Board Answer Paper: March 2020

MATHEMATICS PART – I

Q.1 (A)

i. (A) 15 ***[1 Mark]***

ii. (B) $x(x + 5) = 4$ ***[1 Mark]***

iii. (A) 7 ***[1 Mark]***

iv. (C) 10 ***[1 Mark]***

Hints:

ii. $x(x + 5) = 4$

$\therefore$ $x^2 + 5x - 4 = 0$

Here, x is the only variable and maximum index of the variable is 2.
a = 1, b = 5, c = – 4 are real numbers and $a \neq 0$.

iii. $x = \frac{D_x}{D} = \frac{49}{7} = 7$

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

$\therefore$ $\frac{1}{5} = \frac{2}{n(S)}$

$\therefore$ n (S) = 10

Q.1 (B)

i. $a = t_1 = -2, d = -2$

$\therefore$ $t_2 = t_1 + d = -2 - 2 = \mathbf{-4}$

$t_3 = t_2 + d = -4 - 2 = \mathbf{-6}$ ***[1 Mark]***

ii. Rate of GST = 12 %

$\therefore$ Rate of CGST = Rate of SGST

$= \frac{\text{Rate of GST}}{2}$

$= \frac{12}{2} = 6\%$

$\therefore$ **Rate of CGST = Rate of SGST = 6%** ***[1 Mark]***

iii. Comparing $2x^2 - 5x + 7 = 0$ with $ax^2 + bx + c = 0$, we get
a = 2 and b = – 5 ***[1 Mark]***

iv. $15x + 17y = 21$

$+ \; 17x + 15y = 11$

$32x + 32y = 32$

$\therefore$ $x + y = 1$ ***[1 Mark]***

Q.2 (A)

i.

x	-5	$\boxed{\mathbf{\frac{3}{2}}}$
y	$\boxed{\mathbf{\frac{-13}{6}}}$	0
(x, y)	$\boxed{\mathbf{\left(-5, \frac{-13}{6}\right)}}$	$\boxed{\mathbf{\left(\frac{3}{2}, 0\right)}}$

[½ mark each]

ii. First term = a = 6, common difference = d = 3, S_{27} = ?

$$S_n = \frac{n}{2}[\boxed{2a} + (n-1)d]$$

$$S_{27} = \frac{27}{2}[12 + (27-1)\boxed{3}]$$

$$= \frac{27}{2} \times \boxed{90}$$

$$= 27 \times 45$$

$\therefore$ $S_{27} = \boxed{1215}$ ***[½ mark each]***

iii. Suppose 'S' is sample space.

$\therefore$ n(S) = 52

Event A: Card drawn is a red card.

$\therefore$ Total red cards = $\boxed{13}$ hearts + 13 diamonds

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

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

$\therefore$ $P(A) = \frac{26}{52}$

$\therefore$ $P(A) = \boxed{\frac{1}{2}}$ ***[½ mark each]***

Q.2 (B)

i. $$\begin{vmatrix} \frac{7}{3} & \frac{5}{3} \\ \frac{3}{2} & \frac{1}{2} \end{vmatrix} = \left(\frac{7}{3} \times \frac{1}{2}\right) - \left(\frac{5}{3} \times \frac{3}{2}\right)$$

$$= \frac{7}{6} - \frac{15}{6}$$

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

$\therefore$ $$\begin{vmatrix} \mathbf{\frac{7}{3}} & \mathbf{\frac{5}{3}} \\ \mathbf{\frac{3}{2}} & \mathbf{\frac{1}{2}} \end{vmatrix} = \frac{-4}{3}$$ ***[2 Marks]***

ii. $x^2 - 15x + 54 = 0$

$\therefore$ $x^2 - 9x - 6x + 54 = 0$

$\therefore$ $x(x-9) - 6(x-9) = 0$

$\therefore$ $(x-9)(x-6) = 0$

$\therefore$ $x - 9 = 0$ or $x - 6 = 0$

$\therefore$ $x = 9$ or $x = 6$

$\therefore$ **The roots of the given quadratic equation are 9 and 6.**

[2 Marks]

iii. The given sequence is –12, –5, 2, 9, 16, 23, 30, ...

Here, $t_1 = -12$, $t_2 = -5$, $t_3 = 2$, $t_4 = 9$

$\therefore$ $t_2 - t_1 = -5 - (-12) = -5 + 12 = 7$

$t_3 - t_2 = 2 - (-5) = 2 + 5 = 7$

$t_4 - t_3 = 9 - 2 = 7$

$\therefore$ $t_2 - t_1 = t_3 - t_2 = ... = 7 = d$ = constant

The difference between two consecutive terms is constant.

$\therefore$ **The given sequence is an A.P.**

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

$\therefore$ $t_{20} = -12 + (20 - 1)7$ ...[$\because$ a = –12, d = 7]

$= -12 + 19 \times 7$

$= -12 + 133$

$\therefore$ $t_{20} = 121$

$\therefore$ **20th term of the given A.P. is 121.** *[2 Marks]*

iv. Sample space

S = {23, 25, 27, 29,
32, 35, 37, 39,
52, 53, 57, 59,
72, 73, 75, 79,
92, 93, 95, 97}

$\therefore$ n(S) = 20

Let A be the event that the number formed is an odd number.

$\therefore$ A = {23, 25, 27, 29, 35, 37, 39, 53, 57, 59, 73, 75, 79, 93, 95, 97}

$\therefore$ n(A) = 16

$\therefore$ $P(A) = \frac{n(A)}{n(S)} = \frac{16}{20}$

$\therefore$ $\mathbf{P(A) = \frac{4}{5}}$ *[2 Marks]*

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

$= 10 + \left[\frac{70 - 58}{2(70) - 58 - 42}\right] \times 2$

$= 10 + \left[\frac{12}{140 - 100}\right] \times 2$

$= 10 + \left(\frac{12}{40}\right) \times 2$

$= 10 + \frac{24}{40}$

$= 10 + 0.6$

$\therefore$ **Mode = 10.6** *[2 Marks]*

Q.3 (A)

i.

Age group (in years)	**No. of Persons**	**Measure of central angle**
20 – 25	80	$\frac{\boxed{\mathbf{80}}}{200} \times 360 = \boxed{\mathbf{144^\circ}}$
25 – 30	60	$\frac{60}{200} \times 360 = \boxed{\mathbf{108^\circ}}$
30 – 35	35	$\frac{35}{200} \times \boxed{\mathbf{360}} = 63^\circ$
35 – 40	25	$\frac{25}{200} \times 360 = \boxed{\mathbf{45^\circ}}$
Total	200	$\boxed{\mathbf{360^\circ}}$

[½ mark each]

ii. FV = ₹ 100; Number of shares = 150
Market value = ₹ 120

1. Sum investment = MV × No. of Shares
$= \boxed{120} \times \boxed{150}$

∴ Sum investment = ₹ 18,000

2. Dividend per share = FV × Rate of dividend
$= \boxed{100} \times \frac{\boxed{7}}{100}$
= ₹ 7

∴ Total dividend received = 150 × 7
$= \boxed{1050}$

3. $\text{Rate of return} = \frac{\text{Dividend income}}{\text{Sum invested}} \times 100$
$= \frac{1,050}{18,000} \times 100$
$= \boxed{5.83\%}$

[½ mark each]

Q.3 (B)

i. Let the 2 red balloon be R_1, R_2,
3 blue balloons be B_1, B_2, B_3, and
4 green balloons be G_1, G_2, G_3, G_4.

∴ Sample space
S = {R_1, R_2, B_1, B_2, B_3, G_1, G_2, G_3, G_4}

∴ n(S) = 9

1. Let A be the event that Pranali gets a red balloon.
∴ A = {R_1, R_2}
∴ n(A) = 2
∴ $P(A) = \frac{n(A)}{n(S)}$
∴ $\mathbf{P(A) = \frac{2}{9}}$

2. Let B be the event that Pranali gets a blue balloon.
∴ B = {B_1, B_2, B_3}
∴ n(B) = 3
∴ $P(B) = \frac{n(B)}{n(S)} = \frac{3}{9}$
∴ $\mathbf{P(B) = \frac{1}{3}}$

[3 Marks]

ii. Let the numerator of the fraction be x and the denominator be y.

∴ Fraction = $\frac{x}{y}$

According to the first condition, denominator of a fraction is 4 more than twice its numerator.

∴ $y = 2x + 4$
∴ $2x - y = -4$ …(i)

According to the second condition, denominator becomes 12 times the numerator, if both are reduced by 6.

∴ $(y - 6) = 12(x - 6)$
∴ $y - 6 = 12x - 72$
∴ $12x - y = 72 - 6$
∴ $12x - y = 66$ …(ii)

Subtracting equation (i) from (ii), we get

$12x - y = 66$

$2x - y = -4$

$- \quad + \quad +$

$10x = 70$

∴ $x = \frac{70}{10} = 7$

Substituting $x = 7$ in equation (i), we get

$2x - y = -4$

$2(7) - y = -4$

∴ $14 - y = -4$

∴ $14 + 4 = y$

∴ $y = 18$

∴ Fraction = $\frac{x}{y} = \frac{7}{18}$

∴ **The required fraction is $\frac{7}{18}$.** ***[3 Marks]***

iii.

Class Milk Sold (Litre)	Class mark x_i	Frequency (No. of customers) f_i	Frequency × Class mark $f_i x_i$
1 – 2	1.5	17	25.5
2 – 3	2.5	13	32.5
3 – 4	3.5	10	35
4 – 5	4.5	7	31.5
5 – 6	5.5	3	16.5
Total	–	$\Sigma f_i = 50$	$\Sigma f_i x_i = 141$

Here, $\sum f_i x_i = 141$, $\sum f_i = 50$

Mean = $\overline{X} = \frac{\sum f_i x_i}{\Sigma f_i} = \frac{141}{50} = 2.82$

∴ **The mean of the milk sold is 2.82 litres.** ***[3 Marks]***

iv. Let the three consecutive terms in an A.P. be a – d, a and a + d.

According to the first condition,

sum of three consecutive terms is 27.

$a - d + a + a + d = 27$

∴ $3a = 27$

∴ $a = \frac{27}{3}$

∴ $a = 9$ …(i)

According to the second condition,

product of the three numbers is 504.

$(a - d)\, a\, (a + d) = 504$

∴ $a(a^2 - d^2) = 504$

∴ $9(9^2 - d^2) = 504$ …[From (i)]

∴ $81 - d^2 = \frac{504}{9}$

∴ $81 - d^2 = 56$

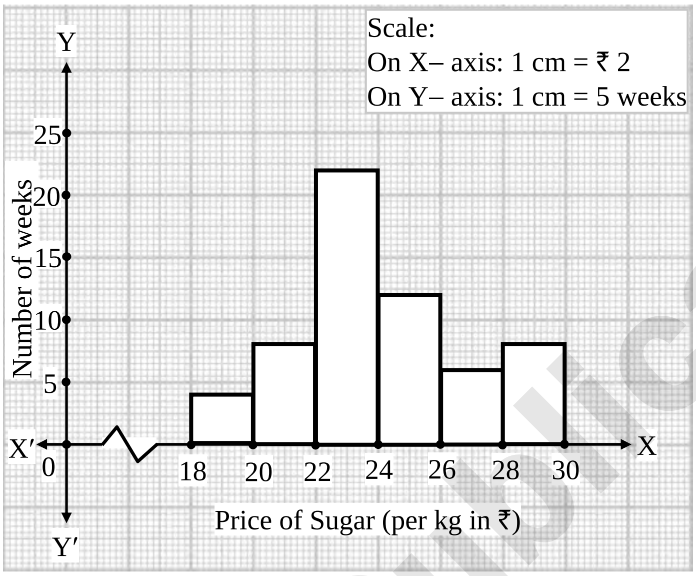
∴ $d^2 = 81 - 56$

∴ $d^2 = 25$

Taking square root of both sides, we get
$d = \pm 5$
When d = 5 and a = 9,
$a - d = 9 - 5 = 4$
$a = 9$
$a + d = 9 + 5 = 14$
When d = – 5 and a = 9,
$a - d = 9 - (-5) = 9 + 5 = 14$
$a = 9$
$a + d = 9 - 5 = 4$
∴ **The three consecutive terms are 4, 9 and 14 or 14, 9 and 4.** ***[3 Marks]***

Q.4

i.



[4 Marks]

ii. The instalments are in A. P.
Amount repaid in 10 instalments (S_{10}) = Amount borrowed + total interest
∴ $S_{10} = 4000 + 500 = 4500$
Number of instalments (n) = 10
Each instalment is less than the preceding instalment by ₹10.
∴ $d = -10$
$S_n = \frac{n}{2}[2a + (n-1)d]$
∴ $S_{10} = \frac{10}{2}[2a + (10-1)(-10)]$
∴ $4500 = 5[2a + 9(-10)]$
∴ $\frac{4500}{5} = 2a - 90$
∴ $900 = 2a - 90$
∴ $2a = 900 + 90$
∴ $2a = 990$
∴ $a = \frac{990}{2}$
∴ $a = 495$
Now, $t_n = a + (n-1)d$
∴ $t_{10} = 495 + (10-1)(-10)$
∴ $t_{10} = 495 + 9(-10)$
∴ $t_{10} = 495 - 90$
∴ $t_{10} = 405$
∴ **Amount of the first instalment is 495 and that of the last instalment is 405.** ***[4 Marks]***

iii. Let the sides of the two squares be x cm and y cm$(x > y)$.
Then, their areas are x^2 and y^2 and their perimeters are $4x$ and $4y$.
According to the first condition,
sum of the areas of two squares is 400 sq.m
$\therefore$ $x^2 + y^2 = 400$ …(i)
According to the second condition,
difference between the perimeters is 16 m
$\therefore$ $4x - 4y = 16$
$\therefore$ $4(x - y) = 16$
$\therefore$ $x - y = 4$
$\therefore$ $x = y + 4$
Substituting the value of x in equation (i), we get
$(y + 4)^2 + y^2 = 400$
$\therefore$ $y^2 + 8y + 16 + y^2 = 400$
$\therefore$ $2y^2 + 8y - 384 = 0$
$\therefore$ $y^2 + 4y - 192 = 0$
$\therefore$ $y^2 + 16y - 12y - 192 = 0$
$\therefore$ $y(y + 16) - 12(y + 16) = 0$
$\therefore$ $(y + 16)(y - 12) = 0$
$\therefore$ $y + 16 = 0$ or $y - 12 = 0$
$\therefore$ $y = -16$ or $y = 12$
But, $y \neq -16$ as the side of a square cannot be negative.
$\therefore$ $y = 12$
$\therefore$ $x = y + 4 = 12 + 4 = 16$
$\therefore$ **The sides of the two squares are 16 cm and 12 cm.** ***[4 Marks]***

Q.5

i. $\sqrt{\frac{x}{y}} = 4$
Squaring on both sides, we get
$\frac{x}{y} = 16$
$\therefore$ $x = 16y$ …(i)
$\frac{1}{x} + \frac{1}{y} = \frac{1}{xy}$
Multiplying both sides by xy, we get
$y + x = 1$
i.e., $x + y = 1$ …(ii)
Substituting $x = 16y$ in equation (ii), we get
$16y + y = 1$
$\therefore$ $17y = 1$
$\therefore$ $y = \frac{1}{17}$
Substituting $y = \frac{1}{17}$ in equation (i), we get
$x = 16y = \frac{16}{17}$
$\therefore$ $\mathbf{(x, y) = \left(\frac{16}{17}, \frac{1}{17}\right)}$ **is the solution of the given equations.**

[3 Marks]

ii. Selling price (S. P.) of the toy = ₹ 24

Let the cost price (C. P.) of the toy be ₹ x.

∴ Gain% = x%

$$\text{Gain\%} = \frac{\text{S.P.} - \text{C.P.}}{\text{C.P.}} \times 100$$

∴ $x = \dfrac{24 - x}{x} \times 100$

∴ $x^2 = (24 - x)100$

∴ $x^2 = 2400 - 100x$

∴ $x^2 + 100x - 2400 = 0$

∴ $x^2 + 120x - 20x - 2400 = 0$

∴ $x(x + 120) - 20(x + 120) = 0$

∴ $(x + 120)(x - 20) = 0$

∴ $x + 120 = 0$ or $x - 20 = 0$

∴ $x = -120$ or $x = 20$

But, the cost price cannot be negative.

∴ $x = 20$

∴ **The cost price of the toy is ₹20.**

[3 Marks]