Mathematics 9th Class

Solved Smart Syllabus

EXERCISE # 1.1

Q#1. Find the order of the following matrices.

$$C = \begin{bmatrix} 2 & 4 \end{bmatrix}$$

Sol/ Order of C is **1-by-2** Ans.

$$G = \begin{bmatrix} 2 & 3 & 0 \\ 1 & 2 & 3 \\ 2 & 4 & 5 \end{bmatrix}$$

Sol/ Order of G is **3-by-3** Ans.

$$H = \begin{bmatrix} 2 & 3 & 4 \\ 1 & 0 & 6 \end{bmatrix}$$

Sol/ Order of H is **2-by-3** Ans.

Q#2. Find the values of a, b, c and d which satisfy the matrix equation.

$$\begin{bmatrix} a+c & a+2b \\ c-1 & 4d-6 \end{bmatrix} = \begin{bmatrix} 0 & -7 \\ 3 & 2d \end{bmatrix}$$

Sol/

$$\begin{bmatrix} a+c & a+2b \\ c-1 & 4d-6 \end{bmatrix} = \begin{bmatrix} 0 & -7 \\ 3 & 2d \end{bmatrix}$$

$a + c = 0 \longrightarrow (1)$

$a + 2b = -7 \longrightarrow (2)$

$c - 1 = 3 \longrightarrow (3)$

$4d - 6 = 2d \longrightarrow (4)$

$(3) \Rightarrow \quad c - 1 = 3$

$c = 3 + 1$

$\boxed{c = 4}$ Ans.

put the value of "c" in eq #(1)

$a + c = 0$

$a + 4 = 0$

$\boxed{a = -4}$ Ans.

Now put the value of "a" in eq #(2)

$a + 2b = -7$

$-4 + 2b = -7$

$2b = -7 + 4$

$2b = -3$

$b = \frac{-3}{2}$

$\boxed{b = -1.5}$ Ans.

$(4) \Rightarrow \quad 4d - 6 = 2d$

$4d - 2d = 6$

$2d = 6$

$d = \frac{6}{2}$

$\boxed{d = 3}$ Ans.

Important M.C.Q

★ The idea of matrices was given by **Arthur Cayley**, an English mathematician of nineteenth century.

EXERCISE # 1.2

Q#1. From the following matrices, identify unit matrices, row matrices, column matrices and null matrices.

$$A = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

Sol// A null matrix

$$B = \begin{bmatrix} 2 & 3 & 4 \end{bmatrix}$$

Sol// B row matrix

$$C = \begin{bmatrix} 4 \\ 0 \\ 6 \end{bmatrix}$$

Sol// C column matrix

$$D = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Sol// D unit matrix

$$E = \begin{bmatrix} 0 \end{bmatrix}$$

Sol// E null matrix

$$F = \begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix}$$

Sol// F column matrix

Q#2. From the following matrices, identify

(a) Square matrices

(b) Rectangular matrices

(c) Row matrices

(d) Column matrices

(e) Identity matrices

(f) Null matrices

(i) $\begin{bmatrix} -8 & 2 & 7 \\ 12 & 0 & 4 \end{bmatrix}$ 2-by-3

Sol// Rectangular matrix

(ii) $\begin{bmatrix} 3 \\ 0 \\ 1 \end{bmatrix}$ 3-by-1

Sol// Column matrix / Rectangular matrix

(iii) $\begin{bmatrix} 6 & -4 \\ 3 & -2 \end{bmatrix}$ 2-by-2

Sol// Square matrix

(iv) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ 2-by-2

Sol// Identity matrix / Square matrix

(v) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$ 3-by-2

Sol// Rectangular matrix

(vi) $\begin{bmatrix} 3 & 10 & -1 \end{bmatrix}$ 1-by-3

Sol// Row matrix / Rectangular matrix

(vii) $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ 3-by-1

Sol// Column matrix / Rectangular matrix

(viii) $\begin{bmatrix} 1 & 2 & 3 \\ -1 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ 3-by-3

Sol// Square matrix

(ix) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$ 3-by-2

Sol// Rectangular Matrix / Null Matrix.

Q#3. From the following matrices, identify diagonal, scalar and unit (identity) matrices.

$$A = \begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix}$$

Sol// A is scalar matrix / Diagonal matrix

$$B = \begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix}$$

Sol// B is Diagonal matrix

$$C = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Sol// C is unit matrix

$$D = \begin{bmatrix} 3 & 0 \\ 0 & 0 \end{bmatrix}$$

Sol// D is Diagonal matrix

$$E = \begin{bmatrix} 5-3 & 0 \\ 0 & 1+1 \end{bmatrix}$$

$$E = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$$

Sol// E is scalar matrix / Diagonal matrix

Q#4. Find negative of matrices A, B, C, D and E when:

$$A = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$$ (smart Syllabus)★

Sol// $-A = -\begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$

$-A = \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}$ Answer in.

$$B = \begin{bmatrix} 3 & -1 \\ 2 & 1 \end{bmatrix}$$

Sol// $-B = -\begin{bmatrix} 3 & -1 \\ 2 & 1 \end{bmatrix}$

$-B = \begin{bmatrix} -3 & 1 \\ -2 & -1 \end{bmatrix}$ Answer in.

$$C = \begin{bmatrix} 2 & 6 \\ 3 & 2 \end{bmatrix}$$

Sol// $-C = -\begin{bmatrix} 2 & 6 \\ 3 & 2 \end{bmatrix}$

$-C = \begin{bmatrix} -2 & -6 \\ -3 & -2 \end{bmatrix}$ Answer in.

$$D = \begin{bmatrix} -3 & 2 \\ -4 & 5 \end{bmatrix}$$ (smart Syllabus)★

Sol// $-D = -\begin{bmatrix} -3 & 2 \\ -4 & 5 \end{bmatrix}$

$-D = \begin{bmatrix} 3 & -2 \\ 4 & -5 \end{bmatrix}$ Answer in.

$$E = \begin{bmatrix} 1 & -5 \\ 2 & 3 \end{bmatrix}$$

Sol// $-E = -\begin{bmatrix} 1 & -5 \\ 2 & 3 \end{bmatrix}$

$-E = \begin{bmatrix} -1 & 5 \\ -2 & -3 \end{bmatrix}$ Answer in.

Q#5. Find the transpose of each of the following matrices:

$$A=\begin{bmatrix}0\\1\\-2\end{bmatrix}$$

Sol//

$$A=\begin{bmatrix}0\\1\\-2\end{bmatrix}$$

$$A^t=\begin{bmatrix}0\\1\\-2\end{bmatrix}^t$$

$$A^t=\begin{bmatrix}0 & 1 & -2\end{bmatrix}$$ Answer.

$$B=\begin{bmatrix}5 & 1 & -6\end{bmatrix}$$ (smart syllabus)

Sol//

$$B=\begin{bmatrix}5 & 1 & -6\end{bmatrix}$$

$$B^t=\begin{bmatrix}5 & 1 & -6\end{bmatrix}^t$$

$$B^t=\begin{bmatrix}5\\1\\-6\end{bmatrix}$$ Answer.

$$C=\begin{bmatrix}1 & 2\\2 & -1\\3 & 0\end{bmatrix}$$ (smart syllabus)

Sol//

$$C=\begin{bmatrix}1 & 2\\2 & -1\\3 & 0\end{bmatrix}$$

$$C^t=\begin{bmatrix}1 & 2\\2 & -1\\3 & 0\end{bmatrix}^t$$

$$C^t=\begin{bmatrix}1 & 2 & 3\\2 & -1 & 0\end{bmatrix}$$ Answer.

$$D=\begin{bmatrix}2 & 3\\0 & 5\end{bmatrix}$$

Sol//

$$D=\begin{bmatrix}2 & 3\\0 & 5\end{bmatrix}$$

$$D^t=\begin{bmatrix}2 & 3\\0 & 5\end{bmatrix}^t$$

$$D^t=\begin{bmatrix}2 & 0\\3 & 5\end{bmatrix}$$ Answer.

$$E=\begin{bmatrix}2 & 3\\-4 & 5\end{bmatrix}$$ (smart syllabus)

Sol//

$$E=\begin{bmatrix}2 & 3\\-4 & 5\end{bmatrix}$$

$$E^t=\begin{bmatrix}2 & 3\\-4 & 5\end{bmatrix}^t$$

$$E^t=\begin{bmatrix}2 & -4\\3 & 5\end{bmatrix}$$ Answer.

$$F=\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}$$

Sol//

$$F=\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}$$

$$F^t=\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}^t$$

$$F^t=\begin{bmatrix}1 & 3\\2 & 4\end{bmatrix}$$ Answer.

Q#6. Verify that if

$$A=\begin{bmatrix}1 & 2\\0 & 1\end{bmatrix},\quad B=\begin{bmatrix}1 & 1\\2 & 0\end{bmatrix}$$

then (i) $(A^t)^t=A$ (ii) $(B^t)^t=B$

Sol//

$$A=\begin{bmatrix}1 & 2\\0 & 1\end{bmatrix} \longrightarrow (1)$$

$$A^t=\begin{bmatrix}1 & 2\\0 & 1\end{bmatrix}^t$$ Taking transpose

$$A^t=\begin{bmatrix}1 & 0\\2 & 1\end{bmatrix}$$

Again taking transpose

$$(A^t)^t = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}^t$$

$$(A^t)^t = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$$

$(A^t)^t = A$ using ①

Hence proved in.

(ii) $(B^t)^t = B$

$$B = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}$$

Sol//

$$B = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix} \longrightarrow ①$$

Taking transpose on both sides

$$B^t = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}^t$$

$$B^t = \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}$$

Again taking transpose on both sides

$$(B^t)^t = \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}^t$$

$$(B^t)^t = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}$$

$(B^t)^t = B$ using ①

Hence proved in.

EXERCISE #1.3

Q#1. Which of the following matrices are conformable for addition?

$$A = \begin{bmatrix} 2 & 1 \\ -1 & 3 \end{bmatrix}$$ order 2-by-2

$$B = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$$ 2-by-1

$$C = \begin{bmatrix} 1 & 0 \\ 2 & -1 \\ 1 & -2 \end{bmatrix}$$ 3-by-2

$$D = \begin{bmatrix} 2+1 \\ 3 \end{bmatrix} = \begin{bmatrix} 3 \\ 3 \end{bmatrix}$$ 2-by-1

$$E = \begin{bmatrix} -1 & 0 \\ 1 & 2 \end{bmatrix}$$ 2-by-2

$$F = \begin{bmatrix} 3 & 2 \\ 1+1 & -4 \\ 3+2 & 2+1 \end{bmatrix} = \begin{bmatrix} 3 & 2 \\ 2 & -4 \\ 5 & 3 \end{bmatrix}$$ 3-by-2

Sol//

Matrices **A** and **E**,

Matrices **B** and **E**,

Matrices **C** and **F**

are conformable for addition because they have same order.

Q#2. Find the additive inverse of following matrices.

$$B=\begin{bmatrix}1 & 0 & -1\\ 2 & -1 & 3\\ 3 & -2 & 1\end{bmatrix}$$

Sol//

Additive inverse of $B=\begin{bmatrix}-1 & 0 & 1\\ -2 & 1 & -3\\ -3 & 2 & -1\end{bmatrix}$ Answer in.

$$C=\begin{bmatrix}4\\ -2\end{bmatrix}$$

Sol//

Additive inverse of $C=\begin{bmatrix}-4\\ 2\end{bmatrix}$ Answer in.

$$F=\begin{bmatrix}\sqrt{3} & 1\\ -1 & \sqrt{2}\end{bmatrix}$$

Sol//

Additive inverse of $F=\begin{bmatrix}-\sqrt{3} & -1\\ 1 & -\sqrt{2}\end{bmatrix}$ Answer in.

Q#3. If $A=\begin{bmatrix}-1 & 2\\ 2 & 1\end{bmatrix}$, $B=\begin{bmatrix}1\\ -1\end{bmatrix}$,

$C=\begin{bmatrix}1 & -1 & 2\end{bmatrix}$, $D=\begin{bmatrix}1 & 2 & 3\\ -1 & 0 & 2\end{bmatrix}$

then find,

(ii) $B+\begin{bmatrix}-2\\ 3\end{bmatrix}$

Sol//

$B+\begin{bmatrix}-2\\ 3\end{bmatrix}$

put the value of B

$=\begin{bmatrix}1\\ -1\end{bmatrix}+\begin{bmatrix}-2\\ 3\end{bmatrix}$

$=\begin{bmatrix}1+(-2)\\ -1+3\end{bmatrix}$

$=\begin{bmatrix}1-2\\ -1+3\end{bmatrix}$

$=\begin{bmatrix}-1\\ 2\end{bmatrix}$ Answer in.

(iv) $D+\begin{bmatrix}0 & 1 & 0\\ 2 & 0 & 1\end{bmatrix}$

Sol//

$D+\begin{bmatrix}0 & 1 & 0\\ 2 & 0 & 1\end{bmatrix}$

put the value of "D"

$=\begin{bmatrix}1 & 2 & 3\\ -1 & 0 & 2\end{bmatrix}+\begin{bmatrix}0 & 1 & 0\\ 2 & 0 & 1\end{bmatrix}$

$=\begin{bmatrix}1+0 & 2+1 & 3+0\\ -1+2 & 0+0 & 2+1\end{bmatrix}$

$=\begin{bmatrix}1 & 3 & 3\\ 1 & 0 & 3\end{bmatrix}$ Answer in.

(vi) $(-1)B$

Sol//

$(-1)B$

put the value of B

$=(-1)\begin{bmatrix}1\\ -1\end{bmatrix}$

$=\begin{bmatrix}-1\\ 1\end{bmatrix}$ Answer in.

Q#4. Perform the indicated operations and simplify the following.

(ii) $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}+\left(\begin{bmatrix}0 & 2\\ 3 & 0\end{bmatrix}-\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}\right)$

Sol//

$$\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}+\left(\begin{bmatrix}0 & 2\\ 3 & 0\end{bmatrix}-\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}\right)$$

$$=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}+\begin{bmatrix}0-1 & 2-1\\ 3-1 & 0-0\end{bmatrix}$$

$$=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}+\begin{bmatrix}-1 & 1\\ 2 & 0\end{bmatrix}$$

$$=\begin{bmatrix}1+(-1) & 0+1\\ 0+2 & 1+0\end{bmatrix}$$

$$=\begin{bmatrix}1-1 & 1\\ 2 & 1\end{bmatrix}$$

$$=\begin{bmatrix}0 & 1\\ 2 & 1\end{bmatrix}$$ Answer is.

(vi) $\left(\begin{bmatrix}1 & 2\\ 0 & 1\end{bmatrix}+\begin{bmatrix}2 & 1\\ 1 & 0\end{bmatrix}\right)+\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}$

Sol//

$$\left(\begin{bmatrix}1 & 2\\ 0 & 1\end{bmatrix}+\begin{bmatrix}2 & 1\\ 1 & 0\end{bmatrix}\right)+\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}$$

$$=\begin{bmatrix}1+2 & 2+1\\ 0+1 & 1+0\end{bmatrix}+\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}$$

$$=\begin{bmatrix}3 & 3\\ 1 & 1\end{bmatrix}+\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}$$

$$=\begin{bmatrix}3+1 & 3+1\\ 1+1 & 1+1\end{bmatrix}$$

$$=\begin{bmatrix}4 & 4\\ 2 & 2\end{bmatrix}$$ Answer is.

Q#5. For the matrices

$$A=\begin{bmatrix}1 & 2 & 3\\ 2 & 3 & 1\\ 1 & -1 & 0\end{bmatrix},\ B=\begin{bmatrix}1 & -1 & 1\\ 2 & -2 & 2\\ 3 & 1 & 3\end{bmatrix}$$

and $C=\begin{bmatrix}-1 & 0 & 0\\ 0 & -2 & 3\\ 1 & 1 & 2\end{bmatrix}$

verify the following rules.

(vi) $2A+B=A+(A+B)$

Sol//

$2A+B=A+(A+B)$

L.H.S $=2A+B$

$$=2\begin{bmatrix}1 & 2 & 3\\ 2 & 3 & 1\\ 1 & -1 & 0\end{bmatrix}+\begin{bmatrix}1 & -1 & 1\\ 2 & -2 & 2\\ 3 & 1 & 3\end{bmatrix}$$

$$=\begin{bmatrix}2 & 4 & 6\\ 4 & 6 & 2\\ 2 & -2 & 0\end{bmatrix}+\begin{bmatrix}1 & -1 & 1\\ 2 & -2 & 2\\ 3 & 1 & 3\end{bmatrix}$$

$$=\begin{bmatrix}2+1 & 4+(-1) & 6+1\\ 4+2 & 6+(-2) & 2+2\\ 2+3 & -2+1 & 0+3\end{bmatrix}$$

$$=\begin{bmatrix}3 & 4-1 & 7\\ 6 & 6-2 & 4\\ 5 & -1 & 3\end{bmatrix}$$

$$=\begin{bmatrix}3 & 3 & 7\\ 6 & 4 & 4\\ 5 & -1 & 3\end{bmatrix}\longrightarrow (1)$$

R.H.S $=A+(A+B)$

$$=\begin{bmatrix}1 & 2 & 3\\ 2 & 3 & 1\\ 1 & -1 & 0\end{bmatrix}+\left(\begin{bmatrix}1 & 2 & 3\\ 2 & 3 & 1\\ 1 & -1 & 0\end{bmatrix}+\begin{bmatrix}1 & -1 & 1\\ 2 & -2 & 2\\ 3 & 1 & 3\end{bmatrix}\right)$$

$$=\begin{bmatrix}1 & 2 & 3\\ 2 & 3 & 1\\ 1 & -1 & 0\end{bmatrix}+\begin{bmatrix}1+1 & 2+(-1) & 3+1\\ 2+2 & 3+(-2) & 1+2\\ 1+3 & -1+1 & 0+3\end{bmatrix}$$

$$=\begin{bmatrix}1 & 2 & 3\\ 2 & 3 & 1\\ 1 & -1 & 0\end{bmatrix}+\begin{bmatrix}2 & 2-1 & 4\\ 4 & 3-2 & 3\\ 4 & 0 & 3\end{bmatrix}$$

$$= \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 1 & -1 & 0 \end{bmatrix} + \begin{bmatrix} 2 & 1 & 4 \\ 4 & 1 & 3 \\ 4 & 0 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 1+2 & 2+1 & 3+4 \\ 2+4 & 3+1 & 1+3 \\ 1+4 & -1+0 & 0+3 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 3 & 7 \\ 6 & 4 & 4 \\ 5 & -1 & 3 \end{bmatrix} \longrightarrow (2)$$

From eq # (1) & (2)

$$L.H.S = R.H.S$$

$$2A + B = A + (A + B)$$

Hence proved Sir.

Q#5 (vii)

$$(C - B) - A = (C - A) - B$$

Sol// $(C-B)-A = (C-A)-B$

$$L.H.S = (C-B)-A$$

$$= \left(\begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 3 \\ 1 & 1 & 2 \end{bmatrix} - \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix} \right) - \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 1 & -1 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} -1-1 & 0-(-1) & 0-1 \\ 0-2 & -2-(-2) & 3-2 \\ 1-3 & 1-1 & 2-3 \end{bmatrix} - \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 1 & -1 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} -2 & 1 & -1 \\ -2 & 0 & 1 \\ -2 & 0 & -1 \end{bmatrix} - \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 1 & -1 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} -2-1 & 1-2 & -1-3 \\ -2-2 & 0-3 & 1-1 \\ -2-1 & 0-(-1) & -1-0 \end{bmatrix}$$

$$= \begin{bmatrix} -3 & -1 & -4 \\ -4 & -3 & 0 \\ -3 & 1 & -1 \end{bmatrix} \longrightarrow (1)$$

$$R.H.S = (C-A)-B$$

$$= \left(\begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 3 \\ 1 & 1 & 2 \end{bmatrix} - \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 1 & -1 & 0 \end{bmatrix} \right) - \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} -1-1 & 0-2 & 0-3 \\ 0-2 & -2-3 & 3-1 \\ 1-1 & 1-(-1) & 2-0 \end{bmatrix} - \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} -2 & -2 & -3 \\ -2 & -5 & 2 \\ 0 & 1+1 & 2 \end{bmatrix} - \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} -2 & -2 & -3 \\ -2 & -5 & 2 \\ 0 & 2 & 2 \end{bmatrix} - \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} -2-1 & -2-(-1) & -3-1 \\ -2-2 & -5-(-2) & 2-2 \\ 0-3 & 2-1 & 2-3 \end{bmatrix}$$

$$= \begin{bmatrix} -3 & -2+1 & -4 \\ -4 & -5+2 & 0 \\ -3 & 1 & -1 \end{bmatrix}$$

$$= \begin{bmatrix} -3 & -1 & -4 \\ -4 & -3 & 0 \\ -3 & 1 & -1 \end{bmatrix} \longrightarrow (2)$$

From eq # (1) & (2)

$$L.H.S = R.H.S$$

$$(C-B)-A = (C-A)-B$$

Hence proved Sir.

Q.#5(viii).

$$(A+B)+C = A+(B+C)$$

Sol// $(A+B)+C = A+(B+C)$

$$L.H.S = (A+B)+C$$

$$= \left(\begin{bmatrix}1&2&3\\2&3&1\\1&-1&0\end{bmatrix}+\begin{bmatrix}1&-1&1\\2&-2&2\\3&1&3\end{bmatrix}\right)+\begin{bmatrix}-1&0&0\\0&-2&3\\1&1&2\end{bmatrix}$$

$$= \begin{bmatrix}1+1&2+(-1)&3+1\\2+2&3+(-2)&1+2\\1+3&-1+1&0+3\end{bmatrix}+\begin{bmatrix}-1&0&0\\0&-2&3\\1&1&2\end{bmatrix}$$

$$= \begin{bmatrix}2&2-1&4\\4&3-2&3\\4&0&3\end{bmatrix}+\begin{bmatrix}-1&0&0\\0&-2&3\\1&1&2\end{bmatrix}$$

$$= \begin{bmatrix}2&1&4\\4&1&3\\4&0&3\end{bmatrix}+\begin{bmatrix}-1&0&0\\0&-2&3\\1&1&2\end{bmatrix}$$

$$= \begin{bmatrix}2+(-1)&1+0&4+0\\4+0&1+(-2)&3+3\\4+1&0+1&3+2\end{bmatrix}$$

$$= \begin{bmatrix}2-1&1&4\\4&1-2&6\\5&1&5\end{bmatrix}$$

$$= \begin{bmatrix}1&1&4\\4&-1&6\\5&1&5\end{bmatrix} \longrightarrow (1)$$

$$R.H.S = A+(B+C)$$

$$= \begin{bmatrix}1&2&3\\2&3&1\\1&-1&0\end{bmatrix}+\left(\begin{bmatrix}1&-1&1\\2&-2&2\\3&1&3\end{bmatrix}+\begin{bmatrix}-1&0&0\\0&-2&3\\1&1&2\end{bmatrix}\right)$$

$$= \begin{bmatrix}1&2&3\\2&3&1\\1&-1&0\end{bmatrix}+\begin{bmatrix}1+(-1)&-1+0&1+0\\2+0&-2+(-2)&2+3\\3+1&1+1&3+2\end{bmatrix}$$

$$= \begin{bmatrix}1&2&3\\2&3&1\\1&-1&0\end{bmatrix}+\begin{bmatrix}1-1&-1&1\\2&-2-2&5\\4&2&5\end{bmatrix}$$

$$= \begin{bmatrix}1&2&3\\2&3&1\\1&-1&0\end{bmatrix}+\begin{bmatrix}1&-1&0\\2&-2&3\\3&1&3\end{bmatrix}+\begin{bmatrix}-1&0&0\\0&-2&3\\1&1&2\end{bmatrix}$$

$$= \begin{bmatrix}1&2&3\\2&3&1\\1&-1&0\end{bmatrix}+\begin{bmatrix}0&-1&1\\2&-4&5\\4&2&5\end{bmatrix}$$

$$= \begin{bmatrix}1+0&2+(-1)&3+1\\2+2&3+(-4)&1+5\\1+4&-1+2&0+5\end{bmatrix}$$

$$= \begin{bmatrix}1&2-1&4\\4&3-4&6\\5&1&5\end{bmatrix}$$

$$= \begin{bmatrix}1&1&4\\4&-1&6\\5&1&5\end{bmatrix} \longrightarrow (2)$$

From eq #(1) & (2)

$$L.H.S = R.H.S$$

$$(A+B)+C = A+(B+C)$$

Hence proved.

Q.#5(ix).

$$A+(B-C) = (A-C)+B$$

Sol// $A+(B-C) = (A-C)+B$

$$L.H.S = A+(B-C)$$

$$= \begin{bmatrix}1&2&3\\2&3&1\\1&-1&0\end{bmatrix}+\left(\begin{bmatrix}1&-1&1\\2&-2&2\\3&1&3\end{bmatrix}-\begin{bmatrix}-1&0&0\\0&-2&3\\1&1&2\end{bmatrix}\right)$$

$$= \begin{bmatrix}1&2&3\\2&3&1\\1&-1&0\end{bmatrix}+\begin{bmatrix}1-(-1)&-1-0&1-0\\2-0&-2-(-2)&2-3\\3-1&1-1&3-2\end{bmatrix}$$

$$= \begin{bmatrix}1&2&3\\2&3&1\\1&-1&0\end{bmatrix}+\begin{bmatrix}1+1&-1&1\\2&-2+2&-1\\2&0&1\end{bmatrix}$$

$$= \begin{bmatrix}1&2&3\\2&3&1\\1&-1&0\end{bmatrix}+\begin{bmatrix}2&-1&1\\2&0&-1\\2&0&1\end{bmatrix}$$

$$= \begin{bmatrix}1+2&2+(-1)&3+1\\2+2&3+0&1+(-1)\\1+2&-1+0&0+1\end{bmatrix}$$

$$= \begin{bmatrix} 3 & 2-1 & 4 \\ 4 & 3 & 1-1 \\ 3 & -1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 1 & 4 \\ 4 & 3 & 0 \\ 3 & -1 & 1 \end{bmatrix} \longrightarrow (1)$$

$$R.H.S = (A-C)+B$$

$$= \left(\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 1 & -1 & 0 \end{bmatrix} - \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 3 \\ 1 & 1 & 2 \end{bmatrix} \right) + \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 1-(-1) & 2-0 & 3-0 \\ 2-0 & 3-(-2) & 1-3 \\ 1-1 & -1-1 & 0-2 \end{bmatrix} + \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 1+1 & 2 & 3 \\ 2 & 3+2 & -2 \\ 0 & -2 & -2 \end{bmatrix} + \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 2 & 2 & 3 \\ 2 & 5 & -2 \\ 0 & -2 & -2 \end{bmatrix} + \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 2+1 & 2+(-1) & 3+1 \\ 2+2 & 5+(-2) & -2+2 \\ 0+3 & -2+1 & -2+3 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 2-1 & 4 \\ 4 & 5-2 & 0 \\ 3 & -1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 1 & 4 \\ 4 & 3 & 0 \\ 3 & -1 & 1 \end{bmatrix} \longrightarrow (2)$$

From eq # (1) & (2)

$L.H.S = R.H.S$

$A+(B-C) = (A-C)+B$

Hence proved nic.

Q#5(x).

$$2A+2B = 2(A+B)$$

Sol// $2A+2B = 2(A+B)$

$$L.H.S = 2A+2B$$

$$= 2\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 1 & -1 & 0 \end{bmatrix} + 2\begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 2 & 4 & 6 \\ 4 & 6 & 2 \\ 2 & -2 & 0 \end{bmatrix} + \begin{bmatrix} 2 & -2 & 2 \\ 4 & -4 & 4 \\ 6 & 2 & 6 \end{bmatrix}$$

$$= \begin{bmatrix} 2+2 & 4+(-2) & 6+2 \\ 4+4 & 6+(-4) & 2+4 \\ 2+6 & -2+2 & 0+6 \end{bmatrix}$$

$$= \begin{bmatrix} 4 & 4-2 & 8 \\ 8 & 6-4 & 6 \\ 8 & 0 & 6 \end{bmatrix}$$

$$= \begin{bmatrix} 4 & 2 & 8 \\ 8 & 2 & 6 \\ 8 & 0 & 6 \end{bmatrix} \longrightarrow (1)$$

$$R.H.S = 2(A+B)$$

$$= 2\left(\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 1 & -1 & 0 \end{bmatrix} + \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix} \right)$$

$$= 2\left(\begin{bmatrix} 1+1 & 2+(-1) & 3+1 \\ 2+2 & 3+(-2) & 1+2 \\ 1+3 & -1+1 & 0+3 \end{bmatrix} \right)$$

$$= 2\begin{bmatrix} 2 & 2-1 & 4 \\ 4 & 3-2 & 3 \\ 4 & 0 & 3 \end{bmatrix}$$

$$= 2\begin{bmatrix} 2 & 1 & 4 \\ 4 & 1 & 3 \\ 4 & 0 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 4 & 2 & 8 \\ 8 & 2 & 6 \\ 8 & 0 & 6 \end{bmatrix} \longrightarrow (2)$$

From eq # (1) & (2)

$L.H.S = R.H.S$

$2A+2B = 2(A+B)$ Hence proved nic

Q#8. If $A=\begin{bmatrix}1 & 2\\ 0 & 1\end{bmatrix}$, $B=\begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix}$, then verify that

(i) $(A+B)^t = A^t + B^t$

Sol $(A+B)^t = A^t + B^t$

$L.H.S = (A+B)^t$

$= \left(\begin{bmatrix}1 & 2\\ 0 & 1\end{bmatrix} + \begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix}\right)^t$

$= \left(\begin{bmatrix}1+1 & 2+1\\ 0+2 & 1+0\end{bmatrix}\right)^t$

$= \begin{bmatrix}2 & 3\\ 2 & 1\end{bmatrix}^t$

$= \begin{bmatrix}2 & 2\\ 3 & 1\end{bmatrix}$ ⟶ ①

$R.H.S = A^t + B^t$

$= \begin{bmatrix}1 & 2\\ 0 & 1\end{bmatrix}^t + \begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix}^t$

$= \begin{bmatrix}1 & 0\\ 2 & 1\end{bmatrix} + \begin{bmatrix}1 & 2\\ 1 & 0\end{bmatrix}$

$= \begin{bmatrix}1+1 & 0+2\\ 2+1 & 1+0\end{bmatrix}$

$= \begin{bmatrix}2 & 2\\ 3 & 1\end{bmatrix}$ ⟶ ②

From eq #① & ②

$L.H.S = R.H.S$

$(A+B)^t = A^t + B^t$

Hence proved

Q#8(ii). Verify that $(A-B)^t = A^t - B^t$

Sol $(A-B)^t = A^t - B^t$

$L.H.S = (A-B)^t$

$= \left(\begin{bmatrix}1 & 2\\ 0 & 1\end{bmatrix} - \begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix}\right)^t$

$= \left(\begin{bmatrix}1-1 & 2-1\\ 0-2 & 1-0\end{bmatrix}\right)^t$

$= \begin{bmatrix}0 & 1\\ -2 & 1\end{bmatrix}^t$

$= \begin{bmatrix}0 & -2\\ 1 & 1\end{bmatrix}$ ⟶ ①

$R.H.S = A^t - B^t$

$= \begin{bmatrix}1 & 2\\ 0 & 1\end{bmatrix}^t - \begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix}^t$

$= \begin{bmatrix}1 & 0\\ 2 & 1\end{bmatrix} - \begin{bmatrix}1 & 2\\ 1 & 0\end{bmatrix}$

$= \begin{bmatrix}1-1 & 0-2\\ 2-1 & 1-0\end{bmatrix}$

$= \begin{bmatrix}0 & -2\\ 1 & 1\end{bmatrix}$ ⟶ ②

From eq #① & ②

$L.H.S = R.H.S$

$(A-B)^t = A^t - B^t$

Hence proved

Q#B(vi). If $B=\begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix}$, then verify that $B-B^t$ is skew symmetric

Sol// If $B-B^t$ is skew symmetric then we have to prove

$$(B-B^t)^t = -(B-B^t)$$

$$L.H.S = (B-B^t)^t$$

$$= \left(\begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix} - \begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix}^t\right)^t$$

$$= \left(\begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix} - \begin{bmatrix}1 & 2\\ 1 & 0\end{bmatrix}\right)^t$$

$$= \left(\begin{bmatrix}1-1 & 1-2\\ 2-1 & 0-0\end{bmatrix}\right)^t$$

$$= \begin{bmatrix}0 & -1\\ 1 & 0\end{bmatrix}^t$$

$$= \begin{bmatrix}1 & 1\\ -1 & 0\end{bmatrix} \longrightarrow (1)$$

$$R.H.S = -(B-B^t)$$

$$= -\left(\begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix} - \begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix}^t\right)$$

$$= -\left(\begin{bmatrix}1 & 1\\ 2 & 0\end{bmatrix} - \begin{bmatrix}1 & 2\\ 1 & 0\end{bmatrix}\right)$$

$$= -\left(\begin{bmatrix}1-1 & 1-2\\ 2-1 & 0-0\end{bmatrix}\right)$$

$$= -\left(\begin{bmatrix}0 & -1\\ 1 & 0\end{bmatrix}\right)$$

$$= \begin{bmatrix}0 & 1\\ -1 & 0\end{bmatrix} \longrightarrow (2)$$

From eq #(1) & (2)

$$L.H.S = R.H.S$$

$$(B-B^t)^t = -(B-B^t)$$

Hence proved that $B-B^t$ is skew symmetric.

EXERCISE # 1.4

Q#1. Which of the following product of matrices is conformable for multiplication?

(i) $\begin{bmatrix}1 & -1\\ 0 & 2\end{bmatrix}\begin{bmatrix}-2\\ 3\end{bmatrix}$

Sol// 2-by-(-2 2)-by-1

If Columns of 1st Matrix is equal to Rows of 2nd Matrix then they are comformable for multiplication.

(ii) $\begin{bmatrix}1 & -1\\ 1 & 0\end{bmatrix}\begin{bmatrix}2 & -1\\ 1 & 3\end{bmatrix}$

Sol// 2-by-(-2 2)-by-2

These matrices are comformable for multiplication.

(iv) $\begin{bmatrix}1 & 2\\ 0 & -1\\ -1 & -2\end{bmatrix}\begin{bmatrix}1 & 0 & -1\\ 0 & 1 & 2\end{bmatrix}$

Sol// 3-by-(-2 2)-by-3

These matrices are comformable for multiplication

(v) $\begin{bmatrix}3 & 2 & 1\\ 0 & 1 & -1\end{bmatrix}\begin{bmatrix}1 & -1\\ 0 & 2\\ -2 & 3\end{bmatrix}$

Sol// 2-by-(3 3)-by-2

These matrices are comformable for multiplication.

Q#4. Multiply the following matrices.

(a) $\begin{bmatrix} 2 & 3 \\ 1 & 1 \\ 0 & -2 \end{bmatrix}\begin{bmatrix} 2 & -1 \\ 3 & 0 \end{bmatrix}$

Sol//

$$= \begin{bmatrix} (2)(2)+(3)(3) & (2)(-1)+(3)(0) \\ (1)(2)+(1)(3) & (1)(-1)+(1)(0) \\ (0)(2)+(-2)(3) & (0)(-1)+(-2)(0) \end{bmatrix}$$

$$= \begin{bmatrix} 4+9 & -2+0 \\ 2+3 & -1+0 \\ 0-6 & 0+0 \end{bmatrix}$$

$$= \begin{bmatrix} 13 & -2 \\ 5 & -1 \\ -6 & 0 \end{bmatrix}$$ Answer is.

(d) $\begin{bmatrix} 8 & 5 \\ 6 & 4 \end{bmatrix}\begin{bmatrix} 2 & -\frac{5}{2} \\ -4 & 4 \end{bmatrix}$

Sol//

$$= \begin{bmatrix} (8)(2)+(5)(-4) & (8)\left(\frac{-5}{2}\right)+(5)(4) \\ (6)(2)+(4)(-4) & (6)\left(\frac{-5}{2}\right)+(4)(4) \end{bmatrix}$$

$$= \begin{bmatrix} 16-20 & -20+20 \\ 12-16 & -15+16 \end{bmatrix}$$

$$= \begin{bmatrix} -4 & 0 \\ -4 & 1 \end{bmatrix}$$ Answer is.

(e) $\begin{bmatrix} -1 & 2 \\ 1 & 3 \end{bmatrix}\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

Sol//

$$= \begin{bmatrix} (-1)(0)+(2)(0) & (-1)(0)+(2)(0) \\ (1)(0)+(3)(0) & (1)(0)+(3)(0) \end{bmatrix}$$

$$= \begin{bmatrix} 0+0 & 0+0 \\ 0+0 & 0+0 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$ Answer is.

Q#5. Let $A=\begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}$, $B=\begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix}$ and $C=\begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$ Verify whether

(ii) $A(BC) = (AB)C$

Sol// $A(BC) = (AB)C$

L.H.S $= A(BC)$

$$= \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}\left(\begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix}\begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}\right)$$

$$= \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}\begin{bmatrix} (1)(2)+(2)(1) & (1)(1)+(2)(3) \\ (-3)(2)+(-5)(1) & (-3)(1)+(-5)(3) \end{bmatrix}$$

$$= \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}\begin{bmatrix} 2+2 & 1+6 \\ -6-5 & -3-15 \end{bmatrix}$$

$$= \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}\begin{bmatrix} 4 & 7 \\ -11 & -18 \end{bmatrix}$$

$$= \begin{bmatrix} (-1)(4)+(3)(-11) & (-1)(7)+(3)(-18) \\ (2)(4)+(0)(-11) & (2)(7)+(0)(-19) \end{bmatrix}$$

$$= \begin{bmatrix} -4-33 & -7-54 \\ 8-0 & 14-0 \end{bmatrix}$$

$$= \begin{bmatrix} -37 & -61 \\ 8 & 14 \end{bmatrix}$$ Answer ⟶ (1)

R.H.S = (AB)C

$$= \left(\begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix} \right) \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$$

$$= \left(\begin{bmatrix} (-1)(1)+(3)(-3) & (-1)(2)+(3)(-5) \\ (2)(1)+(0)(-3) & (2)(2)+(0)(-5) \end{bmatrix} \right) \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} -1-9 & -2-15 \\ 2+0 & 4+0 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} -10 & -17 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} (-10)(2)+(-17)(1) & (-10)(1)+(-17)(3) \\ (2)(2)+(4)(1) & (2)(1)+(4)(3) \end{bmatrix}$$

$$= \begin{bmatrix} -20-17 & -10-51 \\ 4+4 & 2+12 \end{bmatrix}$$

$$= \begin{bmatrix} -37 & -61 \\ 8 & 14 \end{bmatrix}$$ ⟶ (2)

From (1) & (2)

L.H.S = R.H.S

A(BC) = (AB)C

Hence proved in.

Q#5(iv). Let $A = \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix}$ and $C = \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$ verify

$$A(B-C) = AB - AC$$

Sol// $A(B-C) = AB - AC$

L.H.S = A(B-C)

$$= \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix} \left(\begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix} - \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix} \right)$$

$$= \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix} \begin{bmatrix} 1-2 & 2-1 \\ -3-1 & -5-3 \end{bmatrix}$$

$$= \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix} \begin{bmatrix} -1 & 1 \\ -4 & -8 \end{bmatrix}$$

$$= \begin{bmatrix} (-1)(-1)+(3)(-4) & (-1)(1)+(3)(-8) \\ (2)(-1)+(0)(-4) & (2)(1)+(0)(-8) \end{bmatrix}$$

$$= \begin{bmatrix} 1-12 & -1-24 \\ -2-0 & 2-0 \end{bmatrix}$$

$$= \begin{bmatrix} -11 & -25 \\ -2 & 2 \end{bmatrix}$$ ⟶ (1)

R.H.S = AB - AC

$$= \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix} - \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} (-1)(1)+(3)(-3) & (-1)(2)+(3)(-5) \\ (2)(1)+(0)(-3) & (2)(2)+(0)(-5) \end{bmatrix} - \begin{bmatrix} (-1)(2)+(3)(1) & (-1)(1)+(3)(3) \\ (2)(2)+(0)(1) & (2)(1)+(0)(3) \end{bmatrix}$$

$$= \begin{bmatrix} -1-9 & -2-15 \\ 2-0 & 4-0 \end{bmatrix} - \begin{bmatrix} -2+3 & -1+9 \\ 4+0 & 2+0 \end{bmatrix}$$

$$= \begin{bmatrix} -10 & -17 \\ 2 & 4 \end{bmatrix} - \begin{bmatrix} 1 & 8 \\ 4 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} -10-1 & -17-8 \\ 2-4 & 4-2 \end{bmatrix}$$

$$= \begin{bmatrix} -11 & -25 \\ -2 & 2 \end{bmatrix} \longrightarrow (2)$$

From (1) & (2)

L.H.S = R.H.S

$A(B-C) = AB - AC$

Hence proved sir.

Q#6(ii) For the Matrices

$A = \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix}$, $C = \begin{bmatrix} -2 & 6 \\ 3 & -9 \end{bmatrix}$

Verify that

(ii) $(BC)^t = C^t B^t$

Sol// $(BC)^t = C^t B^t$

L.H.S $= (BC)^t$

$$= \left(\begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix} \begin{bmatrix} -2 & 6 \\ 3 & -9 \end{bmatrix} \right)^t$$

$$= \left(\begin{bmatrix} (1)(-2)+(2)(3) & (1)(6)+(2)(-9) \\ (-3)(-2)+(-5)(3) & (-3)(6)+(-5)(-9) \end{bmatrix} \right)^t$$

$$= \begin{bmatrix} -2+6 & 6-18 \\ 6-15 & -18+45 \end{bmatrix}^t$$

$$= \begin{bmatrix} 4 & -12 \\ -9 & 27 \end{bmatrix}^t$$

$$= \begin{bmatrix} 4 & -9 \\ -12 & 27 \end{bmatrix} \longrightarrow (1)$$

R.H.S $= C^t B^t$

$$= \begin{bmatrix} -2 & 6 \\ 3 & -9 \end{bmatrix}^t \begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix}^t$$

$$= \begin{bmatrix} -2 & 3 \\ 6 & -9 \end{bmatrix} \begin{bmatrix} 1 & -3 \\ 2 & -5 \end{bmatrix}$$

$$= \begin{bmatrix} (-2)(1)+(3)(2) & (-2)(-3)+(3)(-5) \\ (6)(1)+(-9)(2) & (6)(-3)+(-9)(-5) \end{bmatrix}$$

$$= \begin{bmatrix} -2+6 & 6-15 \\ 6-18 & -18+45 \end{bmatrix}$$

$$= \begin{bmatrix} 4 & -9 \\ -12 & 27 \end{bmatrix} \longrightarrow (2)$$

From (1) & (2)

L.H.S = R.H.S

$(BC)^t = C^t B^t$

Hence proved sir.

Singular Matrix:

A square matrix A is called singular, if the determinat of A is equal to zero. i.e, $|A| = 0$.

Non-Singular Matrix:

A square matrix A is called non-singular Matrix, if the determinant of A is not equal to zero. i.e $|A| \neq 0$

EXERCISE # 1.5

Q#1. Find the determinant of the following matrices.

(ii) $B = \begin{bmatrix} 1 & 3 \\ 2 & -2 \end{bmatrix}$

Sol//

$B = \begin{bmatrix} 1 & 3 \\ 2 & -2 \end{bmatrix}$

$|B| = \begin{vmatrix} 1 & 3 \\ 2 & -2 \end{vmatrix}$

$|B| = (1)(-2) - (2)(3)$

$|B| = -2 - 6$

$\boxed{|B| = -8}$ Answer.

Q#2. Find which of the following matrices are singular or non-singular?

(i) $A = \begin{bmatrix} 3 & 6 \\ 2 & 4 \end{bmatrix}$

Sol//

$A = \begin{bmatrix} 3 & 6 \\ 2 & 4 \end{bmatrix}$

$|A| = \begin{vmatrix} 3 & 6 \\ 2 & 4 \end{vmatrix}$

$|A| = (3)(4) - (2)(6)$

$|A| = 12 - 12$

$\boxed{|A| = 0}$ singular Matrix

(ii) $B = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$

Sol//

$B = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$

$|B| = \begin{vmatrix} 4 & 1 \\ 3 & 2 \end{vmatrix}$

$|B| = (4)(2) - (3)(1)$

$|B| = 8 - 3$

$\boxed{|B| = 5}$ non-singular matrix

(iv) $D = \begin{bmatrix} 5 & -10 \\ -2 & 4 \end{bmatrix}$

Sol//

$D = \begin{bmatrix} 5 & -10 \\ -2 & 4 \end{bmatrix}$

$|D| = \begin{vmatrix} 5 & -10 \\ -2 & 4 \end{vmatrix}$

$|D| = (5)(4) - (-2)(-10)$

$|D| = 20 - 20$

$\boxed{|D| = 0}$ singular matrix

Q#3. Find the multiplicative inverse (if it exists) of each.

(i) $A = \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}$

Sol// $A^{-1} = ?$

$A^{-1} = \frac{1}{|A|}$ adj of $A \longrightarrow (1)$

$$A=\begin{bmatrix}-1 & 3\\ 2 & 0\end{bmatrix}$$

$$|A|=\begin{vmatrix}-1 & 3\\ 2 & 0\end{vmatrix}$$

$$|A| = (-1)(0)-(2)(3)$$

$$|A| = 0-6$$

$$|A| = -6$$

$$A=\begin{bmatrix}-1 & 3\\ 2 & 0\end{bmatrix}$$

$$\text{Adj of } A=\begin{bmatrix}0 & -3\\ -2 & -1\end{bmatrix}$$

① $\Rightarrow$ $A^{-1}=\frac{1}{|A|}\text{adj of } A$

$$A^{-1}=\frac{1}{-6}\begin{bmatrix}0 & -3\\ -2 & -1\end{bmatrix}$$

$$A^{-1}=\begin{bmatrix}\frac{0}{-6} & \frac{-3}{-6}\\ \frac{-2}{-6} & \frac{-1}{-6}\end{bmatrix}$$

$$A^{-1}=\begin{bmatrix}0 & \frac{1}{2}\\ \frac{1}{3} & \frac{1}{6}\end{bmatrix}$$ Answer Sir.

Q#3(iii). $C=\begin{bmatrix}-2 & 6\\ 3 & -9\end{bmatrix}$

Sol// $C^{-1}=?$

$$C^{-1}=\frac{1}{|C|}\text{adj of } C \longrightarrow ①$$

$$C=\begin{bmatrix}-2 & 6\\ 3 & -9\end{bmatrix}$$

$$|C|=\begin{vmatrix}-2 & 6\\ 3 & -9\end{vmatrix}$$

$$|C| = (-2)(-9)-(3)(6)$$

$$|C| = 18-18$$

$$\boxed{|C| = 0}$$

$$C=\begin{bmatrix}-2 & 6\\ 3 & -9\end{bmatrix}$$

$$\text{Adj of } C=\begin{bmatrix}-9 & -6\\ -3 & -2\end{bmatrix}$$

C^{-1} does not exist because C is a singular Matrix.

Q#3(iv). $D=\begin{bmatrix}\frac{1}{2} & \frac{3}{4}\\ 1 & 2\end{bmatrix}$

Sol// $D^{-1}=?$

$$D^{-1}=\frac{1}{|D|}\text{adj of } D \longrightarrow ①$$

$$D=\begin{bmatrix}\frac{1}{2} & \frac{3}{4}\\ 1 & 2\end{bmatrix}$$

$$|D| = \left(\frac{1}{2}\right)(2)-(1)\left(\frac{3}{4}\right)$$

$$|D| = 1-\frac{3}{4}$$

$$|D| = \frac{1}{1}-\frac{3}{4}$$

$$|D| = \frac{4-3}{4}$$

$$\boxed{|D| = \frac{1}{4}}$$

$$D=\begin{bmatrix}\frac{1}{2} & \frac{3}{4}\\ 1 & 2\end{bmatrix}$$

$$\text{Adj of } D=\begin{bmatrix}2 & -\frac{3}{4}\\ -1 & \frac{1}{2}\end{bmatrix}$$

① $\Rightarrow$ $D^{-1}=\frac{1}{|D|}\text{adj of } D$

$$D^{-1}=\frac{1}{\frac{1}{4}}\begin{bmatrix}2 & -\frac{3}{4}\\ -1 & \frac{1}{2}\end{bmatrix}$$

$$D^{-1}=4\begin{bmatrix}2 & -\frac{3}{4}\\ -1 & \frac{1}{2}\end{bmatrix}$$

$$D^{-1}=\begin{bmatrix}4(2) & 4\left(-\frac{3}{4}\right)\\ 4(-1) & 4\left(\frac{1}{2}\right)\end{bmatrix}$$

$$D^{-1}=\begin{bmatrix}8 & -3\\ -4 & 2\end{bmatrix}$$ Answer Sir.

Q#6. If $A=\begin{bmatrix}4 & 0\\ -1 & 2\end{bmatrix}$, $B=\begin{bmatrix}-4 & -2\\ 1 & -1\end{bmatrix}$

then verify that

(i) $(AB)^{-1}=B^{-1}A^{-1}$

Sol// $(AB)^{-1}=B^{-1}A^{-1}$

$L.H.S=(AB)^{-1}$

First we find AB

$$AB=\begin{bmatrix}4 & 0\\ -1 & 2\end{bmatrix}\begin{bmatrix}-4 & -2\\ 1 & -1\end{bmatrix}$$

$$AB=\begin{bmatrix}(4)(-4)+(0)(1) & (4)(-2)+(0)(-1)\\ (-1)(4)+(2)(1) & (-1)(-2)+(2)(-1)\end{bmatrix}$$

$$AB=\begin{bmatrix}-16+0 & -8+0\\ 4+2 & 2-2\end{bmatrix}$$

$$AB=\begin{bmatrix}-16 & -8\\ 6 & 0\end{bmatrix}$$

Now find $(AB)^{-1}$

$$(AB)^{-1}=\frac{1}{|AB|}\text{ adj of }AB$$

$$AB=\begin{bmatrix}-16 & -8\\ 6 & 0\end{bmatrix}$$

$$|AB|=\begin{vmatrix}-16 & -8\\ 6 & 0\end{vmatrix}$$

$|AB|=(-16)(0)-(6)(-8)$

$|AB|=0+48$

$\boxed{|AB|=48}$

$$AB=\begin{bmatrix}-16 & -8\\ 6 & 0\end{bmatrix}$$

$$\boxed{\text{Adj of } AB=\begin{bmatrix}0 & 8\\ -6 & -16\end{bmatrix}}$$

Now put the values of $|AB|$ and adj of AB in above equation

$$(AB)^{-1}=\frac{1}{|AB|}\text{ adj of }AB$$

$$(AB)^{-1}=\frac{1}{48}\begin{bmatrix}0 & 8\\ -6 & -16\end{bmatrix}$$

$$(AB)^{-1}=\begin{bmatrix}\frac{0}{48} & \frac{8}{48}\\ \frac{-6}{48} & \frac{-16}{48}\end{bmatrix}$$

$$(AB)^{-1}=\begin{bmatrix}0 & \frac{1}{6}\\ -\frac{1}{8} & -\frac{1}{3}\end{bmatrix}\longrightarrow(1)$$

$R.H.S=B^{-1}A^{-1}$

First we find A^{-1} & B^{-1}

$\Rightarrow A^{-1}=?$

$$A^{-1}=\frac{1}{|A|}\text{ adj of }A$$

$$A=\begin{bmatrix}4 & 0\\ -1 & 2\end{bmatrix}$$

$$|A|=\begin{vmatrix}4 & 0\\ -1 & 2\end{vmatrix}$$

$|A|=(4)(2)-(-1)(0)$

$|A|=8+0$

$\boxed{|A|=8}$

$$A=\begin{bmatrix}4 & 0\\ -1 & 2\end{bmatrix}$$

$$\boxed{\text{Adj of } A=\begin{bmatrix}2 & 0\\ 1 & 4\end{bmatrix}}$$

Now put the values of $|A|$ and adj of A in above equation

$$A^{-1}=\frac{1}{|A|}\text{ adj of }A$$

$$A^{-1}=\frac{1}{8}\begin{bmatrix}2 & 0\\ 1 & 4\end{bmatrix}\longrightarrow(2)$$

Now we find B^{-1}

$\Rightarrow B^{-1}=?$

$$B^{-1}=\frac{1}{|B|}\text{ adj of }B$$

$$B=\begin{bmatrix}-4 & -2\\ 1 & -1\end{bmatrix}$$

$$|B|=\begin{vmatrix}-4 & -2\\ 1 & -1\end{vmatrix}$$

$|B|=(-4)(-1)-(1)(-2)$

$|B|=4+2$

$\boxed{|B|=6}$

$$B=\begin{bmatrix}-4 & -2\\ 1 & -1\end{bmatrix}$$

$$\text{Adj of } B=\begin{bmatrix}-1 & 2\\ -1 & -4\end{bmatrix}$$

Now put the values of $|B|$ and Adj of B in above equation.

$$B^{-1} = \frac{1}{|B|} \text{ adj of } B$$

$$B^{-1} = \frac{1}{6}\begin{bmatrix} -1 & 2 \\ -1 & -4 \end{bmatrix} \longrightarrow (b)$$

Now find $B^{-1}A^{-1}$

$$B^{-1}A^{-1} = \frac{1}{6}\begin{bmatrix} -1 & 2 \\ -1 & 4 \end{bmatrix}\frac{1}{8}\begin{bmatrix} 2 & 0 \\ 1 & 4 \end{bmatrix}$$ using equation #(a) & (b)

$$B^{-1}A^{-1} = \frac{1}{6\times 8}\begin{bmatrix} -1 & 2 \\ -1 & -4 \end{bmatrix}\begin{bmatrix} 2 & 0 \\ 1 & 4 \end{bmatrix}$$

$$B^{-1}A^{-1} = \frac{1}{48}\begin{bmatrix} (-1)(2)+(2)(1) & (-1)(0)+(2)(4) \\ (-1)(2)+(-4)(1) & (-1)(0)+(-4)(4) \end{bmatrix}$$

$$B^{-1}A^{-1} = \frac{1}{48}\begin{bmatrix} -2+2 & 0+8 \\ -2-4 & 0-16 \end{bmatrix}$$

$$B^{-1}A^{-1} = \frac{1}{48}\begin{bmatrix} 0 & 8 \\ -6 & -16 \end{bmatrix}$$

$$B^{-1}A^{-1} = \begin{bmatrix} \frac{0}{48} & \frac{8}{48} \\ \frac{-6}{48} & \frac{-16}{48} \end{bmatrix}$$

$$B^{-1}A^{-1} = \begin{bmatrix} 0 & \frac{1}{6} \\ -\frac{1}{8} & -\frac{1}{3} \end{bmatrix} \longrightarrow (2)$$

From equation #(1) & (2)

L.H.S = R.H.S

$(AB)^{-1} = B^{-1}A^{-1}$

Hence proved.

Q#6. If $A=\begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix}$, $B=\begin{bmatrix} -4 & -2 \\ 1 & -1 \end{bmatrix}$

$$D=\begin{bmatrix} 3 & 1 \\ -2 & 2 \end{bmatrix}$$

then verify that $(DA)^{-1} = A^{-1}D^{-1}$

Sol//

$$(DA)^{-1} = A^{-1}D^{-1}$$

$$L.H.S = (DA)^{-1}$$

First we find DA

$$DA = \begin{bmatrix} 3 & 1 \\ -2 & 2 \end{bmatrix}\begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix}$$

$$DA = \begin{bmatrix} (3)(4)+(1)(-1) & (3)(0)+(1)(2) \\ (-2)(4)+(2)(-1) & (-2)(0)+(2)(2) \end{bmatrix}$$

$$DA = \begin{bmatrix} 12-1 & 0+2 \\ -8-2 & 0+4 \end{bmatrix}$$

$$DA = \begin{bmatrix} 11 & 2 \\ -10 & 4 \end{bmatrix}$$

Now find $(DA)^{-1}$

$$(DA)^{-1} = \frac{1}{|DA|} \text{ adj of } DA$$

$$DA = \begin{bmatrix} 11 & 2 \\ -10 & 4 \end{bmatrix}$$

$$|DA| = \begin{vmatrix} 11 & 2 \\ -10 & 4 \end{vmatrix}$$

$$|DA| = (11)(4)-(-10)(2)$$

$$|DA| = 44+20$$

$$\boxed{|DA| = 64}$$

$$DA = \begin{bmatrix} 11 & 2 \\ -10 & 4 \end{bmatrix}$$

$$\text{Adj of } DA = \begin{bmatrix} 4 & -2 \\ 10 & 11 \end{bmatrix}$$

Now put the values of $|DA|$ and adj of DA in above equation

$$(DA)^{-1} = \frac{1}{|DA|} \text{adj of } DA$$

$$(DA)^{-1} = \frac{1}{64}\begin{bmatrix} 4 & -2 \\ 10 & 11 \end{bmatrix}$$

$$(DA)^{-1} = \begin{bmatrix} \frac{4}{64} & \frac{-2}{64} \\ \frac{10}{64} & \frac{11}{64} \end{bmatrix}$$

$$(DA)^{-1} = \begin{bmatrix} \frac{1}{16} & \frac{-1}{32} \\ \frac{5}{32} & \frac{11}{64} \end{bmatrix} \longrightarrow (1)$$

R.H.S $= A^{-1}D^{-1}$

First we find A^{-1} & D^{-1}

$\Rightarrow A^{-1} = ?$

$$A^{-1} = \frac{1}{|A|} \text{adj of } A$$

$$A = \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix}$$

$$|A| = \begin{vmatrix} 4 & 0 \\ -1 & 2 \end{vmatrix}$$

$$|A| = (4)(2) - (-1)(0)$$

$$\therefore |A| = 8 + 0$$

$$\boxed{|A| = 8}$$

$$A = \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix}$$

$$\boxed{\text{Adj of } A = \begin{bmatrix} 2 & 0 \\ 1 & 4 \end{bmatrix}}$$

Now put the values of $|A|$ and adj of A in above equation

$$A^{-1} = \frac{1}{|A|} \text{adj of } A$$

$$A^{-1} = \frac{1}{8}\begin{bmatrix} 2 & 0 \\ 1 & 4 \end{bmatrix} \longrightarrow (a)$$

Now we find D^{-1}

$\Rightarrow D^{-1} = ?$

$$D^{-1} = \frac{1}{|D|} \text{adj of } D$$

$$D = \begin{bmatrix} 3 & 1 \\ -2 & 2 \end{bmatrix}$$

$$|D| = \begin{vmatrix} 3 & 1 \\ -2 & 2 \end{vmatrix}$$

$$|D| = (3)(2) - (-2)(1)$$

$$|D| = 6 + 2$$

$$|D| = 8$$

$$D = \begin{bmatrix} 3 & 1 \\ -2 & 2 \end{bmatrix}$$

$$\text{Adj of } D = \begin{bmatrix} 2 & -1 \\ 2 & 3 \end{bmatrix}$$

Now put the values of $|D|$ and adj of D in above equation

$$D^{-1} = \frac{1}{|D|} \text{adj of } D$$

$$D^{-1} = \frac{1}{8}\begin{bmatrix} 2 & -1 \\ 2 & 3 \end{bmatrix} \longrightarrow (b)$$

Now find $A^{-1}D^{-1}$

$$A^{-1}D^{-1} = \frac{1}{8}\begin{bmatrix} 2 & 0 \\ 1 & 4 \end{bmatrix}\frac{1}{8}\begin{bmatrix} 2 & -1 \\ 2 & 3 \end{bmatrix}$$

$$A^{-1}D^{-1} = \frac{1}{8\times 8}\begin{bmatrix} 2 & 0 \\ 1 & 4 \end{bmatrix}\begin{bmatrix} 2 & -1 \\ 2 & 3 \end{bmatrix}$$

$$A^{-1}D^{-1} = \frac{1}{64}\begin{bmatrix} (2)(2)+(0)(2) & (2)(-1)+(0)(3) \\ (1)(2)+(4)(2) & (1)(-1)+(4)(3) \end{bmatrix}$$

$$A^{-1}D^{-1} = \frac{1}{64}\begin{bmatrix} 4+0 & -2+0 \\ 2+8 & -1+12 \end{bmatrix}$$

$$A^{-1}D^{-1} = \frac{1}{64}\begin{bmatrix} 4 & -2 \\ 10 & 11 \end{bmatrix}$$

$$A^{-1}D^{-1} = \begin{bmatrix} \frac{4}{64} & \frac{-2}{64} \\ \frac{10}{64} & \frac{11}{64} \end{bmatrix}$$

$$A^{-1}D^{-1} = \begin{bmatrix} \frac{1}{16} & \frac{-1}{32} \\ \frac{5}{32} & \frac{11}{64} \end{bmatrix} \longrightarrow (2)$$

From equation # (1) & (2)

L.H.S = R.H.S

$(DA)^{-1} = A^{-1}D^{-1}$ Hence proved

REVIEW EXERCISE 1

Q#3. If $\begin{bmatrix} a+3 & 4 \\ 6 & b-1 \end{bmatrix} = \begin{bmatrix} -3 & 4 \\ 6 & 2 \end{bmatrix}$, then find a and b.

Sol//

$$\begin{bmatrix} a+3 & 4 \\ 6 & b-1 \end{bmatrix} = \begin{bmatrix} -3 & 4 \\ 6 & 2 \end{bmatrix}$$

Compare both sides

$a+3 = -3$, $b-1 = 2$

$a = -3-3$, $b = 2+1$

$\boxed{a = -6}$ Answer No. $\boxed{b = 3}$ Answer No.

Q#5. Find the value of X, if $\begin{bmatrix} 2 & 1 \\ 3 & -3 \end{bmatrix} + X = \begin{bmatrix} 4 & -2 \\ -1 & -2 \end{bmatrix}$

Sol//

$$\begin{bmatrix} 2 & 1 \\ 3 & -3 \end{bmatrix} + X = \begin{bmatrix} 4 & -2 \\ -1 & -2 \end{bmatrix}$$

$$X = \begin{bmatrix} 4 & -2 \\ -1 & -2 \end{bmatrix} - \begin{bmatrix} 2 & 1 \\ 3 & -3 \end{bmatrix}$$

$$X = \begin{bmatrix} 4-2 & -2-1 \\ -1-3 & -2-(-3) \end{bmatrix}$$

$$X = \begin{bmatrix} 2 & -3 \\ -4 & -2+3 \end{bmatrix}$$

$$X = \begin{bmatrix} 2 & -3 \\ -4 & 1 \end{bmatrix}$$ Answer No.

Q#7. If $A = \begin{bmatrix} 3 & 2 \\ 1 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 4 \\ -3 & -5 \end{bmatrix}$, then verify that

$$(AB)^{-1} = B^{-1}A^{-1}$$

Sol// $(AB)^{-1} = B^{-1}A^{-1}$

$L.H.S = (AB)^{-1}$

First we find AB

$$AB = \begin{bmatrix} 3 & 2 \\ 1 & -1 \end{bmatrix}\begin{bmatrix} 2 & 4 \\ -3 & -5 \end{bmatrix}$$

$$AB = \begin{bmatrix} (3)(2)+(2)(-3) & (3)(4)+(2)(-5) \\ (1)(2)+(-1)(-3) & (1)(4)+(-1)(-5) \end{bmatrix}$$

$$AB = \begin{bmatrix} 6-6 & 12-10 \\ 2+3 & 4+5 \end{bmatrix}$$

$$AB = \begin{bmatrix} 0 & 2 \\ 5 & 9 \end{bmatrix}$$

Now find $(AB)^{-1}$

$$(AB)^{-1} = \frac{1}{|AB|}\text{ adj of } AB$$

$$AB = \begin{bmatrix} 0 & 2 \\ 5 & 9 \end{bmatrix}$$

$$|AB| = \begin{vmatrix} 0 & 2 \\ 5 & 9 \end{vmatrix}$$

$$|AB| = (0)(9)-(5)(2)$$

$$|AB| = 0-10$$

$$\boxed{|AB| = -10}$$

$AB = \begin{bmatrix} 0 & 2 \\ 5 & 9 \end{bmatrix}$

adj of $AB = \begin{bmatrix} 9 & -2 \\ -5 & 0 \end{bmatrix}$

Now put the values of $|AB|$ and adj of AB in above equation

$$(AB)^{-1} = \frac{1}{|AB|}\text{ adj of } AB$$

$$(AB)^{-1} = \frac{1}{-10}\begin{bmatrix} 9 & -2 \\ -5 & 0 \end{bmatrix}$$

$$(AB)^{-1} = \begin{bmatrix} \frac{9}{-10} & \frac{-2}{-10} \\ \frac{-5}{-10} & \frac{0}{-10} \end{bmatrix}$$

$$(AB)^{-1} = \begin{bmatrix} -\frac{9}{10} & \frac{1}{5} \\ \frac{1}{2} & 0 \end{bmatrix} \longrightarrow (1)$$

$$R.H.S = B^{-1}A^{-1}$$

First we find B^{-1} & A^{-1}.

$\Rightarrow B^{-1} = ?$

$$B^{-1} = \frac{1}{|B|}\text{adj of } B$$

$$B = \begin{bmatrix} 2 & 4 \\ -3 & -5 \end{bmatrix}$$

$$|B| = \begin{vmatrix} 2 & 4 \\ -3 & -5 \end{vmatrix}$$

$$|B| = (2)(-5) - (-3)(4)$$

$$|B| = -10 + 12$$

$$\boxed{|B| = 2}$$

$$B = \begin{bmatrix} 2 & 4 \\ -3 & -5 \end{bmatrix}$$

$$\text{Adj of } B = \begin{bmatrix} -5 & -4 \\ 3 & 2 \end{bmatrix}$$

Now put the values of $|B|$ and adj of B in above equation.

$$B^{-1} = \frac{1}{|B|}\text{adj of } B$$

$$B^{-1} = \frac{1}{2}\begin{bmatrix} -5 & -4 \\ 3 & 2 \end{bmatrix} \longrightarrow (a)$$

Now we find A^{-1}

$\Rightarrow A^{-1} = ?$

$$A^{-1} = \frac{1}{|A|}\text{adj of } A$$

$$A = \begin{bmatrix} 3 & 2 \\ 1 & -1 \end{bmatrix}$$

$$|A| = \begin{vmatrix} 3 & 2 \\ 1 & -1 \end{vmatrix}$$

$$|A| = (3)(-1) - (1)(2)$$

$$|A| = -3 - 2$$

$$\boxed{|A| = -5}$$

$$A = \begin{bmatrix} 3 & 2 \\ 1 & -1 \end{bmatrix}$$

$$\text{Adj of } A = \begin{bmatrix} -1 & -2 \\ -1 & 3 \end{bmatrix}$$

Now put the value of $|A|$ and adj of A in above equation

$$A^{-1} = \frac{1}{|A|}\text{adj of } A$$

$$A^{-1} = \frac{1}{-5}\begin{bmatrix} -1 & -2 \\ -1 & 3 \end{bmatrix} \longrightarrow (b)$$

Now find $B^{-1}A^{-1}$ by using equation @ & (b)

$$B^{-1}A^{-1} = \frac{1}{2}\begin{bmatrix} -5 & -4 \\ 3 & 2 \end{bmatrix}\frac{1}{-5}\begin{bmatrix} -1 & -2 \\ -1 & 3 \end{bmatrix}$$

$$B^{-1}A^{-1} = \frac{1}{(2)\times(-5)}\begin{bmatrix} -5 & -4 \\ 3 & 2 \end{bmatrix}\begin{bmatrix} -1 & -2 \\ -1 & 3 \end{bmatrix}$$

$$B^{-1}A^{-1} = \frac{1}{-10}\begin{bmatrix} (-5)(-1)+(-4)(-1) & (-5)(-2)+(-4)(3) \\ (3)(-1)+(2)(-1) & (3)(-2)+(2)(3) \end{bmatrix}$$

$$B^{-1}A^{-1} = \frac{1}{-10}\begin{bmatrix} 5+4 & 10-12 \\ -3-2 & -6+6 \end{bmatrix}$$

$$B^{-1}A^{-1} = \frac{1}{-10}\begin{bmatrix} 9 & -2 \\ -5 & 0 \end{bmatrix}$$

$$B^{-1}A^{-1} = \begin{bmatrix} \frac{9}{-10} & \frac{-2}{-10} \\ \frac{-5}{-10} & \frac{0}{-10} \end{bmatrix}$$

$$B^{-1}A^{-1} = \begin{bmatrix} \frac{9}{-10} & \frac{1}{5} \\ \frac{1}{2} & 0 \end{bmatrix} \longrightarrow (2)$$

From equation # (1) & (2)

$$L.H.S = R.H.S$$

$$(AB)^{-1} = B^{-1}A^{-1}$$ Hence proved

Q#1 (i) Find the value of "x" and "y" by Crammer's Rule.

$$2x-2y=4 \quad , \quad 3x+2y=6$$

Sol//

$$2x-2y=4$$
$$3x+2y=6$$

$$\begin{bmatrix}2 & -2\\ 3 & 2\end{bmatrix}\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}4\\ 6\end{bmatrix}$$

A X B

$$x=\frac{|A_x|}{|A|} \qquad y=\frac{|A_y|}{|A|}$$

$$A=\begin{bmatrix}2 & -2\\ 3 & 2\end{bmatrix}$$

$$|A|=\begin{vmatrix}2 & -2\\ 3 & 2\end{vmatrix}$$

$$|A|=(2)(2)-(3)(-2)$$

$$|A|=4+6$$

$$\boxed{|A|=10}$$

$$A_x=\begin{bmatrix}4 & -2\\ 6 & 2\end{bmatrix}$$

$$|A_x|=\begin{vmatrix}4 & -2\\ 6 & 2\end{vmatrix}$$

$$|A_x|=(4)(2)-(6)(-2)$$

$$|A_x|=8+12$$

$$\boxed{|A_x|=20}$$

$$A_y=\begin{bmatrix}2 & 4\\ 3 & 6\end{bmatrix}$$

$$|A_y|=\begin{vmatrix}2 & 4\\ 3 & 6\end{vmatrix}$$

$$|A_y|=(2)(6)-(3)(4)$$

$$|A_y|=12-12$$

$$\boxed{|A_y|=0}$$

$$x=\frac{|A_x|}{|A|}$$

$$x=\frac{20}{10}$$

$$\boxed{x=2}$$ Answer

$$y=\frac{|A_y|}{|A|}$$

$$y=\frac{0}{10}$$

$$\boxed{y=0}$$ Answer

Q#1 (iii) Find the value of "x" and "y" by Crammer's Rule.

$$4x+2y=8 \quad , \quad 3x-y=-1$$

Sol//

$$4x+2y=8$$
$$3x-1y=-1$$

$$\begin{bmatrix}4 & 2\\ 3 & -1\end{bmatrix}\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}8\\ -1\end{bmatrix}$$

$$A \quad X \quad B$$

$$x=\frac{|A_x|}{|A|} \qquad y=\frac{|A_y|}{|A|}$$

$$A=\begin{bmatrix}4 & 2\\ 3 & -1\end{bmatrix}$$

$$|A|=\begin{vmatrix}4 & 2\\ 3 & -1\end{vmatrix}$$

$$|A|=(4)(-1)-(3)(2)$$

$$|A|=-4-6$$

$$\boxed{|A|=-10}$$

$$A_x=\begin{bmatrix}8 & 2\\ -1 & -1\end{bmatrix}$$

$$|A_x|=\begin{vmatrix}8 & 2\\ -1 & -1\end{vmatrix}$$

$$|A_x|=(8)(-1)-(-1)(2)$$

$$|A_x|=-8+2$$

$$\boxed{|A_x|=-6}$$

$$A_y=\begin{bmatrix}4 & 8\\ 3 & -1\end{bmatrix}$$

$$|A_y|=\begin{vmatrix}4 & 8\\ 3 & -1\end{vmatrix}$$

$$|A_y|=(4)(-1)-(3)(8)$$

$$|A_y|=-4-24$$

$$\boxed{|A_y|=-28}$$

$$x=\frac{|A_x|}{|A|}$$

$$x=\frac{-6}{-10}$$

$$\boxed{x=\frac{3}{5}}$$ Answer

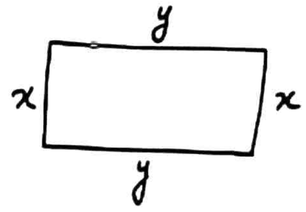
$$y=\frac{|A_y|}{|A|}$$

$$y=\frac{-28}{-10}$$

$$\boxed{y=\frac{14}{5}}$$ Answer

Q#3 Two sides of a rectangle differ by 3.5cm. Find the dimensions of rectangle if its perimeter is 67cm.

ایک مستطیل کے دو اضلاع کی لمبائی میں 3.5 سم کا فرق ہے۔ ان دونوں اضلاع کی لمبائی معلوم کریں۔ جبکہ مستطیل کا احاطہ 67 سم ہے۔



$x - y = 3.5$

$x - y = \frac{35}{10}$

$10(x - y) = 35$

$\boxed{10x - 10y = 35}$

$P = 2(x+y)$

$67 = 2(x+y)$

$67 = 2x + 2y$

$\boxed{2x + 2y = 67}$

$10x - 10y = 35$

$2x + 2y = 67$

$$\begin{bmatrix} 10 & -10 \\ 2 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 35 \\ 67 \end{bmatrix}$$

A X B

$x = \frac{|A_x|}{|A|}$, $y = \frac{|A_y|}{|A|}$

$A = \begin{bmatrix} 10 & -10 \\ 2 & 2 \end{bmatrix}$

$|A| = \begin{vmatrix} 10 & -10 \\ 2 & 2 \end{vmatrix}$

$|A| = (10)(2) - (2)(-10)$

$|A| = 20 + 20$

$\boxed{|A| = 40}$

$A_x = \begin{bmatrix} 35 & -10 \\ 67 & 2 \end{bmatrix}$

$|A_x| = \begin{vmatrix} 35 & -10 \\ 67 & 2 \end{vmatrix}$

$|A_x| = (35)(2) - (67)(-10)$

$|A_x| = 70 + 670$

$\boxed{|A_x| = 740}$

670
+ 70
740

$A_y = \begin{bmatrix} 10 & 35 \\ 2 & 67 \end{bmatrix}$

$|A_y| = \begin{vmatrix} 10 & 35 \\ 2 & 67 \end{vmatrix}$

$|A_y| = (10)(67) - (2)(35)$

$|A_y| = 670 - 70$

$\boxed{|A_y| = 600}$

$x = \frac{|A_x|}{|A|}$

$x = \frac{740}{40}$

$x = \frac{370}{20}$

$x = \frac{185}{10}$

$\boxed{x = \frac{37}{2}}$ Ans

$y = \frac{|A_y|}{|A|}$

$y = \frac{600}{40}$

$y = \frac{30}{2}$

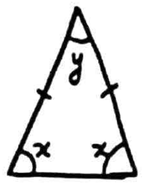
$\boxed{y = 15}$ Ans

37
5 | 185
-15↓
35
-35
x

Q#4 The third angle of an isosceles triangle is 16° less then the sum of the two equal angles. Find three angles of the triangle.

ایک مساوی الساقین مثلث کا تیسرا زاویہ باقی دو برابر زاویوں کے مجموعہ سے 16° کم ہے۔ مثلث کے تینوں زاویوں کی مقدار معلوم کریں

Sol//



$2x - 16 = y$

$\boxed{2x - y = 16}$

$x + x + y = 180^\circ$

$\boxed{2x + y = 180^\circ}$

$2x - 1y = 16$

$2x + 1y = 180$

$$\begin{bmatrix} 2 & -1 \\ 2 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 16 \\ 180 \end{bmatrix}$$

A X B

$x = \frac{|A_x|}{|A|}$, $y = \frac{|A_y|}{|A|}$

$A = \begin{bmatrix} 2 & -1 \\ 2 & 1 \end{bmatrix}$

$|A| = \begin{vmatrix} 2 & -1 \\ 2 & 1 \end{vmatrix}$

$|A| = (2)(1) - (2)(-1)$

$|A| = 2 + 2$

$\boxed{|A| = 4}$

$A_x = \begin{bmatrix} 16 & -1 \\ 180 & 1 \end{bmatrix}$

$|A_x| = \begin{vmatrix} 16 & -1 \\ 180 & 1 \end{vmatrix}$

$|A_x| = (16)(1) - (180)(-1)$

$|A_x| = 16 + 180$

$\boxed{|A_x| = 196}$

$A_y = \begin{bmatrix} 2 & 16 \\ 2 & 180 \end{bmatrix}$

$|A_y| = \begin{vmatrix} 2 & 16 \\ 2 & 180 \end{vmatrix}$

$|A_y| = (2)(180) - (2)(16)$

$|A_y| = 360 - 32$

$\boxed{|A_y| = 328}$

$x = \frac{|A_x|}{|A|}$

$x = \frac{196}{4}$

$\boxed{x = 49}$ Answer

$y = \frac{|A_y|}{|A|}$

$y = \frac{328}{4}$

$\boxed{y = 82}$ Answer

$\frac{180}{360} \times 2$

Q#1(i) Find the value of "x" and "y" by Matrix Inversion (ضربی معکوس) Method.

$2x-2y=4$, $3x+2y=6$

Sol//

$2x-2y=4$

$3x+2y=6$

$$\begin{bmatrix}2 & -2\\ 3 & 2\end{bmatrix}\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}4\\ 6\end{bmatrix}$$

$A \quad X = B$

$X = A^{-1}B \longrightarrow (1)$

$A^{-1} = ?$ $\quad A^{-1} = \frac{1}{|A|}$ adj of A

$$A=\begin{bmatrix}2 & -2\\ 3 & 2\end{bmatrix}$$

$$|A|=\begin{vmatrix}2 & -2\\ 3 & 2\end{vmatrix}$$

$|A| = (2)(2)-(3)(-2)$

$|A| = 4+6$

$\boxed{|A|=10}$

جگہ علامت

$$A=\begin{bmatrix}2 & -2\\ 3 & 2\end{bmatrix}$$

$$\text{Adj of } A=\begin{bmatrix}2 & +2\\ -3 & 2\end{bmatrix}$$

$A^{-1} = \frac{1}{|A|}$ adj of A

$$A^{-1}=\frac{1}{10}\begin{bmatrix}2 & 2\\ -3 & 2\end{bmatrix}$$

$(1) \Rightarrow X = A^{-1}B$

Now putting the values of X, A^{-1} and B

$$\begin{bmatrix}x\\ y\end{bmatrix}=\frac{1}{10}\begin{bmatrix}2 & 2\\ -3 & 2\end{bmatrix}\begin{bmatrix}4\\ 6\end{bmatrix}$$

$$\begin{bmatrix}x\\ y\end{bmatrix}=\frac{1}{10}\begin{bmatrix}(2)(4)+(2)(6)\\ (-3)(4)+(2)(6)\end{bmatrix}$$

$$\begin{bmatrix}x\\ y\end{bmatrix}=\frac{1}{10}\begin{bmatrix}8+12\\ -12+12\end{bmatrix}$$

$$\begin{bmatrix}x\\ y\end{bmatrix}=\frac{1}{10}\begin{bmatrix}20\\ 0\end{bmatrix}$$

$$\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}\frac{20}{10}\\ \frac{0}{10}\end{bmatrix}$$

$$\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}2\\ 0\end{bmatrix}$$

$\boxed{x=2}$, $\boxed{y=0}$

Answer

Q#1(iii) Find the value of "x" and "y" by Matrix Inversion (ضربی معکوس) Method.

$$4x+2y=8 \quad , \quad 3x-y=-1$$

Sol//

$$4x+2y=8$$
$$3x-1y=-1$$

$$\begin{bmatrix}4 & 2\\ 3 & -1\end{bmatrix}\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}8\\ -1\end{bmatrix}$$

$$A \quad X = B$$

$$X = A^{-1}B \rightarrow (1)$$

$A^{-1}=?$

$$A^{-1}=\frac{1}{|A|}\text{ adj of }A$$

(حلقہ) (علامت)

$$A=\begin{bmatrix}4 & 2\\ 3 & -1\end{bmatrix}$$

$$|A|=\begin{vmatrix}4 & 2\\ 3 & -1\end{vmatrix}$$

$$|A|=(4)(-1)-(3)(2)$$

$$|A|=-4-6$$

$$\boxed{|A|=-10}$$

$$A=\begin{bmatrix}4 & 2\\ 3 & -1\end{bmatrix}$$

$$\text{Adj of } A=\begin{bmatrix}-1 & -2\\ -3 & 4\end{bmatrix}$$

$$A^{-1}=\frac{1}{|A|}\text{ adj of }A$$

$$A^{-1}=\frac{1}{-10}\begin{bmatrix}-1 & -2\\ -3 & 4\end{bmatrix}$$

$(1) \Rightarrow X=A^{-1}B$

Now put the value of X, A^{-1} and B

$$\begin{bmatrix}x\\ y\end{bmatrix}=\frac{1}{-10}\begin{bmatrix}-1 & -2\\ -3 & 4\end{bmatrix}\begin{bmatrix}8\\ -1\end{bmatrix}$$

$$\begin{bmatrix}x\\ y\end{bmatrix}=\frac{1}{-10}\begin{bmatrix}(-1)(8)+(-2)(-1)\\ (-3)(8)+(4)(-1)\end{bmatrix}$$

$$\begin{bmatrix}x\\ y\end{bmatrix}=\frac{1}{-10}\begin{bmatrix}-8+2\\ -24-4\end{bmatrix}$$

$$\begin{bmatrix}x\\ y\end{bmatrix}=\frac{1}{-10}\begin{bmatrix}-6\\ -28\end{bmatrix}$$

$$\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}\frac{-6}{-10}\\ \frac{-28}{-10}\end{bmatrix}$$

$$\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}\frac{3}{5}\\ \frac{14}{5}\end{bmatrix}$$

$$\boxed{x=\frac{3}{5}} \quad , \quad \boxed{y=\frac{14}{5}}$$

Answer hai.

Q#1 Use the laws of exponents to simplify $\dfrac{(243)^{-\frac{2}{3}}\,(32)^{-\frac{1}{5}}}{\sqrt{(196)^{-1}}}$

Sol//

$$\frac{(243)^{-\frac{2}{3}}(32)^{-\frac{1}{5}}}{\sqrt{(196)^{-1}}} = \frac{(3^5)^{-\frac{2}{3}}\,(2^5)^{-\frac{1}{5}}}{\left[(196)^{-1}\right]^{1/2}} = \frac{(3)^{-\frac{10}{3}}\,(2)^{-1}}{\left[14^2\right]^{-1/2}}$$

$$= \frac{(3)^{-\frac{10}{3}}\,(2)^{-1}}{(14)^{-1}} = \frac{(14)^1}{(3)^{\frac{10}{3}}\,(2)^1} = \frac{14^7}{(3)^{\frac{10}{3}}\,2_1} = \frac{7}{(3)^{\frac{10}{3}}}$$

$$= \frac{7}{\left(3^{10}\right)^{\frac{1}{3}}} \qquad \frac{10}{3} = 10\times\frac{1}{3}$$

$$= \frac{7}{\left(3^{9+1}\right)^{1/3}} = \frac{7}{\left(3^9\cdot 3^1\right)^{1/3}} = \frac{7}{(3^9)^{\frac{1}{3}}_1\,(3^1)^{1/3}}$$

$$= \frac{7}{3^3\,(3)^{1/3}} = \boxed{\frac{7}{27\sqrt[3]{3}}} \quad \text{Ans}$$

$3^5 = 3\times3\times3\times3\times3$ (9, 27, 81, 243)

$2^5 = 2\times2\times2\times2\times2$ (4, 8, 16, 32)

$14^2 = 14\times14 = 196$

$3^3 = 3\times3\times3$ (9, 27)

$(\ )^{1/3} = \sqrt[3]{\ }$

Q#2. Simplify $\dfrac{(81)^n \cdot 3^5 - (3)^{4n-1}(243)}{(9^{2n})(3^3)}$

Sol//

$$\frac{(81)^n \cdot 3^5 - (3)^{4n-1}(243)}{(9^{2n})(3^3)}$$

$$= \frac{(3^4)^n \cdot 3^5 - (3)^{4n-1}(3^5)}{(3^2)^{2n}(3)^3}$$

$$= \frac{3^{4n} \cdot 3^5 - 3^{4n-1} \cdot 3^5}{3^{4n} \cdot 3^3}$$

$$= \frac{3^{4n+5} - 3^{4n-1+5}}{3^{4n+3}}$$

$$= \frac{3^{4n+5}}{3^{4n+3}} - \frac{3^{4n-1+5}}{3^{4n+3}}$$

$$= 3^{4n+5-4n-3} - 3^{4n-1+5-4n-3}$$

$$= 3^{5-3} - 3^{-1+5-3}$$

$$= 3^2 - 3^1$$

$$= 9 - 3$$

$$= \boxed{6}$$ Answer in.

$3^4 = 3\times3\times3\times3 = 81$ (9, 27, 81)

$3^5 = 3\times3\times3\times3\times3 = 243$ (9, 27, 81, 243)

$3^2 = 3\times3 = 9$ (9)

Q#3. Solve the equations for real "x" and "y".

$$(3-2i)(x+yi) = 2(x-2yi)+2i-1$$

Sol//

$$(3-2i)(x+yi) = 2(x-2yi)+2i-1$$

$$3x+3yi-2xi-2yi^2 = 2x-4yi+2i-1$$

$\because i^2=-1$

$$3x-2y(-1)+3yi-2xi = 2x-1+2i-4yi$$

$$[3x+2y]+i(3y-2x)=[2x-1]+i(2-4y)$$

Compare Real and Imaginery terms

$$3x+2y=2x-1$$
$$3x-2x+2y=-1$$
$$x+2y=-1 \longrightarrow (1)$$

$$3y-2x=2-4y$$
$$-2x+3y+4y=2$$
$$-2x+7y=2 \longrightarrow (2)$$

eq#(1) Multiply by 2

$$2(x+2y)=2(-1)$$
$$2x+4y=-2 \longrightarrow (3)$$

Add eq#2 & eq#(3)

$$-2x+7y=2$$
$$2x+4y=-2$$
$$11y=0$$
$$y=\frac{0}{11}$$
$$\boxed{y=0}\ \text{Ans}$$

put the value of "y" in eq#(1)

$$x+2y=-1$$
$$x+2(0)=-1$$
$$x+0=-1$$
$$\boxed{x=-1}\ \text{Ans}$$

Q#4 Simplify $\left[\frac{32x^{-6}y^{-4}z^{1}}{625x^{4}y^{1}z^{-4}}\right]^{2/5}$

Sol//

$$\left[\frac{32x^{-6}y^{-4}z^{1}}{625x^{4}y^{1}z^{-4}}\right]^{2/5}$$

$$=\left[\frac{2^{5}x^{-6-4}y^{-4-1}z^{1+4}}{5^{4}}\right]^{2/5}$$

$$=\left[\frac{2^{5}x^{-10}y^{-5}z^{5}}{5^{4}}\right]^{2/5}$$

$$=\frac{(2^{5})^{\frac{2}{5}}(x^{-10})^{\frac{2}{5}}(y^{-5})^{\frac{2}{5}}(z^{5})^{\frac{2}{5}}}{(5^{4})^{\frac{2}{5}}}$$

$$=\frac{2^{2}x^{-4}y^{-2}z^{2}}{5^{\frac{8}{5}}}$$

$$=\frac{2^{2}x^{-4}y^{-2}z^{2}}{(5^{8})^{1/5}}$$

$$=\frac{2^{2}x^{-4}y^{-2}z^{2}}{(5^{5+3})^{1/5}}$$

$$=\frac{4x^{-4}y^{-2}z^{2}}{(5^{5}.5^{3})^{1/5}}$$

$$=\frac{4x^{-4}y^{-2}z^{2}}{(5^{5})^{1/5}(5^{3})^{1/5}}$$

$$=\frac{4x^{-4}y^{-2}z^{2}}{5(5)^{3/5}}$$

$$=\boxed{\frac{4z^{2}}{5(5)^{3/5}x^{4}y^{2}}}$$ Answer.

$5^{4}=5\times5\times5\times5$ (25, 125, 625)

$\because \frac{8}{5}=8\times\frac{1}{5}$

Q# 6 Simplify $\sqrt{\dfrac{(216)^{2/3}(25)^{1/2}}{(.04)^{-1/2}}}$

Sol//

$$= \sqrt{\frac{(216)^{2/3}(25)^{1/2}}{(.04)^{-1/2}}}$$

$$= \sqrt{\frac{(6^3)^{2/3}(5^2)^{1/2}}{\left(\frac{04}{100}\right)^{-1/2}}}$$

$$= \sqrt{\frac{(6^2)(5)}{\left(\frac{1}{25}\right)^{-1/2}}}$$

$$= \sqrt{\frac{(6^2)(5)}{\left(\frac{25}{1}\right)^{1/2}}}$$

$$= \sqrt{\frac{(6^2)(5)}{(5^2)^{1/2}}}$$

$$= \sqrt{\frac{(6^2)(\cancel{5})}{(\cancel{5})}}$$

$$= \sqrt{6^2}$$

$$= \boxed{6} \quad \text{Answer.}$$

Q# 7 Simplify $\left(\frac{a^p}{a^q}\right)^{p+q} \cdot \left(\frac{a^q}{a^r}\right)^{q+r} \div 5\left(a^p \cdot a^r\right)^{p-r}$

Sol//

$$\left(\frac{a^p}{a^q}\right)^{p+q} \cdot \left(\frac{a^q}{a^r}\right)^{q+r} \div 5\left(a^p \cdot a^r\right)^{p-r}$$

$$= \left(a^{p-q}\right)^{p+q} \cdot \left(a^{q-r}\right)^{q+r} \div 5\left(a^{p+r}\right)^{p-r}$$

$$= a^{(p-q)(p+q)} \cdot a^{(q-r)(q+r)} \div 5\, a^{(p+r)(p-r)}$$

$$= a^{p^2-q^2} \cdot a^{q^2-r^2} \div 5\, a^{p^2-r^2}$$

$$= \frac{a^{p^2-q^2+q^2-r^2}}{5\, a^{p^2-r^2}}$$

$$= \frac{a^{p^2-r^2-p^2+r^2}}{5} = \frac{a^0}{5} = \boxed{\frac{1}{5}}$$ Answer.

Q#1:- Express each of the following numbers in scientific notation:

عام اعداد کو سائنسی ترقیم میں لکھیں۔

(ii) 416.9

Sol// 4^16.9

$= 4.169 \times 10^2$

(v) 83000

Sol// 8^3000.

$= 8.3 \times 10^4$

Q#2. Express in ordinary notation. عام ترقیم میں لکھیں

(ii) 5.06×10^{10}

Sol// 5.06×10^{10}

$= 5\ 06000000000$

(iii) 9.018×10^{-6}

Sol// 9.018×10^{-6}

$= .000009\ 018$

$= 0.000009018$

Q#2. If $\log 31.09 = 1.4926$ find value

سوال۔ اگر $\log 31.09 = 1.4926$ ہو تو درج ذیل کی قیمت معلوم کریں۔

(iii) $\log 0.003109$ (iv) $\log 0.3109$

Sol// $\log 0.\overrightarrow{003}\hat{1}09$

$= \bar{3}.4926$

Sol// $\log 0.\overrightarrow{3}\hat{1}09$

$= \bar{1}.4926$

Q # 4 (ii) Find the unknown term

سوال (ii) نامعلوم کی قیمت معلوم کریں۔

Sol//

$$\log_a 6 = 0.5$$

$$\log_a 6 = 0.5$$

$$a \longrightarrow 6 = a^{0.5}$$

$$6 = a^{\frac{0.5}{10}}$$

$$6 = a^{\frac{5}{10}}$$

$$6 = a^{\frac{1}{2}}$$

Taking square on both side

$$[6]^2 = [a^{\frac{1}{2}}]^2$$

$$\boxed{36 = a}$$ Answer.

Q#6 Find the x in the following

(i) $\log_2 x = 5$

Sol//

$\log_2 x = 5$ ↑

$x = 2^5$

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

$2 \to 4 \to 8 \to 16 \to 32$

$\boxed{x = 32}$

(iv) $\log_x 64 = 2$

Sol//

$\log_x 64 = 2$ ↑

$64 = x^2$

$8^2 = x^2$

Taking square root on both side

$\sqrt{8^2} = \sqrt{x^2}$

$\boxed{8 = x}$

(v) $\log_3 x = 4$

Sol//

$\log_3 x = 4$ ↑

$x = 3^4$

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

$3 \to 9 \to 27 \to 81$

$\boxed{x = 81}$

Q#1 Write the following into sum or difference

سوال- درج ذیل کو لوگارتھم کے مجموعے یا فرق کی شکل میں لکھیں-

(iii) $\log \frac{25 \times 5}{8}$

(v) $\log \frac{(22)^{1/3}}{5^3}$

(vi) $\log \frac{25 \times 47}{29}$

① $\boxed{\log(m \times n) = \log m + \log n}$ ② $\boxed{\log\left(\frac{m}{n}\right) = \log m - \log n}$

③ $\boxed{\log(m^n) = n \log m}$

Sol// $\log \frac{(25 \times 5)}{8}$

$= \log(25 \times 5) - \log 8$

$= \log 25 + \log 5 - \log 8$

Sol// $\log \frac{(22)^{1/3}}{5^3}$

$= \log(22)^{\frac{1}{3}} - \log 5^3$

$= \frac{1}{3} \log 22 - 3 \log 5$

Sol// $\log \frac{(25 \times 47)}{29}$

$= \log(25 \times 47) - \log 29$

$= \log 25 + \log 47 - \log 29$

Q#3. Write in single logarithm

س3۔ مندرجہ ذیل کو واحد لوگارتھم کی شکل میں لکھیں۔

(ii) $\log 25 - 2\log 3$

Sol//

$\log 25 - 2\log 3$

$= \log 25 - \log 3^2$

$= \log \frac{25}{3^2}$

$3^2 = 3 \times 3 = 9$

$= \boxed{\log \frac{25}{9}}$ Answer

(iv) $\log 5 + \log 6 - \log 2$

Sol//

$\log 5 + \log 6 - \log 2$

$= \log(5 \times 6) - \log 2$

$= \boxed{\log\left(\frac{5 \times 6}{2}\right)}$ Answer

Q#4. Find the value of the following

س۴۔ مندرجہ ذیل کی قیمت معلوم کریں۔

(i) $\log_3 2 \times \log_2 81$

Sol//

$$\log_3 2 \times \log_2 81$$

$$= \log_3 81$$

$$= \log_3 3^4$$

$$= 4 \log_3 3$$

$$= 4(1)$$

$$= \boxed{4} \text{ Answer.}$$

$3^4 = 3 \times 3 \times 3 \times 3$

$3 \to 9 \to 27 \to 81$

(ii) $\log_5 3 \times \log_3 25$

Sol//

$$\log_5 3 \times \log_3 25$$

$$= \log_5 25$$

$$= \log_5 5^2$$

$$= 2 \log_5 5$$

$$= 2(1)$$

$$= \boxed{2} \text{ Answer.}$$

$25 = 5 \times 5 = 5^2$

Q#5. If $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 5 = 0.6990$ then find the values of following

(iii) $\log\sqrt{3\frac{1}{3}}$

Sol//

$\log\sqrt{3\frac{1}{3}}$

$= \log\sqrt{\frac{10}{3}}$

$= \log\left(\frac{10}{3}\right)^{1/2}$

$= \frac{1}{2}\log\left(\frac{10}{3}\right)$

$= \frac{1}{2}[\log 10 - \log 3]$

$= \frac{1}{2}[\log(2\times 5) - \log 3]$

$= \frac{1}{2}[\log 2 + \log 5 - \log 3]$

$= \frac{1}{2}[0.3010 + 0.6990 - 0.4771]$

$= \frac{1}{2}[0.5229]$

$= 0.26145$

$= \boxed{0.2615}$ Answer.

(iv) $\log\frac{8}{3}$

Sol// $\log\frac{8}{3}$

$= \log 8 - \log 3$ $\quad 2^3 = 2\times 2\times 2$

$= \log 2^3 - \log 3$

$= 3\log 2 - \log 3$

$= 3(0.3010) - 0.4771$

$= 0.9030 - 0.4771$

$= \boxed{0.4259}$ Answer.

Q#1 Use the log tables to find value of following.

س۔ لاگ ٹیبل کی مدد سے درج ذیل کی قیمتیں معلوم کریں۔

(i) 0.8176×13.64

Sol// Let

$$x = 0.8176 \times 13.64$$

Taking log on both side

$$\log x = \log(0.8176 \times 13.64)$$

$$\log x = \log 0.8176 + \log 13.64$$

$$\log x = 1.04735$$

$$x = \text{anti log}\,(1.04735)$$

$$x = 11.1519$$

$$\boxed{x = 11.152}$$

Q#1 Use the log tables to find value of following.

س۔ لاگ ٹیبل کی مدد سے درج ذیل کی قیمتیں معلوم کریں۔

(iii) $\dfrac{0.678 \times 9.01}{0.0234}$

Sol// let $x = \dfrac{0.678 \times 9.01}{0.0234}$

Taking log on both side

$$\log x = \log\left(\frac{0.678 \times 9.01}{0.0234}\right)$$

$$\log x = \log(0.678 \times 9.01) - \log 0.0234$$

$$\log x = \log 0.678 + \log 9.01 - \log 0.0234$$

$$\log x = 2.4167$$

$$x = \text{anti}\log(2.4167)$$

$$\boxed{x = 261}$$ Answer.

Q#1 Use the log tables to find value of following.

س۔ لاگ ٹیبل کی مدد سے درج ذیل کی قیمتیں معلوم کریں۔

(v) $\dfrac{(1.23)(0.6975)}{(0.0075)(1278)}$

Sol// Let $x = \dfrac{(1.23)(0.6975)}{(0.0075)(1278)}$

Taking log on both side

$$\log x = \log \frac{(1.23)(0.6975)}{(0.0075)(1278)}$$

$$\log x = \log[(1.23)(0.6975)] - \log[(0.0075)(1278)]$$

$$\log x = \log(1.23) + \log(0.6975) - [\log(0.0075) + \log(1278)]$$

$$\log x = \log(1.23) + \log(0.6975) - \log(0.0075) - \log(1278)$$

$$\log x = 1.0482$$

$$x = \text{antilog}(1.0482)$$

$$\boxed{x = 0.0895}$$

Answer.

Q#1 Use the log tables to find value of following.

س۔ لاگ ٹیبل کی مدد سے درج ذیل کی قیمتیں معلوم کریں۔

(viii) $\dfrac{438\sqrt[3]{0.056}}{(388)^4}$

Sol// Let $x = \dfrac{(438)\sqrt[3]{0.056}}{(388)^4}$

Taking log on both side

$$\log x = \log\left(\frac{(438)\sqrt[3]{0.056}}{(388)^4}\right)$$

$$\log x = \log\left[(438)\sqrt[3]{0.056}\right] - \log(388)^4$$

$$\log x = \log(438)^3 + \log\sqrt[3]{0.056} - \log(388)^4$$

$$\log x = \log(438)^3 + \log(0.056)^{1/3} - \log(388)^4$$

$$\log x = 3\log(438) + \frac{1}{3}\log(0.056) - 4\log(388)$$

$$\log x = 7.9244 + (-0.6259) - 10.3553$$

$$\log x = 7.9244 - 0.6259 - 10.3553$$

$$\log x = -3.0568$$

$$x = \text{anti}\log(-3.0568)$$

$$\boxed{x = 0.0008774}$$

Q#4. If $A = \pi r^2$, find "A" when $\pi = \frac{22}{7}$ and $r = 15$

Sol//

$$A = \pi r^2$$

$$A = \frac{22}{7}(15)^2$$

Taking log on both side

$$\log A = \log \frac{22(15)^2}{7}$$

$$\log A = \log[(22)(15)^2] - \log 7$$

$$\log A = \log(22) + \log(15)^2 - \log 7$$

$$\log A = \log 22 + 2\log 15 - \log 7$$

$$\log A = 2.8494$$

$$A = \text{anti}\log(2.8494)$$

$$\boxed{A = 707.1}$$

Q#3. Find the value of "x" in the following.

(iii) $\log_{625} 5 = \frac{1}{4}x$

Sol//

$\log_{625} 5 = \frac{1}{4}x$

$5 = (625)^{\frac{1}{4}x}$

$625 = 5 \times 5 \times 5 \times 5$

$25 \quad 125 \quad 625$

$5 = (5^4)^{\frac{1}{4}x}$

$5^1 = 5^x$

$\boxed{1 = x}$ Answer.

(iv) $\log_{64} x = -\frac{2}{3}$

Sol//

$\log_{64} x = -\frac{2}{3}$

$x = (64)^{-\frac{2}{3}}$

$4^3 = 4 \times 4 \times 4$

$16 \quad 64$

$\boxed{4^3 = 64}$

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

$x = (4)^{-2}$

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

$x = \frac{1}{(4)(4)}$

$\boxed{x = \frac{1}{16}}$ Answer.

Q#5. If $\log 2 = 0.3010$, $\log 3 = 0.4771$ and $\log 5 = 0.6990$ then find the value of the following

(ii) $\log \frac{16}{15}$

Sol// $\log \frac{16}{15}$

$= \log 16 - \log 15$

$= \log(2)^4 - \log(3 \times 5)$

$= 4\log 2 - [\log 3 + \log 5]$

$= 4\log 2 - \log 3 - \log 5$

$= 4(0.3010) - 0.4771 - 0.6990$

$= 1.2040 - 0.4771 - 0.6990$

$= \boxed{0.0279}$ Answer

Q#6. Use log table to find the value of following

$$\sqrt[3]{25.47}$$

Sol/ Let

$$x = \sqrt[3]{25.47}$$

$$x = (25.47)^{1/3}$$

Taking log on both side

$$\log x = \log (25.47)^{1/3}$$

$$\log x = \frac{1}{3} \log (25.47)$$

$$\log x = \frac{1}{3}(1.4060)$$

$$\log x = 0.4687$$

$$x = \text{antilog}(0.4687)$$

$$\boxed{x = 2.942}$$

Answer.

Q#6 (iii) Use log table to find the value of $\dfrac{(8.97)^3 \times (3.95)^2}{\sqrt[3]{15.37}}$

Sol// let $x = \dfrac{(8.97)^3 \times (3.95)^2}{\sqrt[3]{15.37}}$

Taking log on both sides

$$\log x = \log \frac{[(8.97)^3 \times (3.95)^2]}{\sqrt[3]{15.37}}$$

$$\log x = \log[(8.97)^3 \times (3.95)^2] - \log[\sqrt[3]{15.37}]$$

$$\log x = \log(8.97)^3 + \log(3.95)^2 - \log(15.37)^{1/3}$$

$$\log x = 3\log(8.97) + 2\log(3.95) - \frac{1}{3}\log(15.37)$$

$$\log x = 2.85837 + 1.19319 - 0.39555$$

$$\log x = 3.65601$$

$$x = \text{anti}\log(3.65601)$$

$$x = 4529.08$$

Answer.

Q#1. Identify whether the following algebraic expressions are polynomials (Yes or No)

س۔ مندرجہ ذیل الجبری جملوں میں کثیر رقمی کی نشاندہی کریں۔

(ii) $3x^3 - 4x^2 - x\sqrt{x} + 3$

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

Not a polynomials کثیر رقمی نہیں ہے۔

(iv) $\frac{3x}{2x-1} + 8$

Not a polynomials. کثیر رقمی نہیں ہے

Q#2. State whether each of following expression is rational expression or not.

س۔ بیان کریں درج ذیل جملے ناطق ہیں یا نہیں۔

(i) $\frac{3\sqrt{x}}{3\sqrt{x}+5}$ Not a rational expression.

ناطق جملہ نہیں ہے۔

(iii) $\frac{x^2+6x^1+9}{x^2-9}$ Yes it is a rational expression

ناطق جملہ ہے۔

Q#3. Reduce the following to the lowest form. س3 - مختصر شکل میں لکھیں۔

(i) $\frac{12\cancel{0}x^2y^3z^5}{3\cancel{0}x^3y^1z^2}$

$= \frac{4\ y^{3-1}\ z^{5-2}}{x^{3-2}}$

$= \frac{4\ y^2z^3}{x^1}$

$= \boxed{\frac{4y^2z^3}{x}}$

(i) $\frac{120x^2y^3z^5}{30x^3yz^2}$

(iii) $\frac{(x+y)^2-4xy}{(x-y)^2}$

(iv) $\frac{(x^3-y^3)(x^2-2xy+y^2)}{(x-y)(x^2+xy+y^2)}$

(vi) $\frac{x^2-4x+4}{2x^2-8}$

Q#3. Reduce the following to the lowest form. سوال نمبر 3 - مختصر شکل میں لکھیں۔

$$\frac{(x+y)^2-4xy}{(x-y)^2}$$

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

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

$$= \frac{[(x)^2+(y)^2+2(x)(y)]-4xy}{(x)^2+(y)^2-2(x)(y)}$$

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

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

$= \boxed{1}$ Answer.

$-4xy$
$+2xy$
$-2xy$

(i) $\dfrac{120x^2y^3z^5}{30x^3yz^2}$

(iii) $\dfrac{(x+y)^2-4xy}{(x-y)^2}$

(iv) $\dfrac{(x^3-y^3)(x^2-2xy+y^2)}{(x-y)(x^2+xy+y^2)}$

(vi) $\dfrac{x^2-4x+4}{2x^2-8}$

Q#3. Reduce the following to the lowest form. س3 - مختصر شکل میں لکھیں۔

$$\frac{\boxed{(x^3-y^3)}(x^2-2xy+y^2)}{(x-y)(x^2+xy+y^2)}$$

a^3-b^3
$=(a-b)(a^2+ab+b^2)$
Inverse

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

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

$$= x^2-2xy+y^2$$

$$= \boxed{(x-y)^2}$$ Answer.

(i) $\frac{120x^2y^3z^5}{30x^3yz^2}$

(iii) $\frac{(x+y)^2-4xy}{(x-y)^2}$

(iv) $\frac{(x^3-y^3)(x^2-2xy+y^2)}{(x-y)(x^2+xy+y^2)}$

(vi) $\frac{x^2-4x+4}{2x^2-8}$

Q#3. Reduce the following to the lowest form. س3 - مختصر شکل میں لکھیں۔

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

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

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

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

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

$$= \frac{\cancel{(x-2)}(x-2)}{2\cancel{(x-2)}(x+2)} = \boxed{\frac{(x-2)}{2(x+2)}}$$ Answer.

(i) $\dfrac{120x^2y^3z^5}{30x^3yz^2}$

(iii) $\dfrac{(x+y)^2-4xy}{(x-y)^2}$

(iv) $\dfrac{(x^3-y^3)(x^2-2xy+y^2)}{(x-y)(x^2+xy+y^2)}$

(vi) $\dfrac{x^2-4x+4}{2x^2-8}$

Q#4. Evaluate ($x^2y^3-5z^4$ / xyz) for $x=4$, $y=-2$ and $z=-1$

(قیمت معلوم کریں)

Sol//

$$\frac{(x)^2(y)^3-5(z)^4}{(x)(y)(z)}$$

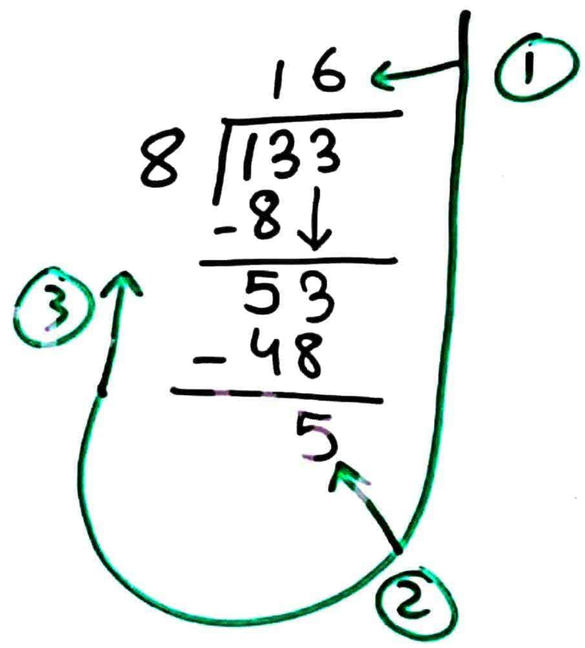
$$=\frac{(4)^2(-2)^3-5(-1)^4}{(4)(-2)(-1)}$$

$$=\frac{16(-8)-5(1)}{8}$$

$$=\frac{-128-5}{8}$$

$$=-\frac{133}{8}$$

$$=\boxed{-16\frac{5}{8}}$$ Answer.



Q#6. Perform indicated operations and simplify.

س6- دیئے گئے عمل سے مختصر کریں۔

(i) $x^2-49 \cdot \frac{5x+2}{x+7}$

a^2-b^2

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

$= (x)^2-(7)^2 \cdot \frac{(5x+2)}{(x+7)}$

$= (x-7)(x+7) \cdot \frac{(5x+2)}{(x+7)}$

$= \boxed{(x-7)(5x+2)}$ Answer:

(i) $x^2-49 \cdot \frac{5x+2}{x+7}$

(iii) $\frac{x^6-y^6}{x^2-y^2} \div x^4+x^2y^2+y^4$

(v) $\frac{x^2+xy}{y(x+y)} \cdot \frac{x^2+xy}{y(x+y)} \div \frac{x^2-x}{xy-2y}$

Q#6. Perform indicated operations and simplify.

سوال نمبر 6 - دیئے گئے عمل سے مختصر کریں۔

(iii) $\dfrac{x^6-y^6}{x^2-y^2} \div x^4+x^2y^2+y^4$

$= \dfrac{(x^2)^3-(y^2)^3}{x^2-y^2} \div x^4+x^2y^2+y^4$

$x^3-y^3 = (x-y)(x^2+xy+y^2)$

$= \dfrac{(x^2-y^2)((x^2)^2+(x^2)(y^2)+(y^2)^2)}{(x^2-y^2)} \div x^4+x^2y^2+y^4$

$= \dfrac{x^4+x^2y^2+y^4}{1} \times \dfrac{1}{x^4+x^2y^2+y^4}$

$= \boxed{1}$ Answer.

(i) $x^2-49 \cdot \dfrac{5x+2}{x+7}$

(iii) $\dfrac{x^6-y^6}{x^2-y^2} \div x^4+x^2y^2+y^4$

(v) $\dfrac{x^2+xy}{y(x+y)} \cdot \dfrac{x^2+xy}{y(x+y)} \div \dfrac{x^2-x}{xy-2y}$

Q#6. Perform indicated operations and simplify.

سوال نمبر 6 دیئے گئے عمل سے مختصر کریں۔

(v) $\dfrac{x^2+xy}{y(x+y)} \cdot \dfrac{x^2+xy}{y(x+y)} \div \dfrac{x^2-x}{xy-2y}$

$= \dfrac{x(x+y)}{y(x+y)} \cdot \dfrac{x(x+y)}{y(x+y)} \div \dfrac{x(x-1)}{y(x-2)}$

$= \dfrac{x^2}{y^2} \div \dfrac{x(x-1)}{y(x-2)}$

$= \dfrac{x^2}{y^2} \times \dfrac{y(x-2)}{x(x-1)}$

$= \boxed{\dfrac{x(x-2)}{y(x-1)}}$ Answer.

(i) $x^2-49 \cdot \dfrac{5x+2}{x+7}$

(iii) $\dfrac{x^6-y^6}{x^2-y^2} \div x^4+x^2y^2+y^4$

(v) $\dfrac{x^2+xy}{y(x+y)} \cdot \dfrac{x^2+xy}{y(x+y)} \div \dfrac{x^2-x}{xy-2y}$

Q#3. If $m+n+p=10$, $mn+np+mp=27$, then find value of $m^2+n^2+p^2$

Sol//

$$(a+b+c)^2 = a^2+b^2+c^2+2ab+2bc+2ca$$

$$\boxed{(a+b+c)^2 = a^2+b^2+c^2+2(ab+bc+ca)}$$

$$(m+n+p)^2 = m^2+n^2+p^2+2(mn+np+mp)$$

$$(10)^2 = m^2+n^2+p^2+2(27)$$

$$100 = m^2+n^2+p^2+54$$

$$100-54 = m^2+n^2+p^2$$

$$\boxed{46 = m^2+n^2+p^2}$$ Answer

Q#5. If $x+y+z=12$ and $x^2+y^2+z^2=64$ then find $xy+yz+zx$

Sol//

$$(x+y+z)^2 = x^2+y^2+z^2+2(xy+yz+zx)$$

$$(12)^2 = 64 + 2(xy+yz+zx)$$

$$144 = 64 + 2(xy+yz+zx)$$

$$144-64 = 2(xy+yz+zx)$$

$$80 = 2(xy+yz+zx)$$

$$\frac{\overset{40}{\cancel{80}}}{\cancel{2}_{1}} = xy+yz+zx$$

$$\boxed{40 = xy+yz+zx}$$

Q#8. If $x-y=4$, $xy=21$ then find the value of x^3-y^3.

Sol//

$$\boxed{(x-y)^3 = x^3-y^3-3xy(x-y)}$$

$$(4)^3 = x^3-y^3-3(21)(4)$$

$$64 = x^3-y^3-252$$

$$64+252 = x^3-y^3$$

$$\boxed{316 = x^3-y^3}$$ Answer

Q# 11. If $x - \frac{1}{x} = 7$, then find $x^3 - \frac{1}{x^3}$

Sol//

$$\left(x - \frac{1}{x}\right)^3 = (x)^3 - \left(\frac{1}{x}\right)^3 - 3(x)\left(\frac{1}{x}\right)\left(x - \frac{1}{x}\right)$$

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

$$343 = x^3 - \frac{1}{x^3} - 21$$

$$343 + 21 = x^3 - \frac{1}{x^3}$$

$$\boxed{364 = x^3 - \frac{1}{x^3}}$$ Answer.

$7^3 = 7 \times 7 \times 7$

$49 \quad 343$

Q# 13. If $5x - \frac{1}{5x} = 6$ then find the value of $125x^3 - \frac{1}{125x^3}$

Sol//

$$(a-b)^3 = a^3 - b^3 - 3ab(a-b)$$

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

$$(6)^3 = 125x^3 - \frac{1}{125x^3} - 3(\ 6\ )$$

$$216 = 125x^3 - \frac{1}{125x^3} - 18$$

$$216 + 18 = 125x^3 - \frac{1}{125x^3}$$

$$\boxed{234 = 125x^3 - \frac{1}{125x^3}}$$ Answer.

Q#14. Factorize تجزی کریں

(i) x^3-y^3-x+y

(ii) $8x^3-\frac{1}{27y^3}$

$$a^3-b^3=(a-b)(a^2+ab+b^2)$$

Sol// $(x-y)(x^2+xy+y^2)-x+y$

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

$=(x-y)\left[(x^2+xy+y^2)-1\right]$

$=(x-y)\left[x^2+xy+y^2-1\right]$

Sol// $(2x)^3-\left(\frac{1}{3y}\right)^3$

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

$=\left(2x-\frac{1}{3y}\right)\left(4x^2+\frac{2x}{3y}+\frac{1}{9y^2}\right)$

Q#1. Simplify

(i) $3\sqrt{162}$

Sol//

$$= 3\sqrt{2 \times 3 \times 3 \times 3 \times 3}$$

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

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

$$= 3\sqrt{2} \times 3 \times 3$$

$$= \boxed{27\sqrt{2}}$$ Answer.

2	162
3	81
3	27
3	9
3	3
	1

(iv) $\sqrt[5]{96x^6y^7z^8}$

Sol//

$$= \sqrt[5]{96x^6y^7z^8}$$

$$= \sqrt[5]{2 \times 2 \times 2 \times 2 \times 2 \times 3 x^{5+1} y^{5+2} z^{5+3}}$$

$$= \sqrt[5]{2^5 \times 3 \times x^5 . x . y^5 . y^2 . z^5 . z^3}$$

$$= \sqrt[5]{2^5 x^5 y^5 z^5} \times \sqrt[5]{3xy^2z^3}$$

$$= (2^5 x^5 y^5 z^5)^{1/5} \times \sqrt[5]{3xy^2z^3}$$

$$= (z^5)^{1/5} . (x^5)^{1/5} . (y^5)^{1/5} . (z^5)^{1/5} \sqrt[5]{3xy^2z^3}$$

$$= \boxed{2xyz\sqrt[5]{3xy^2z^3}}$$

2	96
2	48
2	24
2	12
2	6
3	3
	1

Q#2. Simplify

(i) $\frac{\sqrt{18}}{\sqrt{3}\sqrt{2}}$

Sol//

$$\frac{\sqrt{18}}{\sqrt{3}\sqrt{2}}$$

$$= \frac{\sqrt{18}}{\sqrt{3\times 2}}$$

$$= \frac{\sqrt{18}}{\sqrt{6}}$$

$$= \sqrt{\frac{18}{6}}$$

$$= \boxed{\sqrt{3}} \text{ Answer.}$$

(v) $\sqrt{21} \times \sqrt{7} \times \sqrt{3}$

Sol//

$$\sqrt{21} \times \sqrt{7} \times \sqrt{3}$$

$$= \sqrt{21} \times \sqrt{7\times 3}$$

$$= \sqrt{21} \times \sqrt{21}$$

$$= (\sqrt{21})^2$$

$$= \boxed{21} \text{ Answer.}$$

Q#3. Simplify

(i) $\sqrt{45} - 3\sqrt{20} + 4\sqrt{5}$

Sol// $\sqrt{45} - 3\sqrt{20} + 4\sqrt{5}$

$= \sqrt{9 \times 5} - 3\sqrt{4 \times 5} + 4\sqrt{5}$

$= \sqrt{9}\sqrt{5} - 3\sqrt{4}\sqrt{5} + 4\sqrt{5}$

$= 3\sqrt{5} - 3(2)\sqrt{5} + 4\sqrt{5}$

$= 3\sqrt{5} - 6\sqrt{5} + 4\sqrt{5}$

$= (3 - 6 + 4)\sqrt{5}$

$= \boxed{1\sqrt{5}}$ Answer.

(iv) $2(6\sqrt{5} - 3\sqrt{5})$

Sol// $2(6\sqrt{5} - 3\sqrt{5})$

$= 2(6 - 3)\sqrt{5}$

$= 2(3)\sqrt{5}$

$= \boxed{6\sqrt{5}}$ Answer.

Q#4. Simplify

(i) $(3+\sqrt{3})(3-\sqrt{3})$

Sol//

$(a+b)(a-b)$

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

$= (3+\sqrt{3})(3-\sqrt{3})$

$= (3)^2-(\sqrt{3})^2$

$= 9-3$

$= \boxed{6}$ Answer.

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

Sol//

$(a+b)(a-b)$

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

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

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

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

$= \frac{6-1}{3}$

$= \boxed{\frac{5}{3}}$

(v) $(\sqrt{x}+\sqrt{y})(\sqrt{x}-\sqrt{y})(x+y)(x^2+y^2)$

Sol//

$(\sqrt{x}+\sqrt{y})(\sqrt{x}-\sqrt{y})(x+y)(x^2+y^2)$

$= \left[(\sqrt{x})^2-(\sqrt{y})^2\right](x+y)(x^2+y^2)$

$= (x-y)(x+y)(x^2+y^2)$

$= \left[(x)^2-(y)^2\right](x^2+y^2)$

$= (x^2-y^2)(x^2+y^2)$

$= (x^2)^2-(y^2)^2$

$= \boxed{x^4-y^4}$ Answer.

Q#4. If $x - \frac{1}{x} = 2$ then find the value of $x^4 + \frac{1}{x^4}$

Sol//

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

Taking square on both sides

$$\left(x - \frac{1}{x}\right)^2 = (2)^2 \qquad (a-b)^2 = a^2 + b^2 - 2ab$$

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

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

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

$$\boxed{x^2 + \frac{1}{x^2} = 6}$$

$$x^2 + \frac{1}{x^2} = 6$$

Again taking square on both sides

$$\left(x^2 + \frac{1}{x^2}\right)^2 = (6)^2$$

formula $(a+b)^2 = a^2 + b^2 + 2ab$

$$(x^2)^2 + \left(\frac{1}{x^2}\right)^2 + 2(x^2)\left(\frac{1}{x^2}\right) = 36$$

$$x^4 + \frac{1}{x^4} + 2 = 36$$

$$x^4 + \frac{1}{x^4} = 36 - 2$$

$$\boxed{x^4 + \frac{1}{x^4} = 34}$$ Answer

Q#4. If $x - \frac{1}{x} = 2$ then find the value of $x^4 + \frac{1}{x^4}$

Sol//

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

Taking square on both sides

$$\left(x - \frac{1}{x}\right)^2 = (2)^2 \qquad (a-b)^2 = a^2 + b^2 - 2ab$$

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

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

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

$$\boxed{x^2 + \frac{1}{x^2} = 6}$$

$$x^2 + \frac{1}{x^2} = 6$$

Again taking square on both sides

$$\left(x^2 + \frac{1}{x^2}\right)^2 = (6)^2$$

formula $(a+b)^2 = a^2 + b^2 + 2ab$

$$(x^2)^2 + \left(\frac{1}{x^2}\right)^2 + 2(x^2)\left(\frac{1}{x^2}\right) = 36$$

$$x^4 + \frac{1}{x^4} + 2 = 36$$

$$x^4 + \frac{1}{x^4} = 36 - 2$$

$$\boxed{x^4 + \frac{1}{x^4} = 34}$$ Answer

Q# 5(ii) If $x = \frac{\sqrt{5}-\sqrt{2}}{\sqrt{5}+\sqrt{2}}$, find value of $x+\frac{1}{x}$, $x^2+\frac{1}{x^2}$, $x^3+\frac{1}{x^3}$

Sol//

$$x = \frac{\sqrt{5}-\sqrt{2}}{\sqrt{5}+\sqrt{2}}$$

$$\boxed{\frac{1}{x} = \frac{\sqrt{5}+\sqrt{2}}{\sqrt{5}-\sqrt{2}}}$$

$$x+\frac{1}{x} = \frac{(\sqrt{5}-\sqrt{2})}{(\sqrt{5}+\sqrt{2})} + \frac{(\sqrt{5}+\sqrt{2})}{(\sqrt{5}-\sqrt{2})}$$

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

$$x+\frac{1}{x} = \frac{[(\sqrt{5})^2+(\sqrt{2})^2-2(\sqrt{5})(\sqrt{2})]+[(\sqrt{5})^2+(\sqrt{2})^2+2(\sqrt{5})(\sqrt{2})}{(\sqrt{5})^2-(\sqrt{2})^2}$$

$$x+\frac{1}{x} = \frac{5+2-2\sqrt{5}\sqrt{2}+5+2+2\sqrt{5}\sqrt{2}}{5-2}$$

$$x+\frac{1}{x} = \frac{5+2+5+2}{3}$$

$$\boxed{x+\frac{1}{x} = \frac{14}{3}} \text{ Ans.}$$

$$x+\frac{1}{x} = \frac{14}{3}$$

Taking square on both side

$$\left(x+\frac{1}{x}\right)^2 = \left(\frac{14}{3}\right)^2$$

$$(x)^2+\left(\frac{1}{x}\right)^2+2(x)\left(\frac{1}{x}\right) = \frac{196}{9}$$

$$x^2+\frac{1}{x^2}+2 = \frac{196}{9}$$

$$x^2+\frac{1}{x^2} = \frac{196}{9}-\frac{2}{1}$$

$$x^2+\frac{1}{x^2} = \frac{196-18}{9}$$

$$\boxed{x^2+\frac{1}{x^2} = \frac{178}{9}}$$

Ans.

$$x + \frac{1}{x} = \frac{14}{3}$$

Taking cube on both sides

$$\left(x + \frac{1}{x}\right)^3 = \left(\frac{14}{3}\right)^3$$

$$(a+b)^3 = a^3 + b^3 + 3ab(a+b)$$

$$(x)^3 + \left(\frac{1}{x}\right)^3 + 3(x)\left(\frac{1}{x}\right)\left(x + \frac{1}{x}\right) = \frac{2744}{27}$$

$$x^3 + \frac{1}{x^3} + 3\left(\frac{14}{3}\right) = \frac{2744}{27}$$

$$x^3 + \frac{1}{x^3} + 14 = \frac{2744}{27}$$

$$x^3 + \frac{1}{x^3} = \frac{2744}{27} - \frac{14}{1}$$

$$x^3 + \frac{1}{x^3} = \frac{2744 - 378}{27}$$

$$\boxed{x^3 + \frac{1}{x^3} = \frac{2366}{27}}$$

Answer

Q#5. If $x = 2+\sqrt{3}$ then find the value of $x - \frac{1}{x}$ and $\left(x - \frac{1}{x}\right)^2$

Sol//

$$\boxed{x = 2+\sqrt{3}}$$

$$\frac{1}{x} = \frac{1}{2+\sqrt{3}}$$

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

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

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

$$\frac{1}{x} = \frac{(2-\sqrt{3})}{4-3}$$

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

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

$x - \frac{1}{x} = ?$

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

$x - \frac{1}{x} = \cancel{2} + \sqrt{3} \cancel{-2} + \sqrt{3}$

$x - \frac{1}{x} = \sqrt{3} + \sqrt{3}$

$x - \frac{1}{x} = 1\sqrt{3} + 1\sqrt{3}$

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

$$\boxed{x - \frac{1}{x} = 2\sqrt{3}}$$

$\left(x - \frac{1}{x}\right)^2 = \left(2\sqrt{3}\right)^2$

$\left(x - \frac{1}{x}\right)^2 = 2^2(\sqrt{3})^2$

$\left(x - \frac{1}{x}\right)^2 = 4(3)$

$$\boxed{\left(x - \frac{1}{x}\right)^2 = 12}$$

Ans.

Q#3 (iii) If $x = \sqrt{3} + 2$ then find the value of $x + \frac{1}{x}$

Sol//

$$\boxed{x = \sqrt{3} + 2}$$

$$\frac{1}{x} = \frac{1}{\sqrt{3}+2}$$

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

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

$$\frac{1}{x} = \frac{(\sqrt{3}-2)}{3-4}$$

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

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

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

$+3$
-4
-1

$x + \frac{1}{x} = ?$

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

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

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

$\boxed{x + \frac{1}{x} = 4}$ Ans.

Q#2. Find the conjugate of $x+\sqrt{y}$ درج ذیل کا کانجوگیٹ معلوم کریں۔

(iii) $2+\sqrt{3}$ (vii) $7-\sqrt{6}$ (viii) $9+\sqrt{2}$

Conjugate $= 2-\sqrt{3}$ Conjugate $= 7+\sqrt{6}$ Conjugate $= 9-\sqrt{2}$

Q#1. Rationalize denominator of following.

سوال- مخرج کو ناطق بنائیں-

(i) $\frac{3}{4\sqrt{3}}$

(vi) $\frac{2}{\sqrt{5}-\sqrt{3}}$

(vii) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

Sol//

(vii) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

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

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

$= \frac{(\sqrt{3})^2+(1)^2-2(\sqrt{3})(1)}{3-1}$ $\quad (a-b)^2 = a^2+b^2-2ab$

$= \frac{3+1-2\sqrt{3}}{2} = \frac{4-2\sqrt{3}}{2} = \frac{2(2-\sqrt{3})}{2} = \boxed{2-\sqrt{3}}$ Ans.

Q#1. Rationalize denominator of following-

سوال- مخرج کو ناطق بنائیں-

Sol//

$$\frac{3}{4\sqrt{3}}$$

$$= \frac{3}{4\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$= \frac{3\sqrt{3}}{4(\sqrt{3})^2}$$

$$= \frac{3\sqrt{3}}{4(3)}$$

$$= \frac{\overset{1}{\cancel{3}}\sqrt{3}}{\underset{4}{\cancel{12}}}$$

$$= \boxed{\frac{\sqrt{3}}{4}} \text{ Ans.}$$

(vii) $\frac{2}{\sqrt{5}-\sqrt{3}}$

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

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

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

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

$$= \boxed{\sqrt{5}+\sqrt{3}} \text{ Ans.}$$

(i) $\frac{3}{4\sqrt{3}}$

(vi) $\frac{2}{\sqrt{5}-\sqrt{3}}$

(vii) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

$(a-b)(a+b)$

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

Q#8. Simplify مختصر کریں $\frac{\sqrt{a^2+2}+\sqrt{a^2-2}}{\sqrt{a^2+2}-\sqrt{a^2-2}}$

Sol//

$$\frac{\left(\sqrt{a^2+2}+\sqrt{a^2-2}\right)}{\left(\sqrt{a^2+2}-\sqrt{a^2-2}\right)}$$

$$= \frac{\left(\sqrt{a^2+2}+\sqrt{a^2-2}\right)}{\left(\sqrt{a^2+2}-\sqrt{a^2-2}\right)} \times \frac{\left(\sqrt{a^2+2}+\sqrt{a^2-2}\right)}{\left(\sqrt{a^2+2}+\sqrt{a^2-2}\right)}$$

$$= \frac{\left(\sqrt{a^2+2}+\sqrt{a^2-2}\right)^2}{\left(\sqrt{a^2+2}\right)^2-\left(\sqrt{a^2-2}\right)^2}$$

$$= \frac{\left(\sqrt{a^2+2}\right)^2+\left(\sqrt{a^2-2}\right)^2+2\left(\sqrt{a^2+2}\right)\left(\sqrt{a^2-2}\right)}{(a^2+2)-(a^2-2)}$$

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

$$= \frac{2a^2+2\sqrt{(a^2)^2-(2)^2}}{4}$$

$$= \frac{2\left[a^2+\sqrt{a^4-4}\right]}{4}$$

$$= \left[\frac{a^2+\sqrt{a^4-4}}{2}\right]^{1/2}$$

Answer

Q# 7 (iii) If $q = \sqrt{5} + 2$ then find the value of $q^2 + \frac{1}{q^2}$

Sol//

$$\boxed{q = \sqrt{5} + 2}$$

$$\frac{1}{q} = ?$$

$$\frac{1}{q} = \frac{1}{\sqrt{5}+2}$$

$$\frac{1}{q} = \frac{1}{(\sqrt{5}+2)} \times \frac{(\sqrt{5}-2)}{(\sqrt{5}-2)}$$

$$\frac{1}{q} = \frac{(\sqrt{5}-2)}{(\sqrt{5})^2 - (2)^2}$$

$$\frac{1}{q} = \frac{(\sqrt{5}-2)}{5-4}$$

$$\frac{1}{q} = \frac{(\sqrt{5}-2)}{1}$$

$$\boxed{\frac{1}{q} = (\sqrt{5}-2)}$$

$$q + \frac{1}{q} = ?$$

$$q + \frac{1}{q} = (\sqrt{5}+2) + (\sqrt{5}-2)$$

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

$$q + \frac{1}{q} = \sqrt{5} + 2 + \sqrt{5} - 2$$

$$\boxed{q + \frac{1}{q} = 2\sqrt{5}}$$

Taking square on both sides

$$\left(q + \frac{1}{q}\right)^2 = \left(2\sqrt{5}\right)^2$$

$$(q)^2 + \left(\frac{1}{q}\right)^2 + 2(q)\left(\frac{1}{q}\right) = 4(5)$$

$$q^2 + \frac{1}{q^2} + 2 = 20$$

$$q^2 + \frac{1}{q^2} = 20 - 2$$

$$\boxed{q^2 + \frac{1}{q^2} = 18}$$

Answer

Q#6. If $P = 2+\sqrt{3}$ then find $P^2 - \frac{1}{P^2}$

Sol//

$$P^2 - \frac{1}{P^2}$$

$$= (P)^2 - \left(\frac{1}{P}\right)^2$$

$$= \left(P - \frac{1}{P}\right)\left(P + \frac{1}{P}\right)$$

$\boxed{P = 2+\sqrt{3}}$

$\frac{1}{P} = ?$

$\frac{1}{P} = \frac{1}{2+\sqrt{3}}$

$\frac{1}{P} = \frac{1}{(2+\sqrt{3})} \times \frac{(2-\sqrt{3})}{(2-\sqrt{3})}$

$\frac{1}{P} = \frac{(2-\sqrt{3})}{(2)^2 - (\sqrt{3})^2}$

$\frac{1}{P} = \frac{(2-\sqrt{3})}{4-3}$

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

$\boxed{\frac{1}{P} = (2-\sqrt{3})}$

$P - \frac{1}{P} = ?$

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

$P - \frac{1}{P} = \cancel{2} + \sqrt{3} - \cancel{2} + \sqrt{3}$

$\boxed{P - \frac{1}{P} = 2\sqrt{3}}$

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

$P + \frac{1}{P} = 2 + \cancel{\sqrt{3}} + 2 - \cancel{\sqrt{3}}$

$\boxed{P + \frac{1}{P} = 4}$

$P^2 - \frac{1}{P^2} = ?$

$P^2 - \frac{1}{P^2} = \left(P - \frac{1}{P}\right)\left(P + \frac{1}{P}\right)$

$P^2 - \frac{1}{P^2} = (2\sqrt{3})(4)$

$\boxed{P^2 - \frac{1}{P^2} = 8\sqrt{3}}$ Answer

Q#5. Find value of x^3+y^3 and xy. If $x+y=5$, $x-y=3$

Sol// $x^3+y^3=?$

$(x+y)^3 = x^3+y^3+3xy(x+y)$

??? (over xy)

formula $\boxed{(x+y)^2-(x-y)^2=4xy}$

$(5)^2-(3)^2=4xy$

$25-9=4xy$

$16=4xy$

$\frac{16}{4}=xy$

$\boxed{4=xy}$ Answer.

$(x+y)^3=x^3+y^3+3xy(x+y)$

$(5)^3=x^3+y^3+3(4)(5)$

$125=x^3+y^3+60$

$125-60=x^3+y^3$

$\boxed{65=x^3+y^3}$ Answer.

Q#1. Factorize تجزی کریں

(i) $9xy - 12x^2y + 18y^2$

(ii) $3x^3y(x-3y) - 7x^2y^2(x-3y)$

(iii) $2xy^3(x^2+5) + 8xy^2(x^2+5)$

Sol// $9xy - 12x^2y + 18y^2$

$= 3\times3xy - 2\times2\times3x^2y + 2\times3\times3y^2$

3	9
3	3
	1

$= 3y(3x - 4x^2 + 6y)$

2	12
2	6
3	3
	1

Sol// $3x^3y(x-3y) - 7x^2y^2(x-3y)$

2	18
3	9
3	3
	1

$= (x-3y)[3x^3y - 7x^2y^2]$

$= (x-3y)x^2y[3x - 7y]$

$= x^2y(x-3y)(3x-7y)$

Q#1. Factorize تجزی کریں

(i) $9xy - 12x^2y + 18y^2$

(ii) $3x^3y(x-3y) - 7x^2y^2(x-3y)$

(iii) $2xy^3(x^2+5) + 8xy^2(x^2+5)$

Sol// $2xy^3(x^2+5) + 8xy^2(x^2+5)$

$= (x^2+5)[2xy^3 + 8xy^2]$

$= (x^2+5)[2xy^3 + 2x2x2xy^2]$

$= (x^2+5)2xy^2[y+4]$

$= 2xy^2(x^2+5)(y+4)$

2	8
2	4
2	2
	1

Q #3. Factorize تجزی کریں

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

(ii) $12x^2 - 36x + 27$

Sol// $\frac{a^2}{b^2} - 2 + \frac{b^2}{a^2}$

Formula

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

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

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

$$= \left(\frac{a}{b} - \frac{b}{a}\right)^2$$

$$= \left(\frac{a}{b} - \frac{b}{a}\right)\left(\frac{a}{b} - \frac{b}{a}\right)$$

Q #3. Factorize تجزی کریں

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

(ii) $12x^2 - 36x + 27$

Sol// $12x^2 - 36x + 27$

$= 2x2x3x^2 - 2x2x3x3x + 3x3x3$

$= 3(4x^2 - 12x + 9)$

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

$= 3\left[(2x)^2 - 2(2x)(3) + (3)^2\right]$

$= 3\left[2x - 3\right]^2$

$= 3(2x-3)(2x-3)$

2	12
2	6
3	3
	1

2	36
2	18
3	9
3	3
	1

3	27
3	9
3	3
	1

$3^2 = 3x3 = 9$

Q#4. Factorize تجزی کریں

(i) $x(x-1)-y(y-1)$

(ii) $3x-243x^3$

Sol// $x(x-1)-y(y-1)$

$= x^2-x-y^2+y$

$= \underline{x^2-y^2}-x+y$

$=(x-y)(x+y)-(x-y)$

$=(x-y)[(x+y)-1]$

$=(x-y)(x+y-1)$

Q#4. Factorize تجزی کریں

(i) $x(x-1)-y(y-1)$

(ii) $3x-243x^3$

Sol// $3x-243x^3$

$= 3x-3\times 81x^3$

$= 3x(1-81x^2)$

$= 3x[(1)^2-(9x)^2]$

$= 3x(1-9x)(1+9x)$

3	243
81	81
	1

formula

a^2-b^2

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

Q #5 Factorize تجزی کریں

(i) $x^2 - a^2 + 2a - 1$

(ii) $25x^2 + 10x + 1 - 36z^2$

(iii) $x^2 - y^2 - 4xz + 4z^2$

Sol// $x^2 - a^2 + 2a - 1$

$= x^2 - (a^2 - 2a + 1)$

$= (x)^2 - [(a)^2 - 2(a)(1) + (1)^2]$

$= (x)^2 - (a-1)^2$

$= (x) - (a-1)\big)\big((x) + (a-1)\big)$

$= (x - a + 1)(x + a - 1)$

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

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

Q#5 Factorize تجزی کریں

(i) $x^2 - a^2 + 2a - 1$

(ii) $25x^2 + 10x + 1 - 36z^2$

(iii) $x^2 - y^2 - 4xz + 4z^2$

Sol//

$$\underbrace{25x^2 + 10x + 1} - \underbrace{36z^2}$$

$$= (5x)^2 + 2(5x)(1) + (1)^2 - (6z)^2$$

$$= (5x+1)^2 - (6z)^2$$

$$= \Big((5x+1) - (6z)\Big)\Big((5x+1) + (6z)\Big)$$

$$= (5x + 1 - 6z)(5x + 1 + 6z)$$

$(a+b)^2$

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

$a^2 - b^2$

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

Q #5 Factorize تجزی کریں

(i) $x^2 - a^2 + 2a - 1$

(ii) $25x^2 + 10x + 1 - 36z^2$

(iii) $x^2 - y^2 - 4xz + 4z^2$

Sol// $x^2 - y^2 - 4xz + 4z^2$

$= \underline{x^2 - 4xz + 4z^2} - y^2$

$= (x)^2 - 2(x)(2z) + (2z)^2 - y^2$

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

$= (x - 2z)^2 - (y)^2$

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

$= \big((x-2z) - (y)\big)\big((x-2z) + (y)\big)$

$= (x - 2z - y)(x - 2z + y)$

Q#1. Factorize تجزی کریں

(i) $a^4+3a^2b^2+4b^4$

(ii) x^4+x^2+25

Sol// $a^4+3a^2b^2+4b^4$

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

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

$=\left((a^2+2b^2)-(ab)\right)\left((a^2+2b^2)+(ab)\right)$

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

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

$=(a+b)^2$

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

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

Q#1. Factorize تجزی کریں

(i) $a^4+3a^2b^2+4b^4$

(ii) x^4+x^2+25

Sol// x^4+x^2+25

$=\underbrace{(x^2)^2+2(x^2)(5)+(5)^2}-9x^2$

$=(x^2+5)^2-(3x)^2$

$=[(x^2+5)-(3x)][(x^2+5)+(3x)]$

$=[x^2+5-3x][x^2+5+3x]$

$=[x^2-3x+5][x^2+3x+5]$

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

$=(a+b)^2$

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

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

Q#2. Factorize تجزی کریں

(i) $x^2+14x+48$

(ii) $x^2+x-132$

Sol// $x^2+14x+48$

$= x^2+6x+8x+48$

$= x(x+6)+8(x+6)$

$= \boxed{(x+6)(x+8)}$

Answer.

$(x^2)(+48)$

$+48\,x^2$

$+14x$

1	48
2	24
3	16
4	12

$+6x \qquad +8x$

Q#2. Factorize تجزی کریں

(i) $x^2+14x+48$

(ii) $x^2+x-132$

Sol//

$x^2+x-132$

$= x^2-11x+12x-132$

$= x(x-11)+12(x-11)$

$= \boxed{(x-11)(x+12)}$

Answer.

$(x^2)(-132)$

$-132x^2$

$+1x$

1	132
2	66
3	44
4	33
6	22

$-11x \quad +12x$

Q#3. Factorize تجزی کریں

(i) $5x^2-16x-21$

(ii) $4x^2-17xy+4y^2$

Sol/ $5x^2-16x-21$

$=5x^2+5x-21x-21$

$=5x(x+1)-21(x+1)$

$=\boxed{(x+1)(5x-21)}$

Answer.

$(5x^2)(-21)$

$-105x^2$

$-16x$

1 105

3 35

$+5x$ $-21x$

Q#3. Factorize تجزی کریں

(i) $5x^2 - 16x - 21$

(ii) $4x^2 - 17xy + 4y^2$

Sol// $4x^2 - 17xy + 4y^2$

$= 4x^2 - 1xy - 16xy + 4y^2$

$= x(4x - y) - 4y(4x - y)$

$= \boxed{(4x - y)(x - 4y)}$

Answer.

$(4x^2)(+4y^2)$

$+16x^2y^2$

$-17xy$

$-1xy$ $\quad$ $-16xy$

2 $\quad$ 8

4 $\quad$ 4

Q#5 Factorize تجزی کریں

(i) $8x^3+60x^2+150x+125$

(ii) $8x^3-125y^3-60x^2y+15xy^2$

Sol// $8x^3+60x^2+150x+125$

$=8x^3+125+60x^2+150x$

$=(2x)^3+(5)^3+3(2x)^2(5)+3(2x)(5)^2$

$=\boxed{(2x+5)^3}$ Answer

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

$(a+b)^3=a^3+b^3+3ab(a+b)$

$\boxed{(a+b)^3=a^3+b^3+3a^2b+3ab^2}$

$(a-b)^3=a^3-b^3-3ab(a-b)$

$\boxed{(a-b)^3=a^3-b^3-3a^2b+3ab^2}$

Q#5 Factorize تجزی کریں

(i) $8x^3+60x^2+150x+125$

(ii) $8x^3-125y^3-60x^2y+150xy^2$

Sol// $8x^3-125y^3-60x^2y+150xy^2$

$=(2x)^3-(5y)^3-3(2x)^2(5y)+3(2x)(5y)^2$

$=\boxed{(2x-5y)^3}$ Answer.

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

$(a+b)^3=a^3+b^3+3ab(a+b)$

$\boxed{(a+b)^3=a^3+b^3+3a^2b+3ab^2}$

$(a-b)^3=a^3-b^3-3ab(a-b)$

$\boxed{(a-b)^3=a^3-b^3-3a^2b+3ab^2}$

Q#6. Factorize تجزی کریں

(i) $27 + 8x^3$

(ii) $8x^3 + 125y^3$

Sol $27+8x^3$

$=(3)^3+(2x)^3$

$3^3 = 3\times3\times3$ → 9, 27

$2^3 = 2\times2\times2$ → 4, 8

$=(3+2x)\left((3)^2-(3)(2x)+(2x)^2\right)$

$=(3+2x)(9-6x+4x^2)$

$(a)^3+(b)^3$

$=(a+b)\left((a)^2-(a)(b)+(b)^2\right)$

$(a)^3-(b)^3$

$=(a-b)\left((a)^2+(a)(b)+(b)^2\right)$

$(a+b)^3 = a^3+b^3+3ab(a+b)$

$(a-b)^3 = a^3-b^3-3ab(a-b)$

Sol $8x^3+125y^3$

$=(2x)^3+(5y)^3$

$=(2x+5y)\left((2x)^2-(2x)(5y)+(5y)^2\right)$

$=(2x+5y)(4x^2-10xy+25y^2)$

Q#3. Factorize تجزی کریں

(i) $4x^2 - 16y^2$

(ii) $8x^3 - \frac{1}{27y^3}$

(iii) $1 - 12pq + 36p^2q^2$

Sol// $4x^2 - 16y^2$

$= (2x)^2 - (4y)^2$

$= (2x - 4y)(2x + 4y)$

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

Sol// $8x^3 - \frac{1}{27y^3}$

$= (2x)^3 - \left(\frac{1}{3y}\right)^3$

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

$= \left(2x - \frac{1}{3y}\right)\left(4x^2 + \frac{2x}{3y} + \frac{1}{9y^2}\right)$

$a^3 - b^3 = (a-b)\left((a)^2 + (a)(b) + (b)^2\right)$

Q#3. Factorize تجزی کریں

(i) $4x^2 - 16y^2$

(ii) $8x^3 - \frac{1}{27y^3}$

(iii) $1 - 12pq + 36p^2q^2$

Sol// $1 - 12pq + 36p^2q^2$

$= (1)^2 - 2(1)(6pq) + (6pq)^2$

$= \boxed{(1 - 6pq)^2}$ Answer.

$(a-b)^2$

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

Q#1. Find the HCF of following expression.

س-درج ذیل کا عاد اعظم معلوم کریں۔

$102xy^2z$, $85x^2yz$, $187xyz^2$

Sol//

$102xy^2z = 2 \times 3 \times 17 \times x \times y \times y \times z$

$85x^2yz = 5 \times 17 \times x \times x \times y \times z$

$187xyz^2 = 11 \times 17 \times x \times y \times z \times z$

2	102
3	51
17	17
	1

5	85
17	17
	1

11	187
17	17
	1

Product of common factor $= 17xyz$

مشترک اجزائے ضربی

H.C.F عاد اعظم $= 17xyz$

Q#4(ii) Find the L.C.M of following expression.

س-درج ذیل کا ذواضعاف اقل معلوم کریں۔

$102xy^2z$, $85x^2yz$, $187xyz^2$

Sol//

$102xy^2z = 2 \times 3 \times 17 \times x \times y \times y \times z$

$85x^2yz = 5 \times 17 \times x \times x \times y \times z$

$187xyz^2 = 11 \times 17 \times x \times y \times z \times z$

2	102
3	51
17	17
	1

5	85
17	17
	1

11	187
17	17
	1

Common factor $= 17xyz$

مشترک اجزائے ضربی

Non Common factor $= 2 \times 3 \times 5 \times 11 \times yz$

غیر مشترک اجزائے ضربی

L.C.M $= (17xyz) \times (2 \times 3 \times 5 \times 11 \times yz)$

L.C.M $= 5610x^2y^2z^2$

Q#2. Find the H.C.F of the following expressions by factorization.

س²- تجزی کی مدد سے عادِ اعظم معلوم کریں۔

x^2+5x+6 , $x^2-4x-12$

Sol// $x^2+5x+6 = \underline{x^2+2x}+3x+6$

$= x(x+2)+3(x+2)$

$= (x+2)(x+3) \longrightarrow (1)$

$x^2-4x-12 = \underline{x^2+2x}-6x-12$

$= x(x+2)-6(x+2)$

$= (x+2)(x-6) \longrightarrow (2)$

From (1) & (2) Common factor = $(x+2)$

So, H.C.F = $(x+2)$

عادِ اعظم $= (x+2)$

$(x^2)(+6)$

$+6x^2$

$+5x$

$-1x$ $+6x$

$+2x$ $+3x$

$(x^2)(-12)$

$-12x^2$

$-4x$

1 12

$+2x$ $-6x$

3 4

Q#2. Find the H.C.F of the following expressions by factorization.

س²- تجزی کی مدد سے عادِ اعظم معلوم کریں۔

(iv) $18(x^3-9x^2+8x)$, $24(x^2-3x+2)$

Sol// $18(x^3-9x^2+8x) = 18x(x^2-9x+8)$

$= 2\times3\times3x[x^2-1x-8x+8]$

$= 2\times3\times3x[x(x-1)-8(x-1)]$

$= (2\times3)\times3x[(x-1)(x-8)]$ ⟶ ①

$(x^2)(+8)$

$+8x^2$

$-9x$

$-1x$, $-8x$

2 , 4

2	18
3	9
3	3
	1

$24(x^2-3x+2) = 2\times2\times2\times3(x^2-3x+2)$

$= 2\times2\times2\times3[x^2-1x-2x+2]$

$= 2\times2\times2\times3[x(x-1)-2(x-1)]$

$= (2\times2\times2\times3)[(x-1)(x-2)]$ ⟶ ②

2	24
2	12
2	6
3	3
	1

$(x^2)(+2)$

$+2x^2$

$-3x$

$-1x$, $-2x$

(عادِ اعظم) H.C.F = Common factor

(عادِ اعظم) H.C.F = $2\times3(x-1)$

(عادِ اعظم) H.C.F = $\boxed{6(x-1)}$ Answer.

Q#1. Solve the following equations.

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

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

(v) $\frac{5(x-3)}{6} - x = 1 - \frac{x}{9}$

(vi) $\frac{x}{3x-6} = 2 - \frac{2x}{x-2}$, $x \neq 2$

(ix) $\frac{2}{x^2-1} - \frac{1}{x+1} = \frac{1}{x+1}$, $x \neq \pm 1$

(x) $\frac{2}{3x+6} = \frac{1}{6} - \frac{1}{2x+4}$, $x \neq -2$

Sol// $\frac{2}{3}x - \frac{1}{2}x = x + \frac{1}{6}$

2	3, 2, 6
3	3, 1, 3
	1, 1, 1

LCM = 2 x 3 = 6

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

$4x - 3x = 6x + 1$

$x = 6x + 1$

$-6x + x = 1$

$-5x = 1$

$x = \frac{1}{-5}$

$x = -\frac{1}{5}$

$S.S = \left\{-\frac{1}{5}\right\}$

$-6x$
$+1x$
$-5x$

حل سیٹ $= \left\{-\frac{1}{5}\right\}$

Sol//

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

$$^{2}\cancel{6}\left(\frac{x-3}{\cancel{3}_{1}}\right) - ^{3}\cancel{6}\left(\frac{x-2}{\cancel{2}_{1}}\right) = 6(-1)$$

$$2(x-3) - 3(x-2) = -6$$

$$2x - \cancel{6} - 3x + \cancel{6} = -6$$

$$+1x = +6$$

$$\boxed{x = 6}$$

$$+2x$$
$$-3x$$
$$\overline{-1x}$$

$$S.S = \{6\} \qquad \{6\} = \text{حل سیٹ}$$

Sol//

$$\frac{5(x-3)}{6} - x = 1 - \frac{x}{9}$$

3	6, 9
2	2, 3
3	1, 3
	1, 1

$$LCM = 3 \times 2 \times 3 = 18$$

$$\overset{3}{\cancel{18}}\left[\frac{5(x-3)}{\cancel{6}_{1}}\right] - 18x = 18(1) - \overset{2}{\cancel{18}}\left(\frac{x}{\cancel{9}_{1}}\right)$$

$$15(x-3) - 18x = 18 - 2x$$

$$15x - 45 - 18x = 18 - 2x$$

①
18
45
63

$$15x - 18x + 2x = 18 + 45$$

$$17x - 18x = 63$$

−18x
+17x
−1x

$$-1x = 63$$

$$x = \frac{63}{-1}$$

$$\boxed{x = -63}$$

$$S.S = \{-63\}$$

Sol//

$$\frac{x}{3x-6} = 2 - \frac{2x}{x-2}$$

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

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

$$\cancel{3(x-2)}\left[\frac{x}{\cancel{3(x-2)}}\right] + 3\cancel{(x-2)}\left[\frac{2x}{\cancel{(x-2)}}\right] = 3(x-2)[2]$$

$$x + 3(2x) = 6(x-2)$$

$$x + 6x = 6x - 12$$

$$x + \cancel{6x} - \cancel{6x} = -12$$

$$\boxed{x = -12} \qquad S.S = \{-12\}$$

Sol//

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

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

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

$$\cancel{(x-1)(x+1)}\left[\frac{2}{\cancel{(x-1)(x+1)}}\right] - (x-1)\cancel{(x+1)}\left[\frac{1}{\cancel{(x+1)}}\right] = (x-1)\cancel{(x+1)}\left[\frac{1}{\cancel{(x+1)}}\right]$$

$$2 - (x-1)(1) = (x-1)(1)$$

$$2 - (x-1) = (x-1)$$

$$2 - x + 1 = x - 1$$

$$2 + 1 + 1 = x + x$$

$$4 = 2x$$

$$\frac{4}{2} = x$$

$$\boxed{2 = x}$$

$$S.S = \{2\}$$

Sol//

$$\frac{2}{3x+6} = \frac{1}{6} - \frac{1}{2x+4}$$

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

3	3, 6, 2
2	1, 2, 2
	1, 1, 1

LCM = 3 × 2 = 6

$$^{2}\cancel{6}\cancel{(x+2)}\left[\frac{2}{\cancel{3}\cancel{(x+2)}}\right] = \cancel{6}(x+2)\left[\frac{1}{\cancel{6}}\right] - \overset{3}{\cancel{6}}\cancel{(x+2)}\left[\frac{1}{\cancel{2}\cancel{(x+2)}_{1}}\right]$$

$$4 = (x+2)(1) - 3(1)$$

$$4 = x + 2 - 3$$

$$4 = x - 1$$

$$4 + 1 = x$$

$$\boxed{5 = x}$$

$$S.S = \{5\}$$

Q#2. Solve and check for extraneous root if any. درج ذیل ہر مساوات کو حل کریں اور اضافی اصل کی پڑتال کریں

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

(ii) $\sqrt[3]{2x-4} - 2 = 0$

(v) $\sqrt[3]{2x+3} = \sqrt[3]{x-2}$

(viii) $\sqrt{\frac{x+1}{2x+5}} = 2$

Sol// $\sqrt{3x+4} = 2$

Taking square on both sides

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

$3x+4 = 4$

$3x = 4-4$

$3x = 0$

$x = \frac{0}{3}$

$\boxed{x=0}$

Check

$\sqrt{3x+4} = 2$

put $x=0$

$\sqrt{3(0)+4} = 2$

$\sqrt{0+4} = 2$

$\sqrt{4} = 2$

$\boxed{2=2}$

S.S = {0}

Q#2. Solve and check for extraneous root if any. درج ذیل ہر مساوات کو حل کریں اور اضافی اصل کی پڑتال کریں

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

(ii) $\sqrt[3]{2x-4} - 2 = 0$

(v) $\sqrt[3]{2x+3} = \sqrt[3]{x-2}$

(viii) $\sqrt{\frac{x+1}{2x+5}} = 2$

Sol//

$$\sqrt[3]{2x-4} - 2 = 0$$

$$\sqrt[3]{2x-4} = 2$$

Taking cube on both sides

$$\left[\sqrt[3]{2x-4}\right]^3 = [2]^3$$

$$2x-4 = 8$$

$$2x = 8+4$$

$$2x = 12$$

$$x = \frac{12}{2}$$

$$\boxed{x = 6}$$

Check پڑتال

$$\sqrt[3]{2x-4} - 2 = 0$$

Put $x=6$

$$\sqrt[3]{2(6)-4} - 2 = 0$$

$$\sqrt[3]{12-4} - 2 = 0$$

$$\sqrt[3]{8} - 2 = 0$$

$$(8)^{1/3} - 2 = 0$$

$$(2^3)^{1/3} - 2 = 0$$

$$2 - 2 = 0$$

$$\boxed{0 = 0}$$

$\boxed{S.S = \{6\}}$

Answer.

Q#2. Solve and check for extraneous root if any. درج ذیل ہر مساوات کو حل کریں اور اضافی اصل کی پڑتال کریں

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

(ii) $\sqrt[3]{2x-4} - 2 = 0$

(v) $\sqrt[3]{2x+3} = \sqrt[3]{x-2}$

(viii) $\sqrt{\frac{x+1}{2x+5}} = 2$

Sol// $\sqrt[3]{2x+3} = \sqrt[3]{x-2}$

Taking cube on both side

$$\left(\sqrt[3]{2x+3}\right)^3 = \left(\sqrt[3]{x-2}\right)^3$$

$$2x+3 = x-2$$

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

$$\boxed{x = -5}$$

Check پڑتال

$$\sqrt[3]{2x+3} = \sqrt[3]{x-2}$$

put $\boxed{x=-5}$

$$\sqrt[3]{2(-5)+3} = \sqrt[3]{-5-2}$$

$$\sqrt[3]{-10+3} = \sqrt[3]{-7}$$

$$\sqrt[3]{-7} = \sqrt[3]{-7}$$

$$\boxed{S.S = \{-5\}}$$

Q#2. Solve and check for extraneous root if any. درج ذیل ہر مساوات کو حل کریں اور اضافی اصل کی پڑتال کریں

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

(ii) $\sqrt[3]{2x-4} - 2 = 0$

(v) $\sqrt[3]{2x+3} = \sqrt[3]{x-2}$

(viii) $\sqrt{\frac{x+1}{2x+5}} = 2$

Sol// $\sqrt{\frac{x+1}{2x+5}} = 2$

Taking square on both sides

$$\left(\sqrt{\frac{x+1}{2x+5}}\right)^2 = (2)^2$$

$$\frac{x+1}{2x+5} = 4$$

$$x+1 = 4(2x+5)$$

$$x+1 = 8x+20$$

$$-20+1 = 8x-x$$

$$-19 = 7x$$

$$\boxed{\frac{-19}{7} = x}$$

Check پڑتال

$$\sqrt{\frac{x+1}{2x+5}} = 2$$

put $x = -\frac{19}{7}$

$$\sqrt{\frac{-\frac{19}{7}+\frac{1}{1}}{2\left(\frac{-19}{7}\right)+5}} = 2$$

$$\sqrt{\frac{\frac{-19+7}{7}}{\frac{-38+35}{7}}} = 2$$

$$\sqrt{\frac{+12}{+3}} = 2$$

$$\sqrt{\frac{12}{3}^4} = 2$$

$$\sqrt{4} = 2$$

$$\boxed{2 = 2}$$

$$\boxed{S.S = \left\{\frac{-19}{7}\right\}}$$

Answer.

Q#2. Solve for x.

س2 - مندرجہ ذیل مساواتوں کا حل سیٹ معلوم کریں۔

(iii) $|2x+5| = 11$

$|2x+5| = 11$

Sol// $|2x+5| = 11$

$2x+5 = \pm 11$

$2x+5 = 11$	$2x+5 = -11$
$2x = 11-5$	$2x = -11-5$
$2x = 6$	$2x = -16$
$x = \frac{6}{2}$	$x = -\frac{16}{2}$
$x = 3$	$x = -8$

$S.S = \{-8, 3\}$ حل سیٹ $= \{-8, 3\}$

(v) $|x+2| - 3 = 5 - |x+2|$

(vii) $\left|\frac{3-5x}{4}\right| - \frac{1}{3} = \frac{2}{3}$

(viii) $\left|\frac{x+5}{2-x}\right| = 6$

Q#2. Solve for x.

(iii) $|2x+5| = 11$

(v) $|x+2| - 3 = 5 - |x+2|$

(vii) $\left|\frac{3-5x}{4}\right| - \frac{1}{3} = \frac{2}{3}$

(viii) $\left|\frac{x+5}{2-x}\right| = 6$

س2 - مندرجہ ذیل مساواتوں کا حل سیٹ معلوم کریں۔

$|x+2| - 3 = 5 - |x+2|$

Sol// $|x+2| - 3 = 5 - |x+2|$

$|x+2| + |x+2| = 5 + 3$

$2|x+2| = 8$

$|x+2| = \frac{8}{2}$

$|x+2| = 4$

$|x+2| = 4$

$x+2 = \pm 4$

$x+2 = 4$	$x+2 = -4$
$x = 4-2$	$x = -4-2$
$x = 2$	$x = -6$

$S.S = \{2, -6\}$

حل سیٹ $= \{2, -6\}$

Q#2. Solve for x.

(iii) $|2x+5| = 11$

(v) $|x+2| - 3 = 5 - |x+2|$

(vii) $\left|\frac{3-5x}{4}\right| - \frac{1}{3} = \frac{2}{3}$

(viii) $\left|\frac{x+5}{2-x}\right| = 6$

س2 - مندرجہ ذیل مساواتوں کا حل سیٹ معلوم کریں۔

$\left|\frac{3-5x}{4}\right| - \frac{1}{3} = \frac{2}{3}$

Sol//

$\left|\frac{3-5x}{4}\right| - \frac{1}{3} = \frac{2}{3}$

$\left|\frac{3-5x}{4}\right| = \frac{2}{3} + \frac{1}{3}$

$\left|\frac{3-5x}{4}\right| = \frac{2+1}{3}$

$\left|\frac{3-5x}{4}\right| = \frac{3}{3}$

$\left|\frac{3-5x}{4}\right| = 1$

$\frac{3-5x}{4} = \pm 1$

$\frac{3-5x}{4} = 1$

$3-5x = 1(4)$

$3-5x = 4$

$3-4 = 5x$

$-1 = 5x$

$\frac{-1}{5} = x$

$\frac{3-5x}{4} = -1$

$3-5x = -1(4)$

$3-5x = -4$

$-5x = -4-3$

$-5x = -7$

$x = \frac{-7}{-5}$

$x = \frac{7}{5}$

$S.S = \left\{-\frac{1}{5}, \frac{7}{5}\right\}$

Q#2. Solve for x.

س2 - مندرجہ ذیل مساواتوں کا حل سیٹ معلوم کریں۔

(iii) $|2x+5| = 11$

(v) $|x+2| - 3 = 5 - |x+2|$

(vii) $\left|\frac{3-5x}{4}\right| - \frac{1}{3} = \frac{2}{3}$

(viii) $\left|\frac{x+5}{2-x}\right| = 6$

$\left|\frac{x+5}{2-x}\right| = 6$

Sol// $\left|\frac{x+5}{2-x}\right| = 6$

$\frac{x+5}{2-x} = \pm 6$

$\frac{x+5}{2-x} = 6$

$x+5 = 6(2-x)$

$x+5 = 12-6x$

$x+6x = 12-5$

$7x = 7$

$x = \frac{7}{7}$

$\boxed{x=1}$

$\frac{x+5}{2-x} = -6$

$x+5 = -6(2-x)$

$x+5 = -12+6x$

$x-6x = -12-5$

$-5x = -17$

$\boxed{x = \frac{17}{5}}$

$S.S = \left\{1, \frac{17}{5}\right\}$

$-6x$
$+1x$
$-5x$

-12
-5
-17

Q#1. Solve حل کریں

(ii) $4x - 10.3 \leq 21x - 1.8$

(iv) $x - 2(5-2x) \geq 6x - 3\frac{1}{2}$

$4x - 10.3 \leq 21x - 1.8$

Sol// $-10.3 + 1.8 \leq 21x - 4x$

$-8.5 \leq 17x$

$-\frac{8.5}{17} \leq x$

$-0.5 \leq x$

$x \geq -0.5$

$S.S = \{x \geq -0.5\}$

Q#1. Solve حل کریں

(ii) $4x - 10.3 \leqslant 21x - 1.8$

(iv) $x - 2(5-2x) \geqslant 6x - 3\frac{1}{2}$

$x - 2(5-2x) \geqslant 6x - 3\frac{1}{2}$

Sol// $x - 2(5-2x) \geqslant 6x - \frac{7}{2}$

$2[x - 2(5-2x)] \geqslant 2[6x - \frac{7}{2}]$

$2x - 4(5-2x) \geqslant 12x - 2(\frac{7}{2})$

$2x - 20 + 8x \geqslant 12x - 7$

$10x - 20 \geqslant 12x - 7$

$-20 + 7 \geqslant 12x - 10x$

$-13 \geqslant 2x$

$-\frac{13}{2} \geqslant x$

$-6.5 \geqslant x$

$\boxed{x \leqslant -6.5}$

$S.S = \{x \leqslant -6.5\}$

Q#2. Solve حل کریں

(iii) $-6 < \frac{x-2}{4} < 6$

$$-6 < \frac{x-2}{4} < 6$$

$$-6 < \frac{x-2}{4}$$

$$-6 \times 4 < x-2$$

$$-24 < x-2$$

$$-24+2 < x$$

$$-22 < x$$

$$\frac{x-2}{4} < 6$$

$$x-2 < 6 \times 4$$

$$x-2 < 24$$

$$x < 24+2$$

$$x < 26$$

$$-22 < x < 26$$

$$S.S = \{-22 < x < 26\}$$

(iv) $3 \geq \frac{7-x}{2} \geq 1$

Q#2. Solve حل کریں

(iii) $-6 < \frac{x-2}{4} < 6$

(iv) $3 \geqslant \frac{7-x}{2} \geqslant 1$

$3 \geqslant \frac{7-x}{2} \geqslant 1$

$3 \geqslant \frac{7-x}{2}$

$3 \times 2 \geqslant 7-x$

$6 \geqslant 7-x$

$x \geqslant 7-6$

$x \geqslant 1$

$\boxed{1 \leqslant x}$

$\frac{7-x}{2} \geqslant 1$

$7-x \geqslant 1 \times 2$

$7-x \geqslant 2$

$7-2 \geqslant x$

$5 \geqslant x$

$\boxed{x \leqslant 5}$

$1 \leqslant x \leqslant 5$

$S.S = \{1 \leqslant x \leqslant 5\}$

Q#3(i). Define Linear Equation.

Ans. An equation whose degree is one is called linear equation.

$$ax + b = 0 \qquad a, b \in R \ , \ a \neq 0$$

س3- یک درجی مساوات کی تعریف کریں۔

جواب - ایسی مساوات جس کا درجہ ایک ہو، یک درجی مساوات کہلاتی ہے۔

$$ax + b = 0 \qquad a, b \in R \ , \ a \neq 0$$

Q#3(iii). The formula relating degree Fahrenheit to degree Celsius is

$F = \frac{9}{5}C + 32$ For what value of C is $F < 0$?

س 3 - حرارت کی پیمائش کرنے کے لیے ڈگری فارن ہائیٹ اور ڈگری سینٹی گریڈ کے درمیان تعلق کا فارمولا $F = \frac{9}{5}C + 32$ ہے۔ C کی کس قیمت کے لیے $F < 0$ ہو گا۔

$$F < 0$$

$$\frac{9}{5}C + 32 < 0$$

$$\frac{9}{5}C < -32$$

$$C < \frac{-32 \times 5}{9}$$

$$C < -\frac{160}{9}$$

$$\boxed{C < -17.78}$$

Q # 5 (i) Solve حل کریں $|3x+14|-2=5x$

Sol//

$$|3x+14|-2=5x$$

$$|3x+14|=5x+2$$

$$3x+14=\pm(5x+2)$$

$3x+14=(5x+2)$

$3x+14=5x+2$

$14-2=5x-3x$

$12=2x$

$\frac{12}{2}=x$

$\boxed{6=x}$

$3x+14=-(5x+2)$

$3x+14=-5x-2$

$3x+5x=-2-14$

$8x=-16$

$x=-\frac{16}{8}$

$\boxed{x=-2}$

$S.S=\{-2,6\}$

Q#4. Find the value of m and c of the following lines by expressing them in the form $y = mx + c$

سوال 4- دی ہوئی مساواتوں کو $y=mx+c$ میں ظاہر کرنے کے بعد m اور c کی قیمت بتائیں۔

(ii) $x - 2y = -2$

Sol//

$$x - 2y = -2$$

$$-2y = -x - 2$$

$$\frac{-2y}{-2} = \frac{-x}{-2} - \frac{2}{-2}$$

$$y = \frac{1}{2}x + 1$$

$$y = mx + c$$

$m = \frac{1}{2}$ $\quad$ $c = 1$

(iii) $3x + y - 1 = 0$

Sol//

$$3x + y - 1 = 0$$

$$y = -3x + 1$$

$$y = mx + c$$

$m = -3$ $\quad$ $c = 1$

Q#5. Verify whether the following point lies on the line $2x-y+1=0$ or not.

س5- تصدیق کریں کہ کیا نیچے دیے گئے نقاط لائن $2x-y+1=0$ پر واقع ہیں یا نہیں۔

(ii) $(0,0)$

Sol// $(0,0)$ $\quad x=0, y=0$

$x \quad y$

$$2x-y+1=0$$

Put $x=0$ & $y=0$

$$2(0)-(0)+1=0$$

$$0-0+1=0$$

$$1 \neq 0$$

$(0,0)$ does not lies on given lies.

$(0,0)$ لائن پر واقع نہیں ہے۔

(v) $(5,3)$

Sol// $(5,3)$ $\quad x=5, y=3$

$x \quad y$

$$2x-y+1=0$$

Put $x=5$ & $y=3$

$$2(5)-(3)+1=0$$

$$10-3+1=0$$

$$8 \neq 0$$

$(5,3)$ does not lies on given line.

$(5,3)$ لائن پر واقع نہیں ہے۔

Q#1. Find distance between given points.

$$d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

سوال 1 - درج ذیل نقاط کے جوڑوں کے درمیان فاصلہ معلوم کریں۔

(a) $A(9,2)$, $B(7,2)$

(c) $A(-8,1)$, $B(6,1)$

(f) $A(0,0)$, $B(0,-5)$

$A(9,2)$ $B(7,2)$
$x_1\ y_1$ $x_2\ y_2$

$x_1=9$, $y_1=2$, $x_2=7$, $y_2=2$

$$d=|AB|=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

$$=\sqrt{(7-9)^2+(2-2)^2}$$

$$=\sqrt{(-2)^2+(0)^2}$$

$$=\sqrt{4+0}$$

$$=\sqrt{4}$$

$$=\boxed{2}$$ Answer.

Review Exercise

Q#3(ii) $(7,5)$, $(1,-1)$

Q#1. Find distance between given points. $d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

س1 - درج ذیل نقاط کے جوڑوں کے درمیان فاصلہ معلوم کریں۔

(a) A (9, 2), B (7, 2)

(c) A (-8, 1), B (6, 1)

(f) A (0, 0), B (0, -5)

Review Exercise

Q#3(ii) (7, 5), (1, -1)

Sol// A $(-8, 1)$ B $(6, 1)$

x_1, y_1 x_2, y_2

$x=-8$, $y_1=1$, $x_2=6$, $y_2=1$

$$d=|AB|=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

$$=\sqrt{(6-(-8))^2+(1-1)^2}$$

$$=\sqrt{(6+8)^2+(0)^2}$$

$$=\sqrt{(14)^2+0}$$

$$=\sqrt{196}$$

$$=\boxed{14}$$ Answer.

Q#1. Find distance between given points.

$$d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

سوال 1 - درج ذیل نقاط کے جوڑوں کے درمیان فاصلہ معلوم کریں۔

(a) $A(9,2)$, $B(7,2)$

(c) $A(-8,1)$, $B(6,1)$

(f) $A(0,0)$, $B(0,-5)$

$A(0,0)$, $B(0,-5)$

x_1,y_1 , x_2,y_2

$x_1=0$, $y_1=0$, $x_2=0$, $y_2=-5$

$$d=|AB|=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

$$=\sqrt{(0-0)^2+(-5-0)^2}$$

$$=\sqrt{(0)^2+(-5)^2}$$

$$=\sqrt{0+25}$$

$$=\sqrt{25}$$

$$=\boxed{5}$$ Answer.

Review Exercise

Q#3(ii) $(7,5)$, $(1,-1)$

Q#1. Find distance between given points. $d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

س1 - درج ذیل نقاط کے جوڑوں کے درمیان فاصلہ معلوم کریں۔

(a) A (9, 2), B (7, 2)

(c) A (-8, 1), B (6, 1)

(f) A (0, 0), B (0, -5)

(7, 5) , (1, -1)

x_1, y_1 x_2, y_2

$x_1=7 \quad y_1=5 \quad x_2=1 \quad y_2=-1$

$$d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

$$d=\sqrt{(1-7)^2+(-1-5)^2}$$

$$d=\sqrt{(-6)^2+(-6)^2}$$

$$d=\sqrt{36+36}$$

$$\boxed{d=\sqrt{72}}$$ Answer in

Review Exercise

Q#3(ii) (7, 5) , (1, -1)

Q#1. Find the mid point of the line segment joining each of the following pairs of points.

س 1- درج ذیل کا درمیانی نقطہ معلوم کریں۔

(a) $A(9,2)$ $B(7,2)$

Sol// $A(9,2)$ $B(7,2)$
$x_1\ y_1$ $x_2\ y_2$

$x_1 = 9$, $y_1 = 2$, $x_2 = 7$, $y_2 = 2$

$$\text{Mid point} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

$$= \left(\frac{9+7}{2}, \frac{2+2}{2}\right)$$

$$= \left(\frac{16}{2}, \frac{4}{2}\right)$$

$$= (8, 2)$$

(d) $A(-4,9)$ $B(-4,-3)$

Sol// $A(-4,9)$ $B(-4,-3)$
$x_1\ y_1$ $x_2\ y_2$

$x_1 = -4$, $y_1 = 9$, $x_2 = -4$, $y_2 = -3$

$$\text{Mid point} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

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

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

$$= \left(\frac{-8}{2}, \frac{6}{2}\right)$$

$$= (-4, 3)$$

(f) $A(0,0)$ $B(0,-5)$

Sol// $A(0,0)$ $B(0,-5)$
$x_1\ y_1$ $x_2\ y_2$

$x_1 = 0$, $y_1 = 0$, $x_2 = 0$, $y_2 = -5$

$$\text{Mid point} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

$$= \left(\frac{0+0}{2}, \frac{0+(-5)}{2}\right)$$

$$= \left(\frac{0}{2}, \frac{0-5}{2}\right)$$

$$= \left(0, -\frac{5}{2}\right)$$

(i) $(6,6)$ $(4,-2)$

Sol// $(6,6)$ $(4,-2)$
$x_1\ y_1$ $x_2\ y_2$

$x_1 = 6$, $y_1 = 6$, $x_2 = 4$, $y_2 = -2$

$$\text{Mid point} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

$$= \left(\frac{6+4}{2}, \frac{6+(-2)}{2}\right)$$

$$= \left(\frac{10}{2}, \frac{6-2}{2}\right)$$

$$= \left(5, \frac{4}{2}\right)$$

$$= (5, 2)$$

(ii) $(-5,-7)$ $(-7,-5)$

Sol// $(-5,-7)$ $(-7,-5)$
$x_1\ y_1$ $x_2\ y_2$

$x_1 = -5$ $y_1 = -7$

$x_2 = -7$ $y_2 = -5$

$$\text{Mid point} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

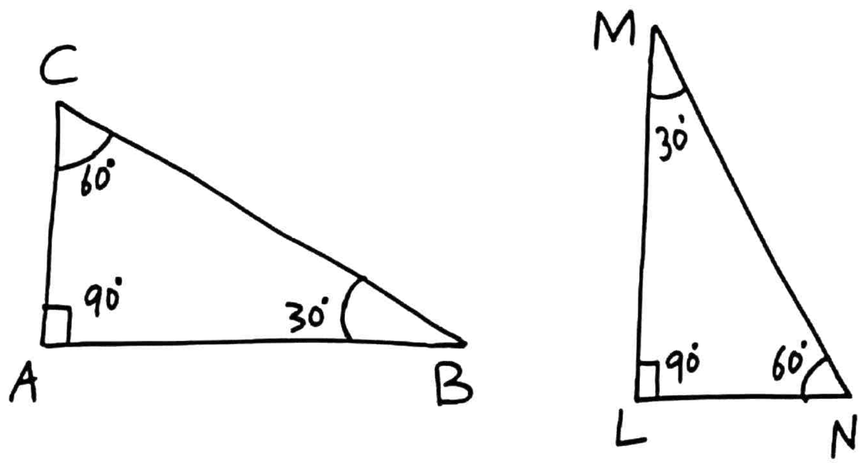
$$= \left(\frac{-5+(-7)}{2}, \frac{-7+(-5)}{2}\right)$$

$$= \left(\frac{-5-7}{2}, \frac{-7-5}{2}\right)$$

$$= \left(\frac{-12}{2}, \frac{-12}{2}\right)$$

$$= (-6, -6)$$

Q#2. If $\triangle ABC \cong \triangle LMN$, then

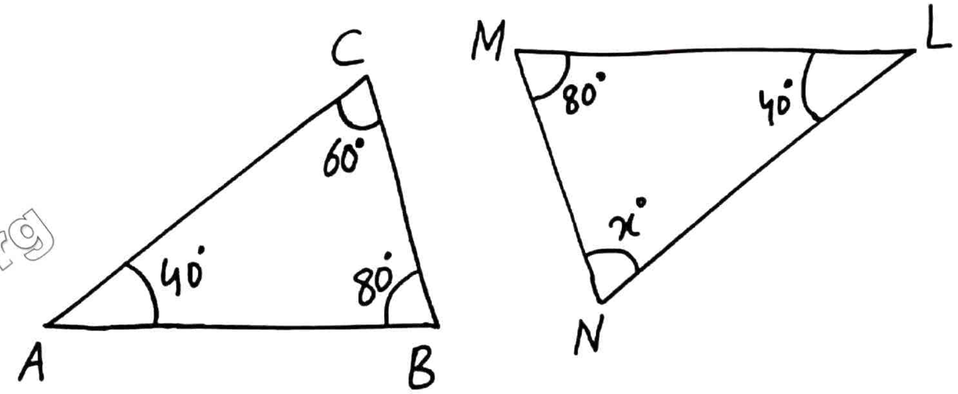


(i) $m\angle M \cong$ 30° $m\angle B$

(ii) $m\angle N \cong$ 60° $m\angle C$

(iii) $m\angle A \cong$ 90° $m\angle L$

Q#3. If $\triangle ABC \cong \triangle LMN$, then find the unknown x.



$m\angle A \cong m\angle L \cong 40°$

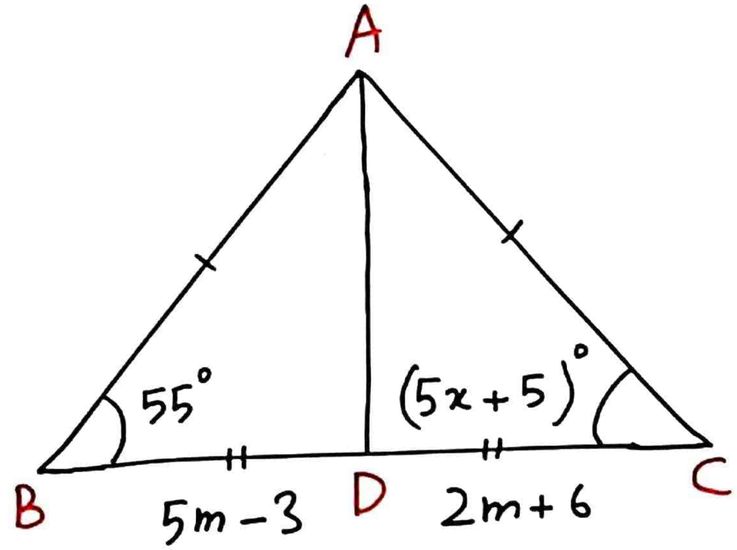
$m\angle B \cong m\angle M \cong 80°$

$m\angle C \cong m\angle N \cong \boxed{x° \cong 60°}$

Q#4. Find the value of unknowns for the given congruent triangles

Sol//

$x = ?$ $\quad m = ?$



$$55^\circ = (5x+5)^\circ$$

$$55 = 5x + 5$$

$$55 - 5 = 5x$$

$$50 = 5x$$

$$\frac{50}{5} = x$$

$$\boxed{10 = x}$$

$$5m - 3 = 2m + 6$$

$$5m - 2m = 6 + 3$$

$$3m = 9$$

$$m = \frac{9}{3}$$

$$\boxed{m = 3}$$

Q#5:- If $\Delta PQR \cong \Delta ABC$, then find the value of unknown x, y and z.

Sol//

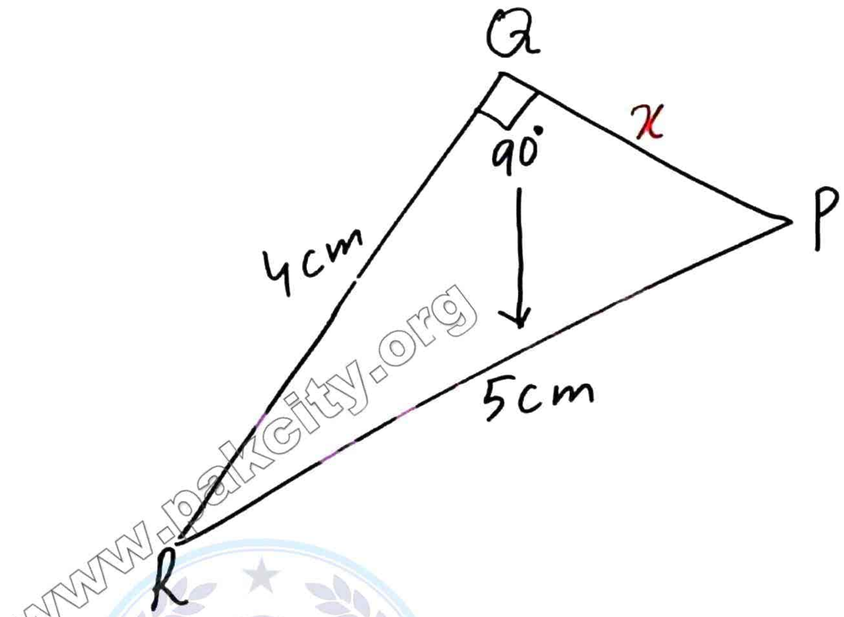
$$5 = y - 1$$

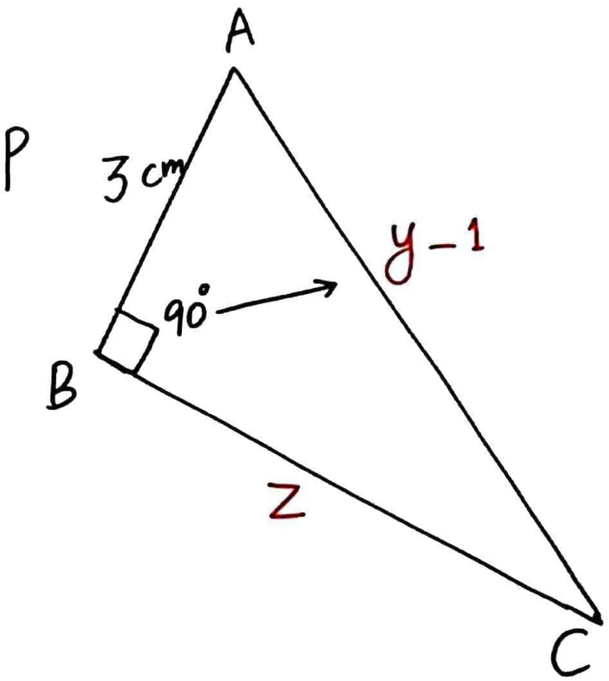
$$5 + 1 = y$$

$$\boxed{6cm = y}$$

$$\boxed{x = 3cm}$$

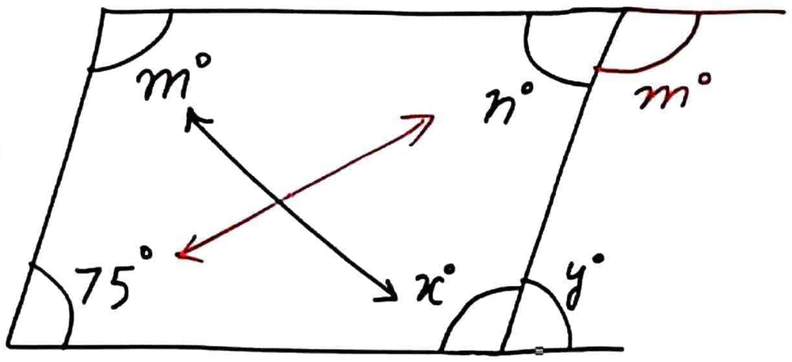
$$\boxed{Z = 4cm}$$





Q#3. Find the unknown in given figure.

سوال 3- دی گئی شکل میں نامعلوم کی مقدار معلوم کریں۔



$75^\circ = n^\circ$

$n^\circ + m^\circ = 180^\circ$

$75^\circ + m^\circ = 180^\circ$

$m^\circ = 180^\circ - 75^\circ$

$m^\circ = 105^\circ$

$x^\circ = m^\circ$

$x^\circ = 105^\circ$

$x^\circ + y^\circ = 180^\circ$

Putting the value of x°

$105^\circ + y^\circ = 180^\circ$

$y^\circ = 180^\circ - 105^\circ$

$y^\circ = 75^\circ$

Q#4. If the given figure ABCD is a parallelogram, then find x and m.

$55^\circ = 11x^\circ$

$\frac{55^\circ}{11} = x^\circ$

$\boxed{5^\circ = x^\circ}$

$\boxed{5 = x}$

$55^\circ + (5m+10)^\circ = 180^\circ$

$(5m+10)^\circ = 180^\circ - 55^\circ$

$(5m+10)^\circ = 125^\circ$

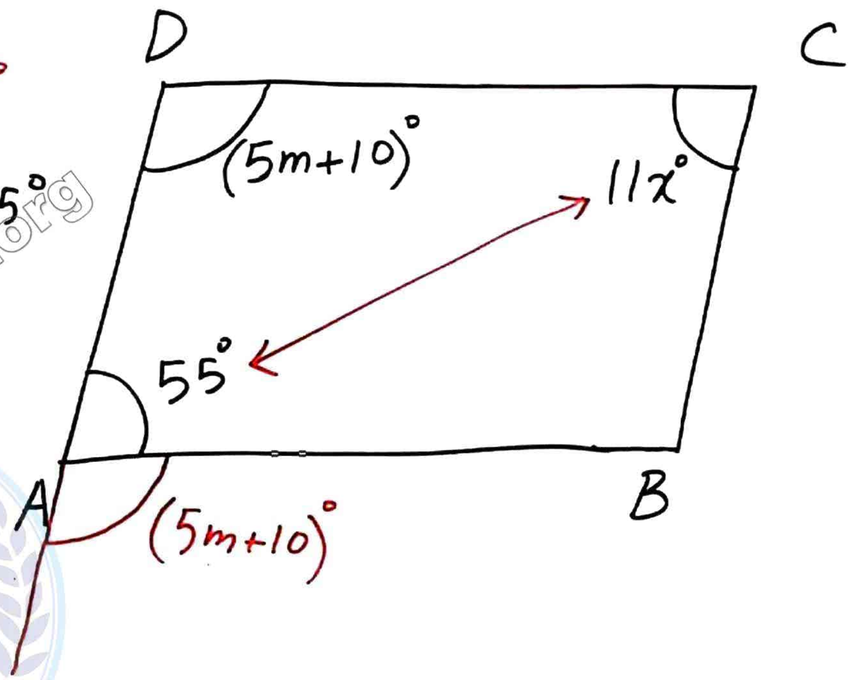
$5m + 10 = 125$

$5m = 125 - 10$

$5m = 115$

$m = \frac{115}{5}$

$\boxed{m = 23}$



Q#5. The given figure LMNP is a parallelogram. Find the value of m, n.

Q#6. In the Q#5. sum of opposite angles of parallelogram is 110°. Find the remaining angles.

$4m+n=10 \longrightarrow (1)$ $\quad$ $8m-4n=8 \longrightarrow (2)$

Multiply by 2

$2(4m+n)=2(10)$

$8m+2n=20 \longrightarrow (3)$

Subtract eq (2) from eq (3)

$$\begin{array}{r} 8m+2n=20 \\ -8m\mp 4n=-8 \\ \hline 6n=12 \end{array}$$

$n=\frac{12}{6}$

$\boxed{n=2}$

Now put $n=2$ in eq # (1)

$4m+n=10$

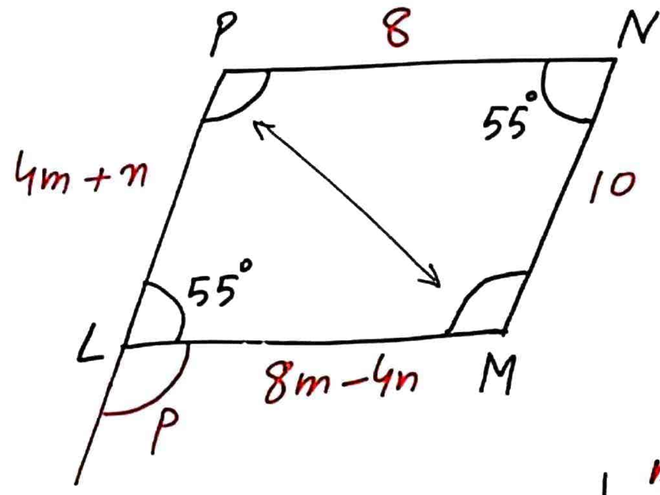
$4m+2=10$

$4m=10-2$

$4m=8$

$m=\frac{8}{4}$

$\boxed{m=2}$



$55^\circ + m\angle P = 180^\circ$

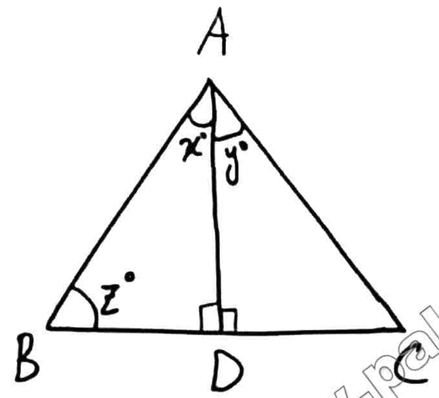
$m\angle P = 180^\circ - 55^\circ$

$\boxed{m\angle P = 125^\circ}$

$m\angle M = m\angle P$

$\boxed{m\angle M = 125^\circ}$

Q#4. The given triangle ABC is equilateral triangle and $\overline{AD}$ is bisector of angle A, then find the values of unknowns x°, y° and z°



Sol// Given that

ΔABC is equilateral
(مساوی الاضلاع)

$\Rightarrow m\angle A = m\angle B = m\angle C = 60^\circ$

$\overline{AD}$ is angle bisector of $\angle A$

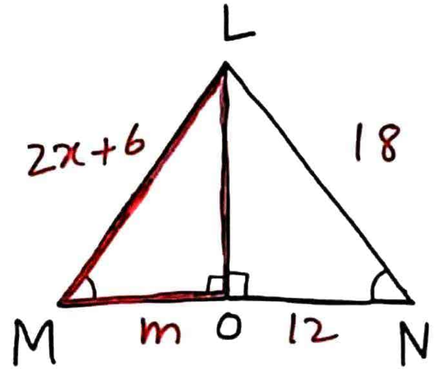
So,

$m\angle x^\circ = 30^\circ$

$m\angle y^\circ = 30^\circ$

$m\angle z^\circ = 60^\circ$

Q#5. In the given congruent triangles LMO and LNO, find the unknowns x and m.



Sol//

$2x+6 = 18$

$2x = 18-6$

$2x = 12$

$x = \frac{12}{2}$

$\boxed{x = 6}$

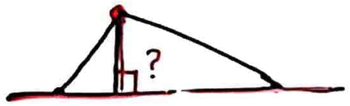
$\boxed{m = 12}$

Q#2- What will be angle for shortest distance from an outside point to the line?

س2- کسی خط کے بیرونی نقطہ سے بھیجے گئے قطعات خط میں سے فاصلہ میں سب سے چھوٹا قطعہ خط، اِس خط کے ساتھ کتنی مقدار کا زاویہ بنائے گا۔

Ans:- The angle for shortest distance from an outside point to line is 90°.

ج- سب سے چھوٹا قطعہ خط 90 ڈگری کا زاویہ بنائے گا۔



Q#3- If 13cm, 12cm and 5cm are the lengths of triangles, then verify that difference of measures of angle two sides of triangle is less than the measure of third side.

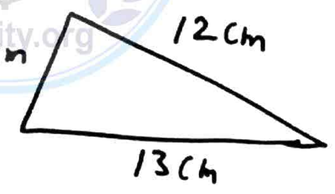
س3- اگر ایک مثلث کے اضلاع کی لمبائیاں 13cm، 12cm اور 5cm ہوں تو تصدیق کریں کہ مثلث کے دو اضلاع کی لمبائیوں کا فرق تیسرے ضلع کی لمبائی سے کم ہوتا ہے۔

Sol//

$$13 - 12 = 1 < 5$$

$$13 - 5 = 8 < 12$$

$$12 - 5 = 7 < 13$$



Q#4. If 10cm, 6cm and 8cm are the lengths of a triangle then verify that sum of measures of two sides of triangle is greater than the third side.

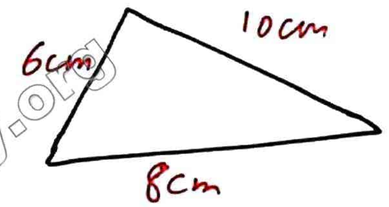
س4- اگر ایک مثلث کے اضلاع کی لمبائیاں 10cm، 6cm اور 8cm ہوں تو تصدیق کریں کہ مثلث کے دو اضلاع کی لمبائیوں کا مجموعہ تیسرے ضلع کی لمبائی سے بڑا ہوتا ہے۔

Sol//

$8 + 10 = 18 > 6$

$8 + 6 = 14 > 10$

$10 + 6 = 16 > 8$



Q#5. 3cm, 4cm and 7cm are not the lengths of the triangle. Give the reason.

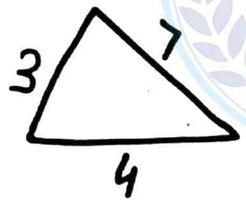
س5- 3cm، 4cm اور 7cm مثلث کے اضلاع کی لمبائیاں نہیں ہیں وجہ بتائیں۔

Sol//

✗ $3+4=7 \not> 7$

✓ $3+7=10 > 4$

✓ $4+7=11 > 3$



Sum of two sides is not greater than third side.

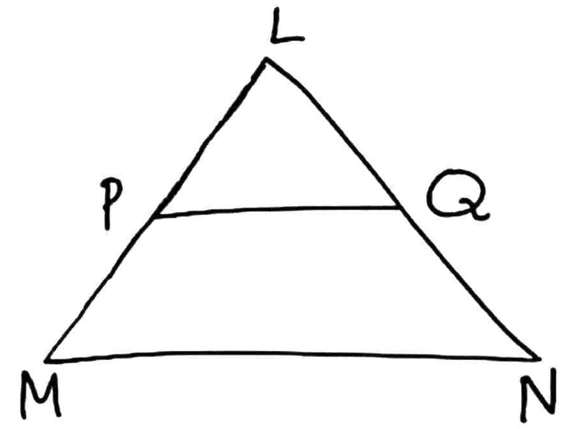
دو اضلاع کا مجموعہ تیسرے ضلع سے بڑا نہیں ہے۔ اس لیے یہ مثلث نہیں ہے

Q#3. In ΔLMN shown in figure $\overline{MN} \parallel \overline{PQ}$.

(i) If $m\overline{LM} = 5cm$, $m\overline{LP} = 2.5cm$,

$m\overline{LQ} = 2.3cm$ then find $m\overline{LN} = ?$

س3- سامنے دی گئی شکل کی مثلث میں $\overline{MN} \parallel \overline{PQ}$ ہے۔



Sol//

$$\frac{m\overline{LM}}{m\overline{LP}} = \frac{m\overline{LN}}{m\overline{LQ}}$$

$$\frac{5cm}{2.5cm} = \frac{m\overline{LN}}{2.3cm}$$

$$\frac{5}{2.5} \times 2.3cm = m\overline{LN}$$

$$\frac{11.5cm}{2.5} = m\overline{LN}$$

$$\boxed{4.6cm = m\overline{LN}}$$

Q#3. In ΔLMN shown in figure $\overline{MN} \parallel \overline{PQ}$.

(ii) If $m\overline{LM} = 6cm$, $m\overline{LQ} = 2.5\,cm$,

$m\overline{QN} = 5\,cm$ then find $m\overline{LP} = ?$

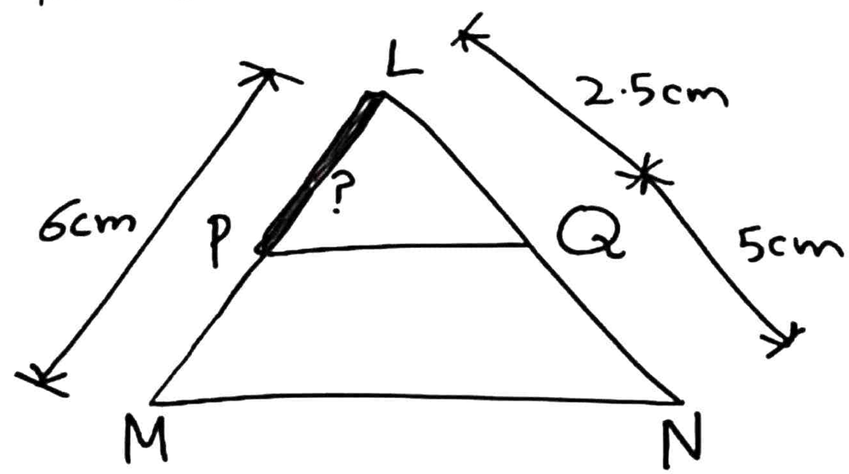
Sol//

$$\frac{m\overline{LM}}{m\overline{LP}} = \frac{m\overline{LN}}{m\overline{LQ}}$$

$$\frac{m\overline{LM}}{m\overline{LP}} = \frac{m\overline{LQ} + m\overline{QN}}{m\overline{LQ}}$$

$$\frac{6cm}{m\overline{LP}} = \frac{2.5cm + 5cm}{2.5cm}$$

س3- سامنے دی گئی شکل کی مثلث میں $\overline{MN} \parallel \overline{PQ}$ ہے۔



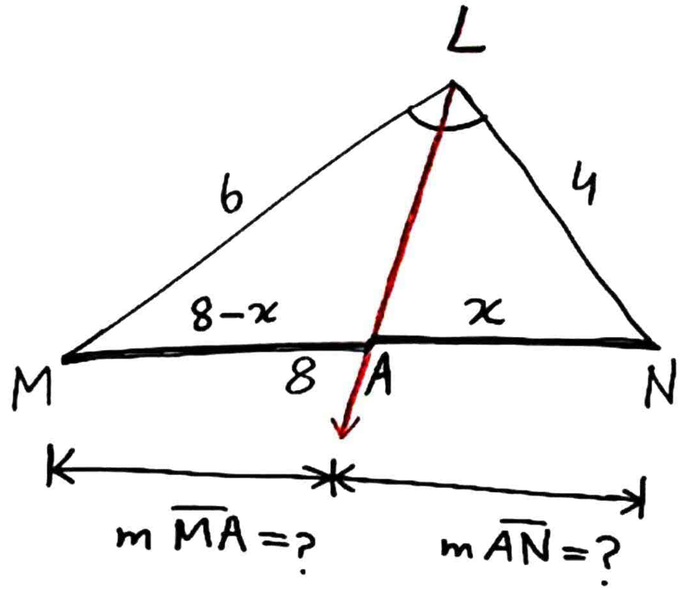
$6cm \times 2.5cm = 7.5cm \times m\overline{LP}$

$15\,cm^2 = 7.5cm \times m\overline{LP}$

$$\frac{15\,cm^2}{7.5cm} = m\overline{LP}$$

$$2cm = m\overline{LP}$$

Q#5. In $\triangle LMN$ shown in figure, $\overrightarrow{LA}$ bisects $\angle L$.
If $m\overline{LN} = 4$, $m\overline{LM} = 6$, $m\overline{MN} = 8$,
then find $m\overline{MA}$ and $m\overline{AN}$.



Sol//

$$\frac{m\overline{MA}}{m\overline{AN}} = \frac{m\overline{LM}}{m\overline{LN}}$$

$$\frac{8-x}{x} = \frac{6}{4}$$

$$(8-x)4 = 6(x)$$

$$32 - 4x = 6x$$

$$32 = 6x + 4x$$

$$32 = 10x$$

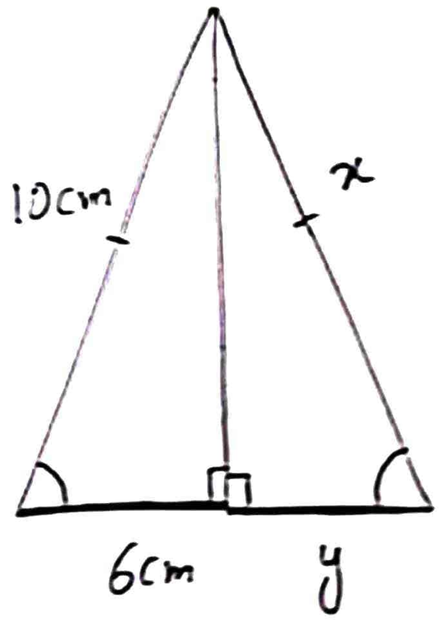
$$\frac{32}{10} = x$$

$$3.2 = x$$

$$m\overline{AN} = x = 3.2$$

$$m\overline{MA} = 8 - x = 8 - 3.2 = 4.8$$

Q# 6. In Isosceles (مساوی الساقین) $\triangle PQR$ shown in figure, find the value of x and y.



Sol//

$$x = 10\text{cm}$$

$$y = 6\text{cm}$$

Q#1. Verify that Δs having following measure of sides are right angled.

سوال- مثلثوں کے اضلاع کی لمبائیاں مندرجہ ذیل ہیں- تصدیق کریں یہ مثلثیں قائمۃ الزاویہ ہیں-

(i) $a = 5cm$, $b = 12\ cm$, $c = 13cm$

Sol// By Pythagores theorem

$(Hyp)^2 = (Base)^2 + (Perp)^2$

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

$(13)^2 = (5)^2 + (12)^2$

$169 = 25 + 144$

$\boxed{169 = 169}$

So given sides are sides of right-triangle

پس دیئے گئے اضلاع کی لمبائیاں قائمۃ الزاویہ مثلث بناتی ہیں۔

(iv) $a = 16cm$ $b = 30cm$ $c = 34cm$

Sol//

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

$(34)^2 = (16)^2 + (30)^2$

$1156 = 256 + 900$

$\boxed{1156 = 1156}$

So given sides are sides of right triangle

پس دیئے گئے اضلاع کی لمبائیاں قائمۃ الزاویہ مثلث بناتی ہیں-

Q#3. The three sides of triangle are measure 8, x and 17 respectively. For what value of "x" will it become base of a right angle triangle.

س3- ایک مثلث کے اضلاع کی لمبائیاں بالترتیب 8، x اور 17 ہیں۔ بیس x کی کس قیمت کے لیے یہ ضلع قائمۃ الزاویہ مثلث کا قاعدہ بن جائے گا۔

Sol// By Pythagores theorem

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

$$(17)^2=x^2+(8)^2$$

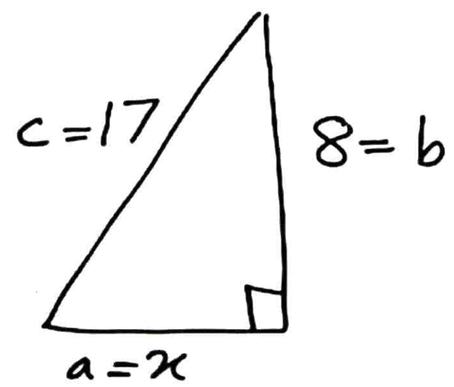
$$289=x^2+64$$

$$289-64=x^2$$

$$225=x^2$$

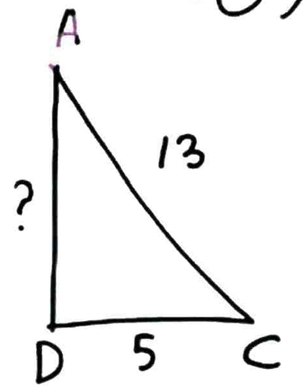
$$\sqrt{225}=\sqrt{x^2}$$

$$\boxed{15=x}$$



Q#6. Find the value of "x" in shown figure.

سوال 6 - دی گئی شکل میں "x" کی قیمت معلوم کریں۔



Sol//

AD = ?

By Pythagores theorem

$|AC|^2 = |DC|^2 + |AD|^2$

$(13)^2 = (5)^2 + |AD|^2$

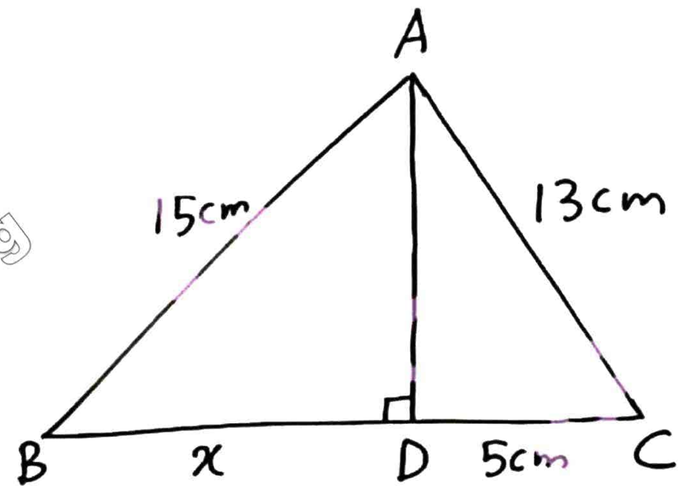
$169 = 25 + |AD|^2$

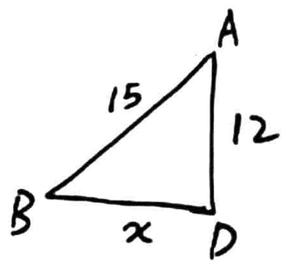
$169 - 25 = |AD|^2$

$144 = |AD|^2$

$\sqrt{144} = \sqrt{|AD|^2}$

$\boxed{12 = AD}$





$|AB|^2 = |BD|^2 + |AD|^2$

$(15)^2 = x^2 + (12)^2$

$225 = x^2 + 144$

$225 - 144 = x^2$

$81 = x^2$

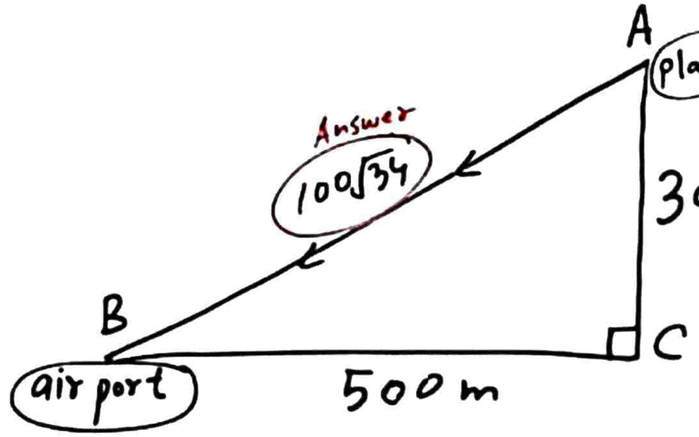
$\sqrt{81} = \sqrt{x^2}$

$\boxed{9 = x}$

Answer

Q#7. A plane is at a height of 300m and is 500m away from the airport as shown in figure. How much distance travel to land at the airport.

سوال۔ سامنے دی گئی شکل کے مطابق ایک ہوائی جہاز 300m کی بلندی پر ہے۔ اس کا ایئرپورٹ سے افقی فاصلہ 500m ہے اس کو ایئرپورٹ پر اترنے کے لیے کتنا فاصلہ طے کرنا پڑے گا۔



Sol// By using pythagores theorem

$$|AB|^2 = |BC|^2 + |AC|^2$$

$$|AB|^2 = (500)^2 + (300)^2$$

$$|AB|^2 = 250000 + 90000$$

$$|AB|^2 = 340000$$

Taking square root on both sides

$$\sqrt{|AB|^2} = \sqrt{340000}$$

$$\boxed{AB = 100\sqrt{34}}$$ Answer.

Q#8. A ladder 17m long rests against a vertical wall. The foot of the ladder is 8m away from the base of the wall. How high up the wall with the ladder.

سوال۔ 17m لمبائی والی سیڑھی ایک عمودی دیوار کے سہارے کھڑی ہے۔ اس کا نچلا پایہ دیوار کی بنیاد سے 8m کے فاصلے پر ہے۔ سیڑھی دیوار سے کتنی اونچی ہے۔

Sol//

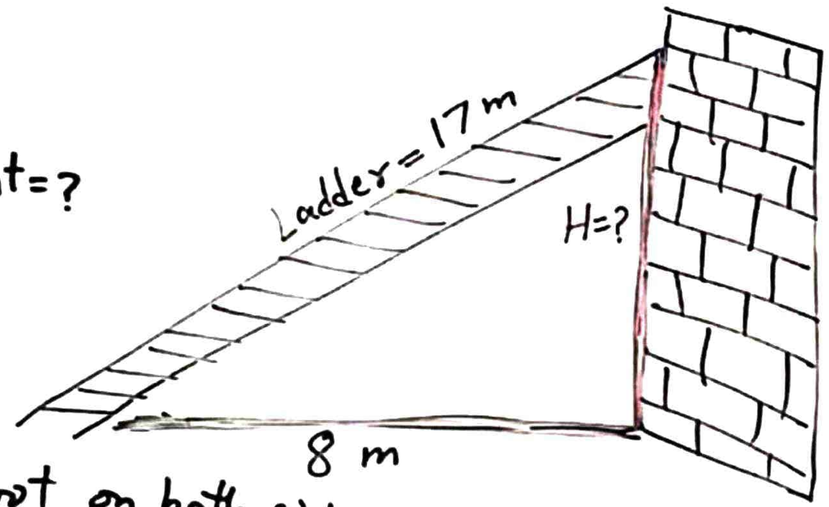
$$(Hyp)^2 = (Base)^2 + (Perp)^2$$

$$(17)^2 = (8)^2 + (height)^2$$

$$289 = 64 + (height)^2$$

$$289 - 64 = (height)^2$$

$$225 = (height)^2$$



Taking square root on both sides

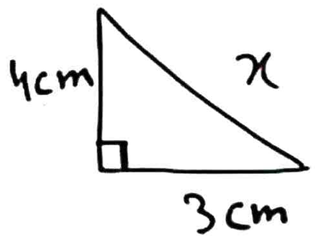
$$\sqrt{225} = \sqrt{(height)^2}$$

15m = height Answer.

Q#2. Find the unknown value in each of the following figures.

سوال 2- مندرجہ ذیل اشکال میں نامعلوم x کی قیمت معلوم کریں۔

(i)



Sol//

$(x)^2 = (3)^2 + (4)^2$

$x^2 = 9 + 16$

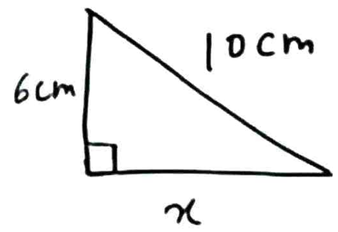
$x^2 = 25$

$\sqrt{x^2} = \sqrt{25}$

$x = 5$

$x = 5cm$

(ii)



$(10)^2 = (x)^2 + (6)^2$

$100 = x^2 + 36$

$100 - 36 = x^2$

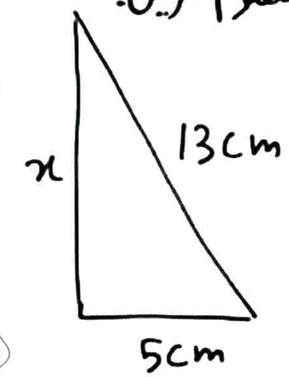
$64 = x^2$

$\sqrt{64} = \sqrt{x^2}$

$8 = x$

$8cm = x$

(iii)



$(13)^2 = (5)^2 + (x)^2$

$169 = 25 + x^2$

$169 - 25 = x^2$

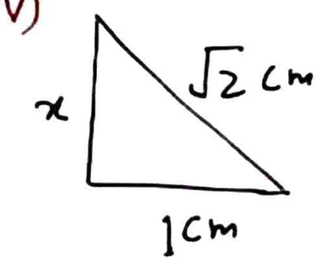
$144 = x^2$

$\sqrt{144} = \sqrt{x^2}$

$12 = x$

$12cm = x$

(iv)



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

$2 = 1 + x^2$

$2 - 1 = x^2$

$1 = x^2$

$\sqrt{1} = \sqrt{x^2}$

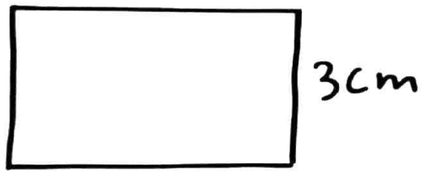
$1 = x$

$1cm = x$

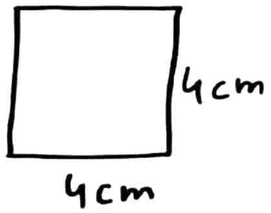
Q#2. Find the area of the following figures

س2- درج ذیل شکلوں کا رقبہ معلوم کریں

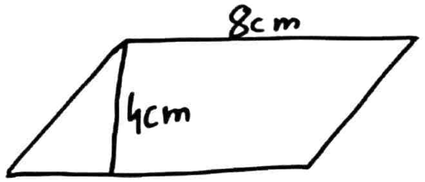
(i)



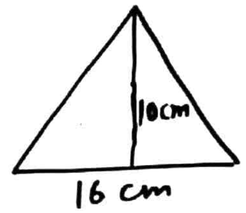
(ii)



(iii)



(iv)



Sol//

Area = (6cm) x (3cm)

Area = 18cm²

Area = (4cm)(4cm)

Area = 16cm²

Area = (4cm)(8cm)

Area = 32cm²

Area = $\frac{\text{Base x height}}{2}$

Area = $\frac{16\text{cm} \times 10\text{cm}}{2}$

Area = $\frac{160\text{cm}^2}{2}$

Area = 80 cm²