MATHEMATICS (PART–I)

SOLUTION : PRACTICE QUESTION PAPER 3

Q. 1. (A) (i) (D)

(ii) (A)

(iii) (C)

(iv) (C).

Q. 1. (A) Explanation to the answers to MCQs in this question has been given below for students' guidance. Please note that, **Students are not expected to write the explanation in the examination.**

Explanations :

(i) $5 \times (-4) - (3) \times (-7)$.

(ii) $P(A) = \dfrac{n(A)}{n(S)}$.

(iii) $\Delta = b^2 - 4ac \qquad \Delta < 0$.

(iv) The value of $t_x - t_y = (x - y) \times d$.

Q. 1. (B) **(i) Solution :**

If a coin and a die thrown simultaneously $n(S) = 12$.

Ans. The number of sample points is **12**.

(ii) Solution :

$$4x + 3y = 17 \qquad \ldots (2)$$

$$3x + 4y = 20 \qquad \ldots (1)$$

$$- \quad - \quad -$$

$$x - y = -3$$

Ans. The value of $(x - y)$ is $-\mathbf{3}$.

(iii) Solution :

$x^2 + 7x + 1 = 0$

Here, $a = 1$, $b = 7$, $c = 1$

$\Delta = b^2 - 4ac = (7)^2 - 4(1)(1) = 49 - 4 = 45$

Ans. The value of the determinant is **45**.

(iv) Solution :

Brokerage is considered on MV.

Here, MV = ₹ 120, Rate of brokerage = 0.5%

Brokerage $= 0.5\%$ of ₹ $120 =$ ₹ $120 \times \frac{0.5}{100} =$ ₹ 0.60

Ans. The brokerage is ₹ **0.60**.

Q. 2. (A) (i) Activity :

Let S be the sample space

Then, $n(S) = 52$

Event A : Card drawn is a black card.

Total black cards $= \boxed{\mathbf{13}}$ clubs $+ 13$ spades

$\therefore\ n(A) = \boxed{\mathbf{26}}$

$P(A) = \boxed{\dfrac{\boldsymbol{n(A)}}{\boldsymbol{n(S)}}}$ ... (Formula)

$\therefore\ P(A) = \dfrac{26}{52}$ $\quad\therefore\ P(A) = \boxed{\dfrac{\mathbf{1}}{\mathbf{2}}}$.

(ii) Activity :

Two-digit numbers divisible by 4 are 12, 16, 20, ..., 96.

$a = 12,\ d = 4,\ t_n = 96$

$t_n = a + (n-1)d$ ... (Formula)

$\therefore\ \boxed{\mathbf{96}} = \boxed{\mathbf{12}} + (n-1) \times 4$ ... (Substituting the values)

$\therefore\ 96 = 8 + \boxed{\mathbf{4}\boldsymbol{n}}$ $\quad\therefore\ 4n = \boxed{\mathbf{88}}$ $\quad\therefore\ n = 22$

There are 22 two-digit numbers divisible by 4.

(iii) Activity :

$D = \begin{vmatrix} 3 & -2 \\ 2 & 1 \end{vmatrix} = \boxed{7}$, $\quad D_x = \begin{vmatrix} 3 & -2 \\ 16 & 1 \end{vmatrix} = \boxed{\mathbf{35}}$, $\quad D_y = \begin{vmatrix} 3 & 3 \\ 2 & 16 \end{vmatrix} = 42.$

$x = \boxed{\dfrac{\mathbf{35}}{\mathbf{7}} = \mathbf{5}}$, $\quad y = \boxed{\dfrac{\mathbf{42}}{\mathbf{7}} = \mathbf{6}}$.

Q. 2. (B) (i) Solution :

$$\begin{vmatrix} \frac{7}{3} & \frac{5}{3} \\ \frac{3}{2} & \frac{1}{2} \end{vmatrix} = \frac{7}{3} \times \frac{1}{2} - \frac{5}{3} \times \frac{3}{2}$$

$$= \frac{7}{6} - \frac{15}{6} = \frac{7-15}{6} = \frac{-8}{6} = -\frac{4}{3}$$

Ans. $-\mathbf{\frac{4}{3}}$.

(ii) Solution :

$6x^2 - x - 2 = 0$

$\therefore\ 6x^2 - 4x + 3x - 2 = 0$

$\therefore\ 2x(3x - 2) + 1(3x - 2) = 0$

$\therefore\ (3x - 2)(2x + 1) = 0$

$\therefore\ 3x - 2 = 0$ or $2x + 1 = 0$

$\therefore\ 3x = 2$ or $2x = -1$

$\therefore\ x = \frac{2}{3}$ or $x = -\frac{1}{2}$

Ans. $\mathbf{\frac{2}{3}}$, $\mathbf{-\frac{1}{2}}$ are the roots of the given quadratic equation.

(iii) Solution :

Here, $a = 10$, $d = 3$, $t_{10} = ?$

$t_n = a + (n - 1)d$ ... (Formula)

$\therefore\ t_{10} = 10 + (10 - 1) \times 3$ ... (Substituting the values)

$= 10 + (9) \times 3$

$= 10 + 27$

$\therefore\ t_{10} = 37$

Ans. t_{10} is **37**.

(iv) Solution :

FV = ₹ 5, Premium = ₹ 20

MV = FV + Premium = ₹ 5 + ₹ 20 = ₹ 25

Sum invested = Number of shares × MV

$\therefore$ 20000 = Number of shares × 25

$\therefore$ number of shares $= \frac{20000}{25} = 800$

Ans. Suresh will get **800 shares.**

(v) Ans.

Class	*cf* (less than type)	Frequency
0–10	6	**6**
10–20	18	$18 - 6 =$ **12**
20–30	28	$28 - 18 =$ **10**
30–40	30	$30 - 28 =$ **2**

Q. 3. (A) (i) Activity :

$x^2 - 5x - 1 = 0$

Here, $a = 1$, $b = \boxed{-5}$, $c = -1$

$$\alpha + \beta = \frac{-b}{a} = \frac{-(-5)}{1} = 5$$

$$\alpha\beta = \frac{c}{a} = \boxed{\frac{-1}{1}} = \boxed{-1}$$

$$\alpha^3 + \beta^3 = (\alpha + \beta)^3 - \boxed{3\alpha\beta(\alpha + \beta)} \quad \text{... (Formula)}$$

$$= (5)^3 - 3 \times (-1) \times 5$$

$$= 125 + \boxed{15} = \boxed{140}.$$

(ii) Activity :

Marks	Class mark (x_i)	Frequency (f_i)	$f_i x_i$
0–10	5	$\boxed{3}$	15
10–20	15	10	$\boxed{150}$
20–30	25	20	500
30–40	$\boxed{35}$	5	175
40–50	45	2	90
Total		$\Sigma f_i = 40$	$\Sigma f_i x_i = \boxed{930}$

$$\text{Mean} = \overline{X} = \boxed{\frac{\Sigma f_i x_i}{\Sigma f_i}} \quad \text{... (Formula)}$$

$$= \frac{930}{40} \quad \text{... (Substituting the values)}$$

$\therefore$ Mean $= \boxed{23.25}$.

Q. 3. (B) (i) Solution :

$3x - y = 2$

$\therefore 3x = y + 2$

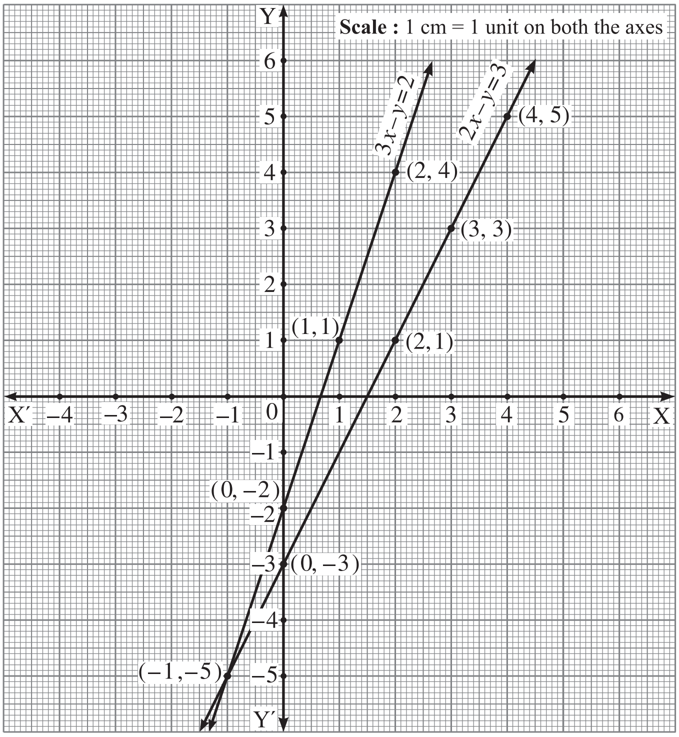
$\therefore y = 3x - 2$

x	-1	0	1	2
y	-5	-2	1	4
(x, y)	$(-1, -5)$	$(0, -2)$	$(1, 1)$	$(2, 4)$

$2x - y = 3$

$\therefore y = 2x - 3$

x	0	2	3	4
y	-3	1	3	5
(x, y)	$(0, -3)$	$(2, 1)$	$(3, 3)$	$(4, 5)$



The coordinates of the point of intersection are $(-1, -5)$.

Ans. The solution of the given simultaneous equation is $x = -\mathbf{1}$, $y = -\mathbf{5}$.

(ii) Solution : $5x^2 + 13x + 8 = 0$

Comparing with $ax^2 + bx + c = 0$,

$a = 5$, $b = 13$, $c = 8$

$b^2 - 4ac = (13)^2 - 4(5)(8) = 169 - 160 = 9$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-13 \pm \sqrt{9}}{2 \times 5} = \frac{-13 \pm 3}{10}$$

$$\therefore\ x = \frac{-13 + 3}{10} \quad \text{or} \quad x = \frac{-13 - 3}{10}$$

$$\therefore\ x = \frac{-10}{10} \quad \text{or} \quad x = -\frac{16}{10}$$

$$\therefore\ x = -1 \quad \text{or} \quad x = -\frac{8}{5}$$

Ans. $-\mathbf{1}$, $-\mathbf{\frac{8}{5}}$ are the roots of the given quadratic equation.

(iii) Solution :

Let the FV of each type of share be ₹ 100.

Company A : dividend 16%, MV = ₹ 80.

$\therefore$ on investing ₹ 80 for a share, the dividend is ₹ 16.

$$\text{Rate of return} = \frac{\text{Dividend income}}{\text{Sum invested}} \times 100$$

$$= \frac{16}{80} \times 100 = 20\% \qquad \dots (1)$$

Company B : dividend 20%, MV = ₹ 120.

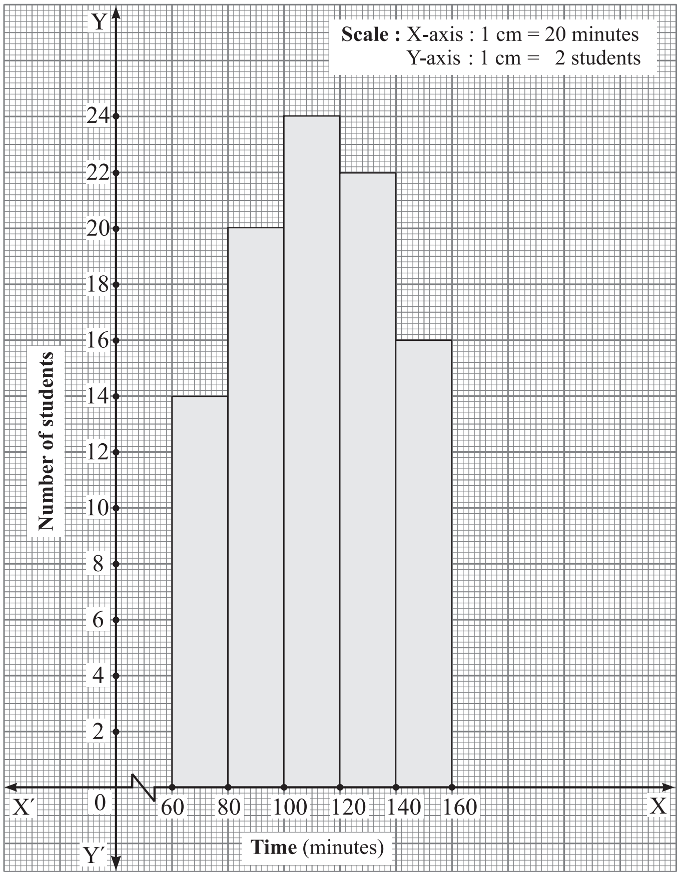
$\therefore$ on investing ₹ 120 for a share, the dividend is ₹ 20.

$$\text{Rate of return} = \frac{\text{Dividend income}}{\text{Sum invested}} \times 100$$

$$= \frac{20}{120} \times 100 \approx 16.67\% \quad \dots (2)$$

Ans. The investment in **Company A** is more profitable. [From (1) and (2)]

(iv) Solution :



Q. 4. (i) Solution :

Let the speed of the boat in still water be x km/h and the speed of the stream be y km/h.

$\therefore$ speed of the boat upstream $= (x - y)$ km/h and

the speed of the boat downstream $= (x + y)$ km/h.

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

From the first condition, $\frac{30}{x-y} + \frac{44}{x+y} = 10 \quad \dots (1)$

From the second condition, $\frac{40}{x-y} + \frac{55}{x+y} = 13 \quad \dots (2)$

Substituting a for $\frac{1}{x-y}$ and b for $\frac{1}{x+y}$, we get

$30a + 44b = 10 \quad ... (3) \quad \text{and} \quad 40a + 55b = 13 \quad ... (4)$

Multiplying equation (3) by 4 and equation (4) by 3,

$$\begin{array}{rcrcrl} & 120a & + & 176b & = & 40 \quad ... (5) \\ - & 120a & + & 165b & = & 39 \quad ... (6) \\ - & & - & & & - \\ \hline & & & 11b & = & 1 \quad ... \text{[Subtracting equation (6) from equation (5)]} \end{array}$$

$\therefore \ b = \dfrac{1}{11}$

Substituting $b = \dfrac{1}{11}$ in equation (3),

$30a + 44 \times \dfrac{1}{11} = 10 \qquad \therefore \ 30a + 4 = 10$

$\therefore \ 30a = 6 \qquad \therefore \ a = \dfrac{6}{30}$

$\therefore \ a = \dfrac{1}{5}$

Resubstituting the values of a and b, we get

$a = \dfrac{1}{x - y} = \dfrac{1}{5} \qquad \therefore \ x - y = 5 \quad ... (7)$

and $b = \dfrac{1}{x + y} = \dfrac{1}{11} \qquad \therefore \ x + y = 11 \quad ... (8)$

Adding equations (7) and (8),

$2x = 16 \qquad \therefore \ x = 8$

Substituting $x = 8$ in equation (8),

$8 + y = 11 \qquad \therefore \ y = 11 - 8 \qquad \therefore \ y = 3$

Ans. The speed of the boat in still water is **8 km/h** and the speed of the stream is **3 km/h.**

(ii) Solution :

Two dice are rolled simultaneously.

$\therefore$ the sample space

$S = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6),$
$(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6),$
$(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6),$
$(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6),$
$(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6),$
$(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\}$

$\therefore \ n(S) = 36.$

(a) Event A : The sum of the digits on the upper faces is a prime number.

$\therefore \ A = \{(1, 1), (1, 2), (1, 4), (1, 6), (2, 1), (2, 3), (2, 5), (3, 2), (3, 4), (4, 1),$
$(4, 3), (5, 2), (5, 6), (6, 1), (6, 5)\}.$

$\therefore\ n(A) = 15.$

$$P(A) = \frac{n(A)}{n(S)}$$

$$\therefore\ P(A) = \frac{15}{36} = \frac{5}{12}.$$

(b) Event B : The sum of the digits on the upper faces is a multiple of 5.

$\therefore\ B = \{(1, 4), (2, 3), (3, 2), (4, 1), (4, 6), (5, 5), (6, 4)\}.$

$\therefore\ n(B) = 7.$

$$P(B) = \frac{n(B)}{n(S)}$$

$$\therefore\ P(B) = \frac{7}{36}$$

Ans. (a) $\mathbf{\frac{5}{12}}$ (b) $\mathbf{\frac{7}{36}}$.

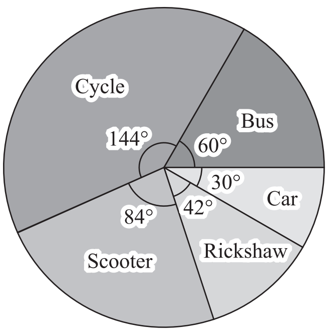
(iii) Solution :

The total number of students $= 20 + 48 + 28 + 14 + 10 = 120$

The number of students are converted into component parts of 360° in the following table :

Vehicle	Number of students	Measure of the central angle
Bus	20	$\frac{20}{120} \times 360° = 60°$
Cycle	48	$\frac{48}{120} \times 360° = 144°$
Scooter	28	$\frac{28}{120} \times 360° = 84°$
Rickshaw	14	$\frac{14}{120} \times 360° = 42°$
Car	10	$\frac{10}{120} \times 360° = 30°$
Total	120	360°

On the basis of the table, the pie diagram is drawn below :



Q. 5. **(i) Solution :**

(1) Comparing $x^2 - \sqrt{12}x - 1 = 0$ with $ax^2 + bx + c = 0$,

$a = 1$, $b = -\sqrt{12}$, $c = -1$.

(2) $b^2 - 4ac = (-\sqrt{12})^2 - 4\ (1)\ (-1) = 12 + 4 = 16$

(3) $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ ... (Formula)

(4) $x = \dfrac{-(-\sqrt{12}) \pm \sqrt{16}}{2 \times 1}$ ... (Substituting the values)

$= \dfrac{\sqrt{12} \pm 4}{2} = \dfrac{\sqrt{4 \times 3} \pm 4}{2} = \dfrac{2\sqrt{3} \pm 4}{2} = \dfrac{2\ (\sqrt{3} \pm 2)}{2}$

$\therefore\ x = \sqrt{3} \pm 2$

Ans. $\mathbf{\sqrt{3} + 2}$, $\mathbf{\sqrt{3} - 2}$ are the roots of the given quadratic equation.

(ii) Solution :

Here, $a = 6$. Let $d = 7$

The A.P. is 6, 13, 20, ...

We have to find the sum of first twenty-one term,

i.e. we have to find S_{21}.

$S_n = \dfrac{n}{2}\ [2a + (n-1)\ d]$ ... (Formula)

$\therefore\ S_{21} = \dfrac{21}{2}[2 \times 6 + (21 - 1) \times 7]$ ... (Substituting the values)

$= \dfrac{21}{2}[12 + 20 \times 7]$

$= \dfrac{21}{2}(12 + 140)$

$= \dfrac{21}{2} \times 152$

$= 1596$

Ans. The sum of the first twenty-one term is **1596**.

Justification :

The value of d is positive and $a = 6$.

$\therefore$ no term of this A.P. will be negative.

$\therefore\ -20$ cannot be the term of this A.P.