = \frac{5+2}{4} = \frac{7}{4}$$

$$y = \frac{7}{4}$$

Put $x = -1$

$$y = \frac{5 - (-1)}{4} = \frac{5+1}{4} = \frac{6}{4} = \frac{3}{2}$$

$$y = \frac{3}{2}$$

Put $x = 0$

$$y = \frac{5 - 0}{4} = \frac{5}{4}$$

Put $x = 1$

$$y = \frac{5 - 1}{4} = \frac{4}{4} = 1$$

$$y = 1$$

Put $x = 2$

$$y = \frac{5 - 2}{4} = \frac{3}{4}$$

Put $x = 3$

$$y = \frac{5 - 3}{4} = \frac{2}{4} = \frac{1}{2}$$

$$y = \frac{1}{2}$$

; $2x + 3y = 0$
Solution:

x	-3	-2	-1	0	1	2	3
y	2	$\frac{4}{3}$	$\frac{2}{3}$	0	$-\frac{2}{3}$	$-\frac{4}{3}$	-2

$$2x + 3y = 0$$

$$3y = -2x$$

$$y = \frac{-2x}{3} \rightarrow \textcircled{2}$$

Put $x = -3$

$$y = \frac{-2(-3)}{3} = \frac{6}{3} = 2$$

$$y = 2$$

Put $x = -2$

$$y = \frac{-2(-2)}{3} = \frac{4}{3} \quad (1.33)$$

Put $x = -1$

$$y = \frac{-2(-1)}{3} = \frac{2}{3}$$

Put $x = 0$

$$y = \frac{-2(0)}{3} = \frac{0}{3} = 0$$

Put $x = 1$

$$y = \frac{-2(1)}{3} = -\frac{2}{3}$$

Put $x = 2$

$$y = \frac{-2(2)}{3} = -\frac{4}{3}$$

Put $x = 3$

$$y = \frac{-2(3)}{3} = -\frac{6}{3} = -2$$

$$y = -2$$

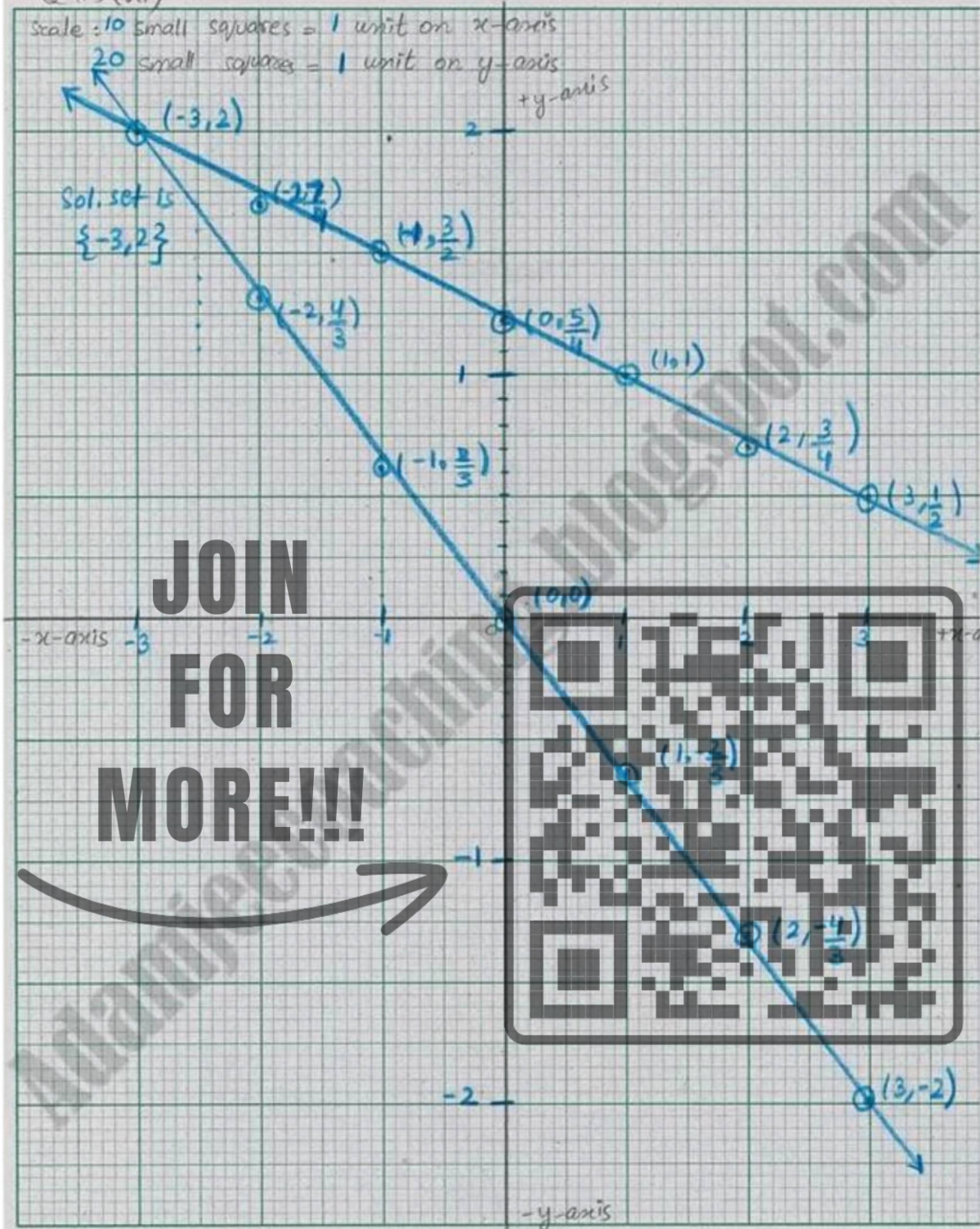
Hence solution set is
 $\{-3, 2\}$ Ans



Q #5(vii)

Scale: 10 small squares = 1 unit on x-axis

20 small squares = 1 unit on y-axis



JOIN
FOR
MORE!!!



viii. $3x = 5y - 2$

Solution:

x	1	6	11	16	-4	-9	-14
y	1	4	7	10	-2	-5	-8

$$3x = 5y - 2$$

$$3x + 2 = 5y$$

$$y = \frac{3x+2}{5} \rightarrow (1)$$

Put $x = 1$

$$y = \frac{3(1)+2}{5} = \frac{3+2}{5} = \frac{5}{5} = 1$$

Put $x = 6$

$$y = \frac{3(6)+2}{5} = \frac{18+2}{5} = \frac{20}{5} = 4$$

Put $x = 11$

$$y = \frac{3(11)+2}{5} = \frac{33+2}{5} = \frac{35}{5} = 7$$

Put $x = 16$

$$y = \frac{3(16)+2}{5} = \frac{48+2}{5} = \frac{50}{5} = 10$$

Put $x = -4$

$$y = \frac{3(-4)+2}{5} = \frac{-12+2}{5} = \frac{-10}{5} = -2$$

Put $x = -9$

$$y = \frac{3(-9)+2}{5} = \frac{-27+2}{5} = \frac{-25}{5} = -5$$

Put $x = -14$

$$y = \frac{3(-14)+2}{5} = \frac{-42+2}{5} = \frac{-40}{5} = -8$$

$3x + 5y = 8$

Solution:

x	1	6	11	16	-4	-9	-14
y	1	-2	-5	-8	4	7	10

$$3x + 5y = 8$$

$$5y = 8 - 3x$$

$$y = \frac{8-3x}{5} \rightarrow (2)$$

Put $x = 1$

$$y = \frac{8-3(1)}{5} = \frac{8-3}{5} = \frac{5}{5} = 1$$

Put $x = 6$

$$y = \frac{8-3(6)}{5} = \frac{8-18}{5} = \frac{-10}{5} = -2$$

Put $x = 11$

$$y = \frac{8-3(11)}{5} = \frac{8-33}{5} = \frac{-25}{5} = -5$$

Put $x = 16$

$$y = \frac{8-3(16)}{5} = \frac{8-48}{5} = \frac{-40}{5} = -8$$

Put $x = -4$

$$y = \frac{8-3(-4)}{5} = \frac{8+12}{5} = \frac{20}{5} = 4$$

Put $x = -9$

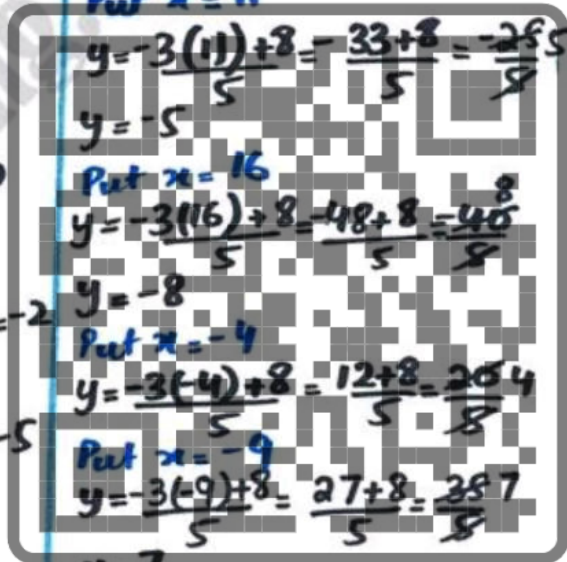
$$y = \frac{8-3(-9)}{5} = \frac{8+27}{5} = \frac{35}{5} = 7$$

Put $x = -14$

$$y = \frac{8-3(-14)}{5} = \frac{8+42}{5} = \frac{50}{5} = 10$$

$y = 10$

JOIN
FOR
MORE!!!



Q #5 (viii)

Scale: 5 small squares = 2 unit on x-axis
5 small squares = 2 unit on y-axis



$$\text{ix- } \frac{x+2}{5} + y = 6$$

Solution:

x	8	3	-2	-7	-12	-17	13
y	4	5	6	7	8	9	3

$$\frac{x+2}{5} + y = 6$$

$$y = 6 - \frac{(x+2)}{5}$$

$$y = \frac{30 - x - 2}{5}$$

$$y = \frac{28 - x}{5} \rightarrow \textcircled{1}$$

Put $x = 8$

$$y = \frac{28 - 8}{5} = \frac{20}{5} = 4$$

$y = 4$

Put $x = 3$

$$y = \frac{28 - 3}{5} = \frac{25}{5} = 5$$

Put $x = -2$

$$y = \frac{28 - (-2)}{5} = \frac{28 + 2}{5} = \frac{30}{5} = 6$$

Put $x = -7$

$$y = \frac{28 - (-7)}{5} = \frac{28 + 7}{5} = \frac{35}{5} = 7$$

Put $x = -12$

$$y = \frac{28 - (-12)}{5} = \frac{28 + 12}{5} = \frac{40}{5} = 8$$

Put $x = -17$

$$y = \frac{28 - (-17)}{5} = \frac{28 + 17}{5} = \frac{45}{5} = 9$$

$y = 9$

Put $x = 13$

$$y = \frac{28 - (13)}{5} = \frac{28 - 13}{5} = \frac{15}{5} = 3$$

Hence, Solution set is $\{8, 4\}$ Ans

$$; y = 2x - 12$$

Solution:

x	8	3	-2	2	1	0	4
y	4	-6	-16	-8	-10	-12	-4

$$y = 2x - 12 \rightarrow \textcircled{2}$$

Put $x = 8$

$$y = 2(8) - 12$$

$$y = 16 - 12$$

$$y = 4$$

Put $x = 3$

$$y = 2(3) - 12$$

$$y = 6 - 12$$

$$y = -6$$

Put $x = -2$

$$y = 2(-2) - 12$$

$$y = -4 - 12$$

$$y = -16$$

Put $x = 2$

$$y = 2(2) - 12$$

$$y = 4 - 12$$

$$y = -8$$

Put $x = 1$

$$y = 2(1) - 12$$

$$y = 2 - 12$$

$$y = -10$$

Put $x = 0$

$$y = 2(0) - 12$$

$$y = 0 - 12$$

$$y = -12$$

Put $x = 4$

$$y = 2(4) - 12$$

$$y = 8 - 12$$

$$y = -4$$

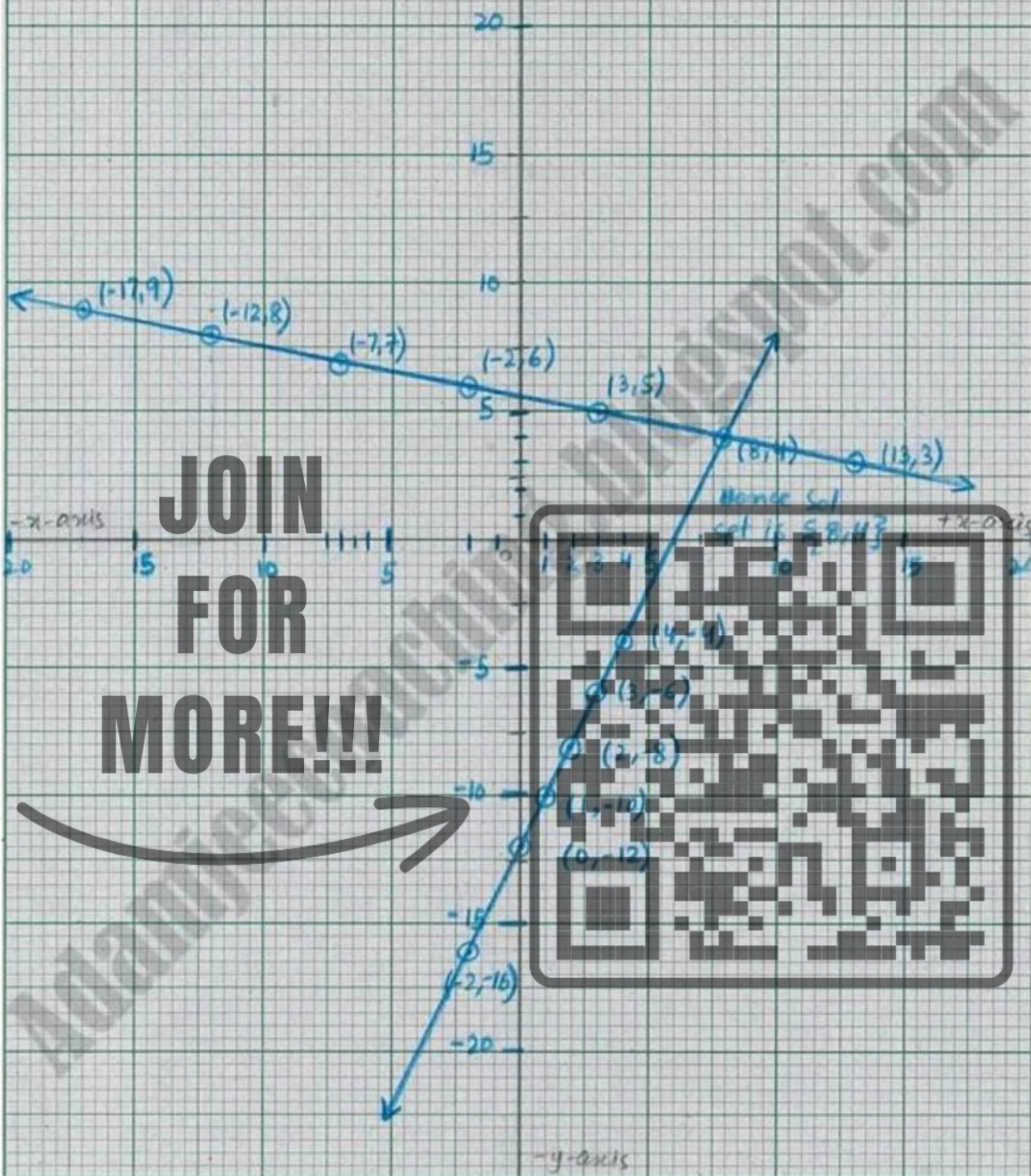


Q #5 (ix)

Ex # 7.3

+y-axis

Scale = 2 small square = 1 unit
small square =



$$x - 3x - 2y = 13$$

Solution:

x	0	1	2	3	4	5	6
y	$-\frac{13}{2}$	-5	$-\frac{7}{2}$	-2	$-\frac{1}{2}$	1	$\frac{5}{2}$

$$3x - 2y = 13$$

$$3x - 13 = 2y$$

$$y = \frac{3x - 13}{2} \rightarrow (1)$$

Put $x = 0$

$$y = \frac{3(0) - 13}{2} = \frac{0 - 13}{2} = -\frac{13}{2} \quad (6.5)$$

Put $x = 1$

$$y = \frac{3(1) - 13}{2} = \frac{3 - 13}{2} = \frac{-10}{2} = -5$$

Put $x = 2$

$$y = \frac{3(2) - 13}{2} = \frac{6 - 13}{2} = -\frac{7}{2} \quad (3.5)$$

Put $x = 3$

$$y = \frac{3(3) - 13}{2} = \frac{9 - 13}{2} = -\frac{4}{2} = -2$$

Put $x = 4$

$$y = \frac{3(4) - 13}{2} = \frac{12 - 13}{2} = -\frac{1}{2} = -0.5$$

Put $x = 5$

$$y = \frac{3(5) - 13}{2} = \frac{15 - 13}{2} = \frac{2}{2} = 1$$

Put $x = 6$

$$y = \frac{3(6) - 13}{2} = \frac{18 - 13}{2} = \frac{5}{2} \quad (2.5)$$

$$2x + 3y = 13$$

Solution:

x	0	1	2	3	4	5	6
y	$\frac{13}{3}$	$\frac{11}{3}$	3	$\frac{7}{3}$	$\frac{5}{3}$	1	$\frac{1}{3}$

$$2x + 3y = 13$$

$$3y = 13 - 2x$$

$$y = \frac{13 - 2x}{3} \rightarrow (2)$$

Put $x = 0$

$$y = \frac{13 - 2(0)}{3} = \frac{13 - 0}{3} = \frac{13}{3} \quad (4.33)$$

Put $x = 1$

$$y = \frac{13 - 2(1)}{3} = \frac{13 - 2}{3} = \frac{11}{3} \quad (3.666)$$

Put $x = 2$

$$y = \frac{13 - 2(2)}{3} = \frac{13 - 4}{3} = \frac{9}{3} = 3$$

Put $x = 3$

$$y = \frac{13 - 2(3)}{3} = \frac{13 - 6}{3} = \frac{7}{3} \quad (2.33)$$

Put $x = 4$

$$y = \frac{13 - 2(4)}{3} = \frac{13 - 8}{3} = \frac{5}{3} \quad (1.66)$$

Put $x = 5$

$$y = \frac{13 - 2(5)}{3} = \frac{13 - 10}{3} = \frac{3}{3} = 1$$

Put $x = 6$

$$y = \frac{13 - 2(6)}{3} = \frac{13 - 12}{3} = \frac{1}{3} \quad (0.33)$$



Q#5(x)

Ex #7.3 +y-axis

Scale: 5 small squares = 1 unit on x-axis
: 5 small squares = 1 unit on y-axis

