MATHEMATICS (PART–I)

SOLUTION : PRACTICE QUESTION PAPER 4

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

(ii) (A)

(iii) (C)

(iv) (B).

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) $x = \frac{D_x}{D}$.

(ii) GSTIN has is alphanumeric.

(iii) $t_n = a + (n-1)\, d$. Use this formula.

(iv) The maximum index of variable x is not 2 in (B).

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

$2x^2 = 32 \quad \therefore x^2 = 16 \quad \therefore x = \pm 4$.

Ans. 4 and **-4** are the roots.

(ii) Solution :

$$P(A) = \frac{n(A)}{n(S)} \qquad \therefore n(S) = \frac{n(A)}{P(A)} = \frac{36}{\frac{3}{4}} = \frac{36 \times 4}{3} = 48$$

Ans. $n(S) = \mathbf{48}$.

(iii) Solution :

$\frac{x}{4} + \frac{y}{3} = 4 \qquad \therefore 3x + 4y = 48$ … (Multiplying both the sides by 12)

$\therefore 3x + 4y - 48 = 0$

Ans. The standard form is $\mathbf{3x + 4y - 48 = 0}$.

(iv) Solution :

The rate of GST = 18%

$\therefore$ GST on ₹ 200 = ₹ 200 $\times \frac{18}{100}$ = ₹ 36

Ans. ₹ 36 is to be paid as GST.

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

Adding the given equations,

$11x + 6y = 4330$ ... (1)

$22x - 6y = 5240$ ... (2)

$33x = \boxed{\mathbf{9570}}$

$\therefore x = \boxed{\mathbf{290}}$

Substituting the value of x in equation (1),

$11 \times 290 + 6y = 4330$

$\therefore 6y = \boxed{\mathbf{1140}}$

$\therefore y = \boxed{\mathbf{190}}$.

(ii) Activity :

Reversing the terms of the given A.P. we get

49, ..., -5, -8, -11.

This is an A.P. We have to find the fourth term, i.e. t_4.

Here, $a = t_1 = \boxed{\mathbf{49}}$, $d = \boxed{\mathbf{-3}}$, $t_4 = ?$

$t_n = \boxed{\boldsymbol{a + (n-1)\,d}}$ ... (Formula)

$\therefore t_4 = 49 + (4 - 1) \times (-3)$

Simplifying, $t_4 = \boxed{\mathbf{40}}$.

(iii) Activity :

The total number of students in the class is 48.

$\therefore n(S) = \boxed{\mathbf{48}}$

Let A be the event that a student not wearing spectacles.

Then $n(A) = \boxed{\mathbf{44}}$ $\qquad P(A) = \boxed{\dfrac{\boldsymbol{n(A)}}{\boldsymbol{n(S)}}}$ ... (Formula)

$\therefore P(A) = \boxed{\dfrac{\mathbf{11}}{\mathbf{12}}}$.

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

$2x - 3y = 9$ … (1) $\qquad 2x + y = 13$ … (2)

Subtracting equation (1) from equation (2),

$2x + y = 13$ … (2)

$-$ $2x - 3y = 9$ … (1)

$-\quad +\quad -$

$4y = 4$

$\therefore y = \dfrac{4}{4} \qquad \therefore y = 1$

Substituting $y = 1$ in equation (2),

$2x + 1 = 13 \quad \therefore\ 2x = 13 - 1 \quad \therefore\ 2x = 12$

$\therefore\ x = \frac{12}{2} \quad \therefore\ x = 6$

Ans. $(x, y) = $ **(6, 1)** is the solution.

(ii) Solution :

$(x - 1)^2 = 2x + 3$

$\therefore\ x^2 - 2x + 1 = 2x + 3$

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

$\therefore\ x^2 - 4x - 2 = 0$

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

$a = 1,\ b = -4,\ c = -2$

Ans. The standard form : $\boldsymbol{x^2 - 4x - 2 = 0;\ a = 1,\ b = -4,\ c = -2}$.

(iii) Solution :

Here, $a = 5$, $d = 11 - 5 = 6$, Let $t_n = 299$.

$t_n = a + (n - 1)\ d$ … (Formula)

$\therefore\ 299 = 5 + (n - 1) \times 6$ … (Substituting the values)

$\therefore\ 299 - 5 = (n - 1) \times 6$

$\therefore\ 294 = (n - 1) \times 6$

$\therefore\ 49 = n - 1$ … (Dividing both the sides by 6)

$\therefore\ n = 49 + 1 \quad \therefore\ n = 50$

Ans. 299 **is a term** of the given A.P.

(iv) Solution :

Let the taxable value of the air conditioner be ₹ x.

28% GST

$\therefore$ GST $=$ ₹ $x \times \frac{28}{100} =$ ₹ $\frac{7x}{25}$

$\therefore$ total value (with GST) $=$ ₹ $\left(x + \frac{7x}{25}\right)$

The total value (with GST) is given to be ₹ 64,000

$\therefore\ x + \frac{7x}{25} = 64000$

$\therefore\ 25x + 7x = 64000 \times 25$ … (Multiplying both sides by 25)

$\therefore\ 32x = 64000 \times 25$

$\therefore\ x = \frac{64000 \times 25}{32} \quad \therefore\ x = 50000$

Ans. The taxable value of the air conditioner is ₹ **50,000**.

(v) Solution :

The value of $g = 300 - 200 = 100$

The class mark of the class 200–300

$= \frac{300 + 200}{2} = \frac{500}{2} = 250$

Ans. The value of g is **100;** class mark of the given class is **250**.

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

Let the mother's present age be x years.

Then the daughter's present age is $\boxed{\mathbf{x - 24}}$ years.

The reciprocal of mother's age is $\boxed{\mathbf{\frac{1}{x}}}$.

The reciprocal of daughter's age is $\frac{1}{x - 24}$.

From the given condition,

$\frac{1}{x} + \frac{1}{x - 24} = \boxed{\mathbf{\frac{1}{9}}}$

Simplifying, $18x - \boxed{\mathbf{216}} = x^2 - 24x$

$\therefore x^2 - \boxed{\mathbf{42}}\, x + 216 = 0$

Factorising, $(x - 36)(x - 6) = 0$

$\therefore x = 36$ or $x = 6$

$x = 6$ is **unacceptable**, because the mother's present age cannot be 6 years.

Mother's present age is 36 years.

(ii) Activity :

Places	Supply of electricity (Thousand units)	Measure of the central angle
Roads	4	$\frac{4}{30} \times \boxed{\mathbf{360^\circ}} = 48^\circ$
Factories	**12**	$\boxed{\mathbf{\frac{12}{30}}} \times 360^\circ = 144^\circ$
Shops	6	$\frac{6}{30} \times 360^\circ = \boxed{\mathbf{72^\circ}}$
Houses	8	$\boxed{\mathbf{\frac{8}{30}}} \times 360^\circ = \boxed{\mathbf{96^\circ}}$
Total	30	360°

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

Writing the given equations in the form $ax + by = c$,

$4x + 3y = 4$. Here, $a_1 = 4, b_1 = 3, c_1 = 4$

$6x + 5y = 8$ $a_2 = 6, b_2 = 5, c_2 = 8$

$$D = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} = \begin{vmatrix} 4 & 3 \\ 6 & 5 \end{vmatrix} = 4 \times 5 - 3 \times 6$$
$$= 20 - 18 = 2$$

$$D_x = \begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix} = \begin{vmatrix} 4 & 3 \\ 8 & 5 \end{vmatrix} = 4 \times 5 - 3 \times 8$$
$$= 20 - 24 = -4$$

$$D_y = \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix} = \begin{vmatrix} 4 & 4 \\ 6 & 8 \end{vmatrix} = 4 \times 8 - 4 \times 6$$
$$= 32 - 24 = 8$$

By Cramer's rule,

$$x = \frac{D_x}{D} = \frac{-4}{2} = -2 \quad \text{and} \quad y = \frac{D_y}{D} = \frac{8}{2} = 4$$

Ans. $(x, y) = \mathbf{(-2, 4)}$ is the solution.

(ii) Solution :

$x^2 - 4kx + k + 3 = 0$

i.e. $x^2 - 4kx + (k + 3) = 0$

Here, $a = 1$, $b = -4k$, $c = k + 3$

If α and β are the roots of the equation,

$\alpha + \beta = 2\alpha\beta$ ... (Given) ... (1)

$\alpha + \beta = -\frac{b}{a} = -\frac{-4k}{1} = 4k$ ... (2)

$\alpha\beta = \frac{c}{a} = \frac{k+3}{1} = k + 3$

$\therefore 2\alpha\beta = 2k + 6$ ... (3)

From (1), (2) and (3),

$4k = 2k + 6 \;\therefore 4k - 2k = 6 \;\therefore 2k = 6 \;\therefore k = 3$

Ans. The value of k is **3.**

(iii) Solution :

Rate of GST = 5%

Output tax (Tax collected at the time of sale) = 5% of ₹ 90000

$= \frac{5}{100} \times 90000 =$ ₹ 4500

Input tax (Tax paid at the time of purchase) = 5% of ₹ 85000

$= \frac{5}{100} \times 85000 =$ ₹ 4250

ITC = Input tax = ₹ 4250

GST payable = Output tax − ITC = ₹ (4500 − 4250) = ₹ 250.

Ans. ITC for Smt Malhotra is ₹ **4250**;

Amount of GST payable by Smt Malhotra is ₹ **250.**

(iv) Solution :

Here, the maximum frequency (60) is in the class 250−500.

∴ the modal class is 250−500.

$L = 250,\quad f_i = 60,\quad f_0 = 10,\quad f_2 = 25,\quad h = 250$

$$\text{Mode} = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 250 + \left[\frac{60 - 10}{2 \times 60 - 10 - 25}\right] \times 250$$

$$= 250 + \frac{50}{120 - 35} \times 250$$

$$= 250 + \frac{50}{85} \times 250$$

$= 250 + 0.588$ (Approx) $\times 250$

$= 250 + 147$

∴ Mode = 397

Ans. The mode of the demand of sweet in **397 grams**.

Q. 4. (i) Solution :

Let the time taken by taps A and B to fill the tank be x hours and y hours respectively.

In 1 hour tap A fills $\frac{1}{x}$ part of the tank.

In 1 hour tap B fills $\frac{1}{y}$ part of the tank.

It takes 8 hours to fill the tank.

∴ in 1 hour $\frac{1}{8}$ part of the tank is filled

∴ $\frac{1}{x} + \frac{1}{y} = \frac{1}{8}$ … (1)

Taps A and B are kept open for 6 hours

∴ they fill $\frac{6}{x} + \frac{6}{y}$ part of the tank.

Then tap B takes 3 hours to fill the tank.

∴ tap B fill $\frac{3}{y}$ part of the tank.

The tank is completely filled.

∴ $\frac{6}{x} + \frac{6}{y} + \frac{3}{y} = 1$

∴ $\frac{6}{x} + \frac{9}{y} = 1$ … (2)

Multiplying equation (1) by 9

$$\frac{9}{x}+\frac{9}{y}=\frac{9}{8} \quad \ldots (3)$$

Subtracting equation (2) from equation (3),

$$\frac{9}{x}+\frac{9}{y}=\frac{9}{8} \quad \ldots (3)$$

$$\frac{6}{x}+\frac{9}{y}=1 \quad \ldots (2)$$

$$- \quad - \quad -$$

$$\frac{3}{x}=\frac{9}{8}-1 \qquad \therefore \frac{3}{x}=\frac{9-8}{8} \qquad \therefore \frac{3}{x}=\frac{1}{8}$$

$\therefore x=24$

Substituting $x=24$ in equation (1),

$$\frac{1}{24}+\frac{1}{y}=\frac{1}{8} \qquad \therefore \frac{1}{y}=\frac{1}{8}-\frac{1}{24}$$

$$\therefore \frac{1}{y}=\frac{3-1}{24} \qquad \therefore \frac{1}{y}=\frac{2}{24} \qquad \therefore \frac{1}{y}=\frac{1}{12} \qquad \therefore y=12$$

Ans. Tap A requires **24 hours** and tap B requires **12 hours** to fill the tank.

(ii) Solution :

Two dice are rolled simultaneously.

$\therefore$ the sample space

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

$\therefore n(S) = 36.$

Event A : The sum of the digits on the upper faces is either 4 or 6.

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

$\therefore n(A) = 8.$

$$P(A)=\frac{n(A)}{n(S)} \qquad \therefore P(A)=\frac{8}{36} \qquad \therefore P(A)=\frac{2}{9}$$

Event B : The sum of the digits on the upper faces is a multiple of 3.

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

$\therefore n(B) = 12$

$$P(B)=\frac{n(B)}{n(S)} \qquad \therefore P(B)=\frac{12}{36} \qquad \therefore P(B)=\frac{1}{3}$$

Ans. The probability of event A is $\mathbf{\frac{2}{9}}$ and that of event B is $\mathbf{\frac{1}{3}}$.

(iii) Solution :

Let the assumed mean (A) be 550. Deviation $(d_i) = x_i - A = x_i - 550$.

Weekly income (in ₹)	**Class mark (x_i)**	**Number of families (f_i)**	**Deviations $d_i = x_i - 550$**	**$f_i d_i$**
200–300	250	4	− 300	− 1200
300–400	350	61	− 200	− 12200
400–500	450	118	− 100	− 11800
500–600	550 → A	139	0	0
600–700	650	126	100	12600
700–800	750	150	200	30000
800–900	850	2	300	600
Total		$\Sigma f_i = 600$		$\Sigma f_i d_i = 18000$

Here, $\Sigma f_i d_i = 18000$; $\Sigma f_i = 600$

$$\bar{d} = \frac{\Sigma f_i d_i}{\Sigma f_i} = \frac{18000}{600} = 30$$

Mean $= \bar{X} = A + \bar{d} = 550 + 30 = 580$

Ans. Mean of the weekly income is **₹ 580**.

Q. 5. (i) Solution :

1. The opposite sides of a rectangle are equal.

$\therefore\ 2x - y + 13 = x + 2y + 4$ and $2x + 6 = 3y$

$\therefore\ 2x - x - y - 2y = 4 - 13$ and $2x - 3y = -6$

$\therefore\ x - 3y = -9$ ... (1) and $2x - 3y = -6$ ... (2)

2. Subtracting equation (1) from equation (2),

$$\begin{array}{rcl} 2x - 3y &=& -6 \quad \dots (2) \\ x - 3y &=& -9 \quad \dots (1) \\ - \quad + & & + \\ \hline x &=& 3 \end{array}$$

Substituting $x = 3$ in equation (1),

$3 - 3y = -9$ $\quad\therefore\ -3y = -9 - 3$ $\quad\therefore\ -3y = -12$

$\therefore\ 3y = 12$ $\quad\therefore\ y = 4$

$x = 3$ and $y = 4$

3. Length $= x + 2y + 4 = 3 + 2\ (4) + 4 = 3 + 8 + 4 = 15$

Breadth $= 3y = 3 \times 4 = 12$.

Ans. The length and breadth of the rectangle are **15 units** and **12 units** respectively.

(ii) (a) Let the four consecutive terms of an A.P. be

$a-3d$, $a-d$, $a+d$ and $a+3d$.

(b) From the first condition,

$(a-3d)+(a-d)+(a+d)+(a+3d)=72$

$\therefore\ 4a=72 \qquad \therefore\ a=\frac{72}{4} \qquad \therefore\ a=18 \qquad \ldots (1)$

(c) Using the second condition,

$\frac{(a-3d)(a+3d)}{(a-d)(a+d)}=\frac{9}{10}$

$\therefore\ \frac{a^2-9d^2}{a^2-d^2}=\frac{9}{10}$

$\therefore\ 10(a^2-9d^2)=9(a^2-d^2)$ ... (Cross multiplying)

$\therefore\ 10a^2-90d^2=9a^2-9d^2$

$\therefore\ 10a^2-9a^2=-9d^2+90d^2$

$\therefore\ a^2=81d^2$

$\therefore\ (18)^2=81d^2$ ... [From (1)]

$\therefore\ d^2=\frac{18\times 18}{81} \qquad \therefore\ d^2=4 \qquad \therefore\ d=\pm 2$

But d is to be considered positive.

$\therefore\ d=2$

$a-3d=18-3(2)=18-6=12,$

$a-d=18-2=16,$

$a+d=18+2=20$

$a+3d=18+3(2)=18+6=24.$

Ans. The four consecutive terms of the A.P. are **12, 16, 20** and **24**.