MATHEMATICS (PART–I)

SOLUTION : PRACTICE QUESTION PAPER 5

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

(ii) (C)

(iii) (D)

(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 :

(ii) $(-1) \times 4 - 7 \times 2$

(iii) No GST is charged on essential commodities.

(iv) Discriminant $(\Delta) = b^2 - 4ac$.

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

FV = ₹ 10, Premium 10%

$\therefore$ premium = ₹ $10 \times \frac{10}{100}$ = ₹ 1.

$\therefore$ MV of the share = FV + premium = ₹ $(10 + 1)$ = ₹ 11.

Ans. The MV of the share is **₹ 11**.

(ii) Solution :

Comparing $5x^2 - 6x - 7 = 0$ with $ax^2 + bx + c = 0$,

$a = 5$, $c = -7$

Ans. The values of a and c are **5** and **-7** respectively.

(iii) Solution :

Here, $n(S) = 4$ … (4 balls : a red, a blue, a yellow and a white)

$n(Y) = 1$

$P(Y) = \frac{n(Y)}{n(S)} = \frac{1}{4}$

Ans. The probability of drawing a yellow ball is $\mathbf{\frac{1}{4}}$.

(iv) Solution :

Substituting $y = -3$ in the given equation,

$3x - 2(-3) = 3$ $\quad \therefore 3x + 6 = 3$ $\quad \therefore 3x = 3 - 6$

$\therefore 3x = -3$ $\quad \therefore x = -1$

Ans. The value of x is **-1**.

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

Here, $a = 3$, $d = \boxed{\mathbf{5}}$, $t_{30} = ?$

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

$\therefore\ t_{30} = 3 + \boxed{\mathbf{(30-1) \times 5}}$ ... (Substituting the values)

$\therefore\ t_{30} = 3 + 29 \times 5$

$\therefore\ t_{30} = \boxed{\mathbf{148}}$.

(ii) Activity :

$3x + 2y = 29$ ... (1)

$5x - y = 18$ ... (2)

Multiplying equation (2) by 2,

$10x - 2y = 36$ ... (3)

Adding equations (1) and (3),

$3x + 2y = 29$ ... (1)

$+\ 10x - 2y = 36$ ... (3)

$\boxed{\mathbf{13x}} = \boxed{\mathbf{65}}$ $\therefore\ x = 5$

Substituting $x = 5$ in equation (1),

$\boxed{\mathbf{15}} + 2y = 29$

$\therefore\ 2y = \boxed{\mathbf{14}}$ $\therefore\ y = 7$.

(iii) Activity :

A die is rolled once. $S = \{A, B, C, D, E, A\}$ $\therefore\ n(S) = 6$

Let X be the event that A appears on the upper face.

Then $X = \left\{\boxed{\mathbf{A, A}}\right\}$ $\therefore\ n(X) = \boxed{\mathbf{2}}$.

$P(X) = \dfrac{\boxed{\boldsymbol{n(X)}}}{n(S)} = \boxed{\dfrac{\mathbf{1}}{\mathbf{3}}}$.

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

$3x - 4y = 10$.

Here, $a_1 = 3$, $b_1 = -4$, $c_1 = 10$

$4x + 3y = 5$

Here, $a_2 = 4$, $b_2 = 3$, $c_2 = 5$.

$$D = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} = \begin{vmatrix} 3 & -4 \\ 4 & 3 \end{vmatrix}$$

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

$= 9 + 16 = 25$

Ans. D = **25**.

(ii) Solution :

Here, $a = t_1 = 3$, $t_{10} = t_n = 21$, $S_{10} = ?$

$S_n = \frac{n}{2}(t_1 + t_n)$ ... (Formula)

$\therefore S_{10} = \frac{10}{2}(3 + 21)$

$= 5 \times 24$

$= 120$

Ans. $S_{10} = \mathbf{120}$.

(iii) Solution :

$3x^2 - 2x + 6 = 0$

Here, $a = 3$, $b = -2$, $c = 6$

$\alpha + \beta = \frac{-b}{a} = \frac{-(-2)}{3} = \frac{2}{3}$

$\alpha\beta = \frac{c}{a} = \frac{6}{3} = 2$

Ans. The values of $\alpha + \beta$ and $\alpha\beta$ are $\mathbf{\frac{2}{3}}$ and **2** respectively.

(iv) Solution :

Brokerage at 0.3% on ₹ 200 = ₹ 200 $\times \frac{0.3}{100}$ = ₹ 0.60

$\therefore$ cost of 1 share = MV + brokerage = ₹ (200 + 0.60) = ₹ 200.60

$\therefore$ the cost of 100 share = ₹ 200.60 × 100 = ₹ 20060.

Ans. Savita paid ₹ **20,060.**

(v) Solution :

Let the total amount spent on sports be ₹ x.

The central angle for football $= \frac{\text{Amount spent on football}}{\text{Total amount}} \times 360°$

$\therefore 45° = \frac{20000}{x} \times 360°$

$\therefore x = \frac{20000 \times 360}{45}$ $\therefore x = 160000$

Ans. The total amount spent on sports is ₹ **1,60,000**.

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

Here, $a = 1$, $b = -13$, $c = \boxed{k}$

Let α and β be the roots of the equation.

$\alpha + \beta = \boxed{\dfrac{-b}{a}}$ ... (Formula)

$= 13$ ... (1)

$\alpha - \beta = \boxed{7}$ ... (Given) ... (2)

Adding equations (1) and (2),

$2\alpha = \boxed{20}$ $\therefore \alpha = 10$

Substituting the value of α in (1),

$10 + \beta = 13$ $\therefore \beta = 3$

$\alpha\beta = \boxed{\dfrac{c}{a}}$ ... (Formula) $\therefore \alpha\beta = k$

$\therefore \boxed{10 \times 3} = k$ $\therefore k = 30.$

(ii) Activity :

Input tax $= 18\%$ of ₹ $\boxed{8000}$ = ₹ $\boxed{1440}$

Output tax $= 18\%$ of ₹ $\boxed{10,000}$ = ₹ $\boxed{1800}$

GST payable = $\boxed{\text{Output tax} - \text{ITC}}$ ... (Formula)

= ₹ (1800 − 1440) = ₹ $\boxed{360}$.

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

Let the greater number be x and smaller number be y.

From the first condition, $x + y = 88$ ... (1)

For the second condition, use the formula,

Dividend = Divisor × quotient + remainder

$x = y \times 5 + 10$

$\therefore x = 5y + 10$

$\therefore x - 5y = 10$ ... (2)

Subtracting equation (2) from (1),

$$\begin{array}{rcl} x + y &=& 88 \quad \text{... (1)} \\ x - 5y &=& 10 \quad \text{... (2)} \\ - \quad + & & - \\ \hline 6y &=& 78 \end{array}$$

$\therefore y = \dfrac{78}{6} = 13$

Substituting $y = 13$ in equation (1),

$x + 13 = 88$

$\therefore\ x = 88 - 13 = 75$

Ans. The required numbers are **75** and **13**.

(ii) Solution :

Let x and $(x+2)$ be the two consecutive even natural numbers.

From the given condition,

$x^2 + (x+2)^2 = 724$

$\therefore\ x^2 + x^2 + 4x + 4 - 724 = 0$

$\therefore\ 2x^2 + 4x - 720 = 0$

$\therefore\ x^2 + 2x - 360 = 0$ ... (Dividing both the sides by 2)

$\therefore\ x^2 + 20x - 18x - 360 = 0$

$\therefore\ x(x+20) - 18(x+20) = 0$

$\therefore\ (x+20)(x-18) = 0$

$\therefore\ x + 20 = 0$ or $x - 18 = 0$

$\therefore\ x = -20$ or $x = 18$

But a natural number cannot be negative.

$\therefore\ x = -20$ is unacceptable.

$\therefore\ x = 18$ and $x + 2 = 18 + 2 = 20$

Ans. 18 and **20** are the required numbers.

(iii) Solution :

Let the first term of an A.P. be a and the common difference d.

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

$\therefore\ t_{18} = a + (18-1)\,d$

$\therefore\ 52 = a + 17d$ ... (Given $t_{18} = 52$) ... (1)

Similarly, $t_{39} = a + (39-1)\,d$

$\therefore\ 115 = a + 38d$ ... (Given $t_{39} = 115$) ... (2)

Subtracting equation (1) from equation (2),

$$\begin{array}{rcl} a + 38d &=& 115 \quad \ldots (2) \\ a + 17d &=& 52 \quad \ldots (1) \\ - \quad - & & - \\ \hline 21d &=& 63 \end{array}$$

$\therefore\ d = \dfrac{63}{21}$ $\therefore\ d = 3$

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

$52 = a + 17 \times 3$ $\therefore\ 52 = a + 51$ $\therefore\ a = 52 - 51$

$\therefore\ a = 1$

Ans. The value of a is **1** and that of d is **3**.

(iv) Solution :

Let us find the investment required for one share.

MV = ₹ 50

Brokerage at 0.2% on ₹ 50 = ₹ 50 × $\frac{0.2}{100}$ = ₹ 0.10

GST on brokerage at 18% = ₹ 0.10 × $\frac{18}{100}$ = ₹ 0.018

∴ investment for one share = ₹ (50 + 0.10 + 0.018) = ₹ 50.118

Investment by Aditi is ₹ 50,118

The number of shares purchased by Aditi

$= \frac{\text{Investment}}{\text{Investment for one share}} = \frac{50118}{50.118} = 1000.$

Ans. Aditi purchased **1000 shares**.

Q. 4. (i) Solution :

Let the digit in the hundreds place be x and that in the units place by y.

The sum of the extreme digits is 3 more than the middle digit.

∴ the middle digit, i.e. the digit in the tens place is $(x+y-3)$

The original number

$= 100x + 10\ (x+y-3) + y$

$= 100x + 10x + 10y - 30 + y$

$= 110x + 11y - 30$ … (1)

The number obtained by reversing the digits

$= 100y + 10\ (x+y-3) + x$

$= 100y + 10x + 10y - 30 + x$

$= 110y + 11x - 30$ … (2)

According to the first condition,

$110x + 11y - 30 = 26\ [x + (x+y-3) + y]$

∴ $110x + 11y - 30 = 26\ (2x + 2y - 3)$

∴ $110x + 11y - 30 = 52x + 52y - 78$

∴ $110x - 52x + 11y - 52y = -78 + 30$

∴ $58x - 41y = -48$ … (3)

According to the second condition,

original number + 198 = the number with digits reversed

∴ $110x + 11y - 30 + 198 = 110y + 11x - 30$ … [From (1) and (2)]

∴ $110x - 11x + 11y - 110y = -30 + 30 - 198$

∴ $99x - 99y = -198$

∴ $x - y = -2$ … (Dividing both the sides by 99) … (4)

Multiplying equation (4) by 41,

$41x - 41y = -82 \quad \dots (5)$

Subtracting equation (5) from equation (3),

$58x - 41y = -48 \quad \dots (3)$

$41x - 41y = -82 \quad \dots (5)$

$-\quad +\quad +$

$17x = 34 \qquad \therefore\ x = \frac{34}{17} \qquad \therefore\ x = 2.$

Substituting $x = 2$ in equation (4),

$2 - y = -2 \qquad \therefore\ -y = -2 - 2$

$\therefore\ -y = -4 \qquad \therefore\ y = 4$

The required number $= 110x + 11y - 30$

$= 110\,(2) + 11\,(4) - 30$

$= 220 + 44 - 30$

$= 220 + 14 = 234$

Ans. The original number is **234**.

(ii) Solution :

The three coefficients a, b, c are determined by rolling a die three times.

Each die has six possibilities.

$\therefore$ the sample space has $6 \times 6 \times 6 = 216$ points.

$\therefore\ n(S) = 216$

Let A be the event that the equation has equal roots.

Then the discriminant $(\Delta) = b^2 - 4ac = 0$.

b	a	c	b^2	$4ac$	$(\Delta) = b^2 - 4ac$
2	1	1	4	4	0
4	1	4	16	16	0
4	4	1	16	16	0
4	2	2	16	16	0
6	3	3	36	36	0

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

$\therefore\ n(A) = 5 \qquad \therefore\ P(A) = \frac{n(A)}{n(S)} \qquad \therefore\ P(A) = \frac{5}{216}$

Ans. The probability that the equation $ax^2 + bx + c = 0$ has equal roots is $\mathbf{\frac{5}{216}}$.

(iii) Solution :

Age group (years)	Frequency (Number of patients) f_i	Cumulative frequency (Less than type)
10 – 20	40	40
20 – 30	32	72 → cf
30 – 40 Median class	35 → f	107
40 – 50	45	152
50 – 60	33	185
60 – 70	15	200
	$N = \Sigma f_i = 200$	

Here, $N = \Sigma f_i = 200$, $\frac{N}{2} = \frac{200}{2} = 100$

Cumulative frequency which is just greater than 100 is 107.

$\therefore$ the corresponding class 30 – 40 is the median class.

$L = 30$, $f = 35$, $cf = 72$, $h = 10$

$$\text{Median} = L + \left[\frac{\frac{N}{2} - cf}{f}\right] \times h$$

$$= 30 + \left[\frac{100 - 72}{35}\right] \times 10$$

$$= 30 + \frac{28}{35} \times 10$$

$$= 30 + 8$$

$$= 38$$

Ans. The median age of the patients is **38 years**.

Q. 5. (i) Solution :

$x^2 + 2\sqrt{2}x - 6 = 0$

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

$a = 1$, $b = 2\sqrt{2}$, $c = -6$.

(2) $b^2 - 4ac = (2\sqrt{2})^2 - 4(1)(-6)$

$= 8 + 24 = 32$

$\therefore \sqrt{b^2 - 4ac} = \sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$

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

(4) $\therefore\ x = \dfrac{-2\sqrt{2} \pm 4\sqrt{2}}{2}$

$= \dfrac{2\,(-\sqrt{2} \pm 2\sqrt{2})}{2} = -\sqrt{2} \pm 2\sqrt{2}$

$\therefore\ x = -\sqrt{2} + 2\sqrt{2}$ or $x = -\sqrt{2} - 2\sqrt{2}$

$\therefore\ x = \sqrt{2}$ or $x = -3\sqrt{2}$

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

(ii) Solution :

The table showing coordinates necessary for drawing a frequency polygon is as follows :

[We have to take a class preceding the lowest class with frequency zero and a class succeeding the highest class with frequency zero.]

Class (Average rainfall in cm)	Class mark	Frequency (number of towns)	Coordinates of points
0 – 10	5	0	(5, 0)
10 – 20	15	12	(15, 12)
20 – 30	25	36	(25, 36)
30 – 40	35	48	(35, 48)
40 – 50	45	40	(45, 40)
50 – 60	55	14	(55, 14)
60 – 70	65	0	(65, 0)