BOARD ANSWER PAPER: MARCH 2022

MATHEMATICS PART - I

Q.1 (A)

i. (B) $x(x + 5) = 2$

ii. (C) $-2, -4, -6, -8$

iii. (D) -9

iv. (A) 1.5

Hints:

i. $x(x + 5) = 2$

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

Here, x is the only variable and maximum index of the variable is 2.

$a = 1, b = 5, c = -2$ are real numbers and $a \neq 0$.

ii. $t_1 = a = -2$

$d = -2$

$t_2 = t_1 + d = -2 - 2 = -4$

$t_3 = t_2 + d = -4 - 2 = -6$

$t_4 = t_3 + d = -6 - 2 = -8$

iii. $y = \frac{D_y}{D} = \frac{-63}{7} = -9$

iv. The probability of any event is from 0 to 1 or 0% to 100%.

Q.1 (B)

i. Substituting $x = 1$ in $4x + 5y = 19$,

$4(1) + 5y = 19$

$\therefore$ $5y = 19 - 4 = 15$

$\therefore$ $y = \frac{15}{5} = 3$

ii. $2m^2 - 5m = 0$ ...(i)

Putting m = 2 in L.H.S. of equation (i), we get

L.H.S. $= 2(2)^2 - 5(2)$

$= 2(4) - 10$

$= 8 - 10$

$= -2$

$\therefore$ L.H.S. ≠ R.H.S.

$\therefore$ m = 2 is not the root of the given quadratic equation.

iii. $a = t_1 = 6, d = -3$

$\therefore$ $t_2 = t_1 + d = 6 - 3 = 3$

$t_3 = t_2 + d = 3 - 3 = 0$

iv. S = {HH, HT, TH, TT}

Q.2 (A)

i. $\begin{vmatrix} 2\sqrt{3} & 9 \\ 2 & 3\sqrt{3} \end{vmatrix} = 2\sqrt{3} \times \boxed{3\sqrt{3}} - 9 \times \boxed{2}$

$= \boxed{18} - 18$

$= \boxed{0}$

ii. Given A.P. : 7, 13, 19, 25, ...

Here first term a = 7, d = 13 – 7 = 6; t_{19} = ?

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

$\therefore$ $t_{19} = 7 + (19 - 1)\,\boxed{6}$

$\therefore$ $t_{19} = 7 + \boxed{108}$

$\therefore$ $t_{19} = \boxed{115}$

iii. One die is rolled.

'S' is sample space.

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

$\therefore$ n(S) = 6

Event A: Prime number on the upper face.

A = { $\boxed{2,3,5}$ }

$\therefore$ n(A) = 3

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

$\therefore$ $P(A) = \dfrac{3}{6} = \boxed{\dfrac{1}{2}}$

Q.2 (B)

i. The given simultaneous equations are

$3x + 5y = 26$ ...(i)

$x + 5y = 22$ ...(ii)

Equations (i) and (ii) are in $ax + by = c$ form.

$D_x = \begin{vmatrix} 26 & 5 \\ 22 & 5 \end{vmatrix} = (26 \times 5) - (22 \times 5)$

$= 130 - 110 = 20$

$D_y = \begin{vmatrix} 3 & 26 \\ 1 & 22 \end{vmatrix} = (3 \times 22) - (1 \times 26)$

$= 66 - 26 = 40$

> **SMART TIP**
> In order to find out if our answer is correct or not, substitute the values of (x, y) in the given equations.
> If L.H.S = R.H.S, then the answer is correct.

ii. Sample space is S.

$\therefore$ n(S) = 5 + 8 + 3 = 16

Let A be the event that Rutuja picks a blue pen.

$\therefore$ n(A) = 8

$\therefore$ $P(A) = \dfrac{n(A)}{n(S)} = \dfrac{8}{16}$

$\therefore$ $P(A) = \dfrac{1}{2}$

$\therefore$ The probability that Rutuja picks a blue pen is $\dfrac{1}{2}$.

iii. The first n even natural numbers are
2, 4, 6, …, 2n.
The above sequence is an A.P.
t_1 = first term = 2, t_n = last term = 2n

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

$= \frac{n}{2}(2 + 2n)$

$= \frac{n}{2} \times 2(1 + n)$

$= n(n + 1)$

$\therefore$ The sum of first n even natural numbers is n(n + 1).

iv. $x^2 + x - 20 = 0$

$\therefore$ $x^2 + 5x - 4x - 20 = 0$

$\therefore$ $x(x + 5) - 4(x + 5) = 0$

$\therefore$ $(x + 5)(x - 4) = 0$

−20
5 −4
$5 \times -4 = -20$
$5 - 4 = 1$

By using the property, if the product of two numbers is zero, then at least one of them is zero, we get

$x + 5 = 0$ or $x - 4 = 0$

$\therefore$ $x = -5$ or $x = 4$

$\therefore$ The roots of the given quadratic equation are −5 and 4.

SMART TIP
In order to find out if our answer is correct or not, for these type of equations, substitute the value of x in the equation. If L.H.S. = R.H.S., then the answer is correct.

v. $49x - 57y = 172$ …(i)

$57x - 49y = 252$ …(ii)

Adding equations (i) and (ii), we get

$$\begin{array}{rl} 49x - 57y & = 172 \\ +\ 57x - 49y & = 252 \\ \hline 106x - 106y & = 424 \end{array}$$

$\therefore$ $x - y = \frac{424}{106}$ …[Dividing both sides by 106]

$\therefore$ $x - y = 4$

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

$$\begin{array}{rl} 49x - 57y & = 172 \\ 57x - 49y & = 252 \\ -\quad\ + & \quad - \\ \hline -8x - 8y & = -80 \end{array}$$

$\therefore$ $x + y = \frac{-80}{-8}$ …[Dividing both sides by −8]

$\therefore$ $x + y = 10$

Q.3 (A)

i. One of the roots of equation

$kx^2 - 10x + 3 = 0$ is 3

Putting $x = \boxed{3}$ in the above equation

$\therefore$ $k(\boxed{3})^2 - 10 \times \boxed{3} + 3 = 0$

$\therefore$ $\boxed{9k} - 30 + 3 = 0$

$\therefore$ $9k = \boxed{27}$

$\therefore$ $k = \frac{27}{9} = \boxed{3}$

SMART TIP

To verify our answer, substitute k = 3 and $x = 3$ in the given equation. If L.H.S. = R.H.S., then our answer is correct.

L.H.S. $= 3(3)^2 - 10(3) + 3$
$= 3 \times 9 - 30 + 3$
$= 27 - 27$
$= 0$
= R.H.S.

Hence, our answer is correct.

ii. 'S' is the sample space.

$\therefore$ n(S) = 52

Event A: The card drawn is an ace.

$\therefore$ $n(A) = \boxed{4}$

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

$\therefore$ $P(A) = \frac{\boxed{4}}{52}$

$\therefore$ $P(A) = \frac{\boxed{1}}{13}$

Event B: The card drawn is a spade.

$\therefore$ $n(B) = \boxed{13}$

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

$\therefore$ $P(B) = \frac{13}{52} = \frac{\boxed{1}}{4}$

Q.3 (B)

i. The given simultaneous equations are

$x + 3y = 7$

$\therefore$ $3y = 7 - x$

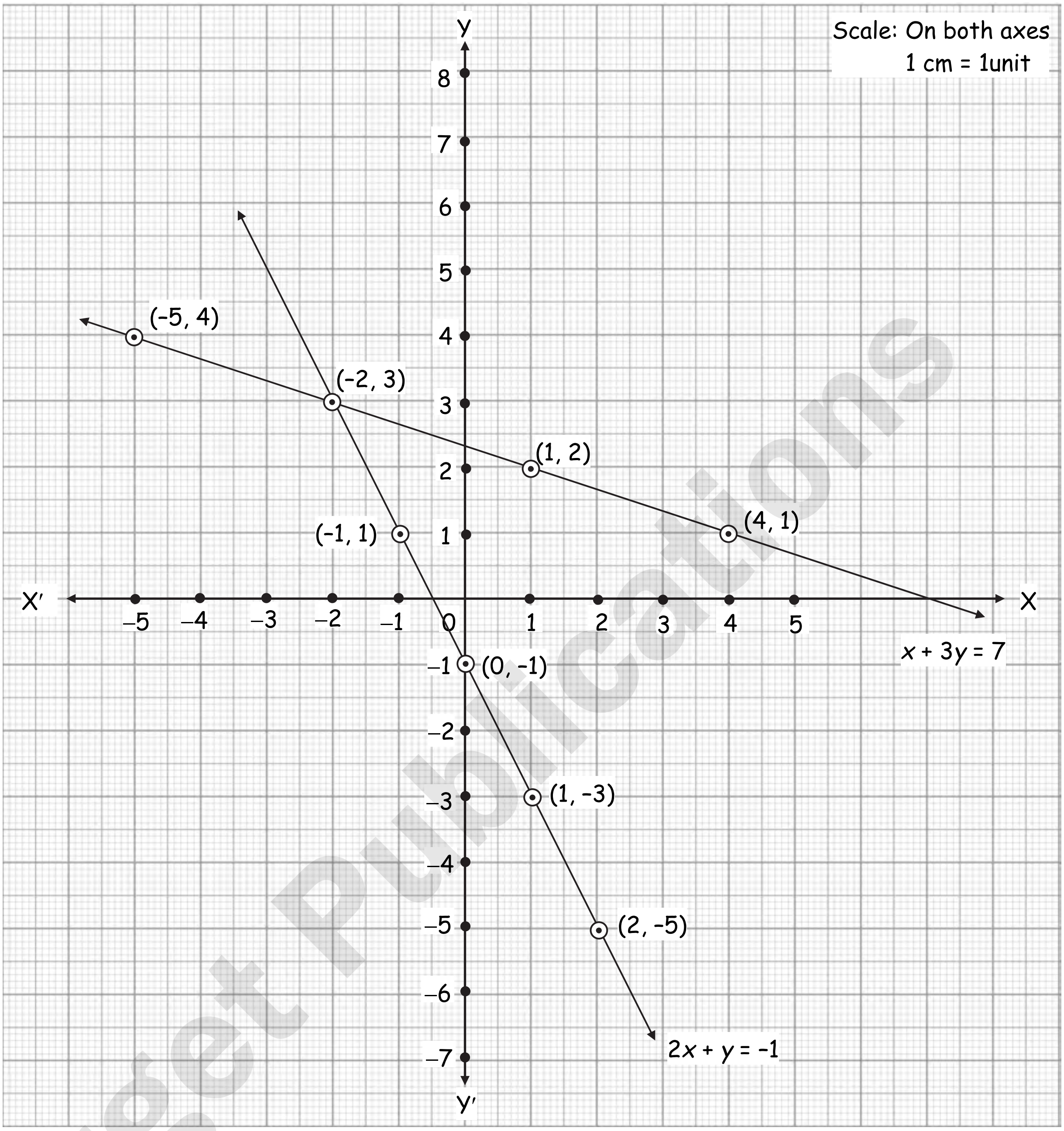
$\therefore$ $y = \frac{7 - x}{3}$

x	1	4	-2	-5
y	2	1	3	4
(x, y)	(1, 2)	(4, 1)	(–2, 3)	(–5, 4)

$2x + y = -1$

$\therefore$ $y = -1 - 2x$

x	0	1	–1	2
y	–1	–3	1	–5
(x, y)	(0, –1)	(1, –3)	(–1, 1)	(2, –5)



The two lines intersect at point (–2, 3).

∴ $x = -2$ and $y = 3$ is the solution of the simultaneous equations $x + 3y = 7$ and $2x + y = -1$.

ii. The number of seats arranged row-wise are as follows:

20, 22, 24, ...

The above sequence is an A.P.

∴ a = 20, d = 22 – 20 = 2, n = 27

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

∴ $S_{27} = \frac{27}{2}[2(20) + (27 - 1)2]$

$= \frac{27}{2}(40 + 26 \times 2)$

$= \frac{27}{2}(40 + 52)$

$= \frac{27}{2} \times 92$

$= 27 \times 46$

$\therefore$ $S_{27} = 1242$

$\therefore$ Total seats in the auditorium are 1242.

iii. Let the present ages of Manish and Savita be x years and y years respectively.
According to the first condition,
sum of the present ages of Manish and Savita is 31.

$\therefore$ $x + y = 31$ …(i)

3 years ago,
Manish's age = $(x - 3)$ years
Savita's age = $(y - 3)$ years
According to the second condition,
3 years ago Manish's age was 4 times the age of Savita.

$(x - 3) = 4(y - 3)$

$\therefore$ $x - 3 = 4y - 12$

$\therefore$ $x - 4y = -12 + 3$

$\therefore$ $x - 4y = -9$ …(ii)

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

$$\begin{array}{rcl} x + y &=& 31 \\ x - 4y &=& -9 \\ - \quad + & & + \\ \hline 5y &=& 40 \end{array}$$

$\therefore$ $y = \frac{40}{5} = 8$

Substituting $y = 8$ in equation (i), we get

$x + y = 31$

$x + 8 = 31$

$\therefore$ $x = 31 - 8$

$\therefore$ $x = 23$

$\therefore$ The present ages of Manish and Savita are 23 years and 8 years respectively.

iv. $x^2 + 10x + 2 = 0$

Comparing the above equation with
$ax^2 + bx + c = 0$, we get

$a = 1, b = 10, c = 2$

$b^2 - 4ac = (10)^2 - 4 \times 1 \times 2 = 100 - 8 = 92$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-10 \pm \sqrt{92}}{2(1)}$$

$$= \frac{-10 \pm \sqrt{4 \times 23}}{2}$$

$$= \frac{-10 \pm 2\sqrt{23}}{2}$$

$$= \frac{2\left(-5 \pm \sqrt{23}\right)}{2} = -5 \pm \sqrt{23}$$

$\therefore$ $x = -5 + \sqrt{23}$ or $x = -5 - \sqrt{23}$

$\therefore$ The roots of the given quadratic equation are $-5 + \sqrt{23}$ and $-5 - \sqrt{23}$.

Q.4

i. Let the divisor be x.

Quotient is 2 more than nine times the divisor.

$\therefore$ Quotient = $9x + 2$

Also, Dividend = 460 and Remainder = 5

Dividend = Divisor $\times$ Quotient + Remainder

$\therefore$ $460 = x \times (9x + 2) + 5$

$\therefore$ $460 = 9x^2 + 2x + 5$

$\therefore$ $9x^2 + 2x + 5 - 460 = 0$

$\therefore$ $9x^2 + 2x - 455 = 0$

$\therefore$ $9x^2 + 65x - 63x - 455 = 0$

$\therefore$ $x(9x + 65) - 7(9x + 65) = 0$

$\therefore$ $(9x + 65)(x - 7) = 0$

$\therefore$ $9x + 65 = 0$ or $x - 7 = 0$

$\therefore$ $x = -\frac{65}{9}$ or $x = 7$

But, natural number cannot be negative.

$\therefore$ $x = 7$

$\therefore$ Quotient $= 9x + 2$

$= 9(7) + 2$

$= 63 + 2$

$= 65$

$\therefore$ Quotient is 65 and Divisor is 7.

ii. For an A.P., let a be the first term and d be the common difference.

$t_9 = 0$ ...[Given]

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

$\therefore$ $t_9 = a + (9 - 1)d$

$\therefore$ $0 = a + 8d$

$\therefore$ $a = -8d$ ...(i)

Also, $t_{19} = a + (19 - 1)d$

$= a + 18d$

$= -8d + 18d$ ...[From (i)]

$\therefore$ $t_{19} = 10d$ ...(ii)

and $t_{29} = a + (29 - 1)d$

$= a + 28d$

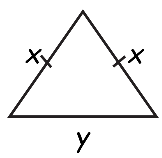
$= -8d + 28d$ ...[From (i)]

$\therefore$ $t_{29} = 20d = 2(10d)$

$\therefore$ $t_{29} = 2(t_{19})$ ...[From (ii)]

$\therefore$ The 29th term is double the 19th term.

iii. Let the length of the two equal sides of the isosceles triangle be x cm and let y cm be the length of the third side (base).



According to the first condition,

Perimeter = 24 cm.

$\therefore$ $x + x + y = 24$

$\therefore$ $2x + y = 24$ ... (i)

According to the second condition,

$x = 2y - 13$ ...(ii)

Substituting $x = 2y - 13$ in equation (i), we get

$2(2y - 13) + y = 24$

$\therefore$ $4y - 26 + y = 24$

$\therefore$ $5y = 50$

$\therefore$ $y = \frac{50}{5}$

$\therefore$ $y = 10$

Substituting $y = 10$ in equation (ii), we get

$x = 2(10) - 13$

$= 20 - 13$

$\therefore$ $x = 7$

$\therefore$ The lengths of all sides of the isosceles triangle are 7cm, 7cm and 10cm.

Q.5

i. Let the number of blue balls be x.

Number of red balls = 8

$\therefore$ Total number of balls = $(x + 8)$

P(blue ball is drawn) = $\frac{x}{x+8}$

P(red ball is drawn) = $\frac{8}{x+8}$

According to the given condition, ratio of probability of getting red ball and blue ball is 2 : 5.

$\therefore$ $\frac{\frac{8}{x+8}}{\frac{x}{x+8}} = \frac{2}{5}$

$\therefore$ $\frac{8}{x+8} = \frac{2}{5} \times \frac{x}{x+8}$

$\therefore$ $40(x + 8) = 2x(x + 8)$

$\therefore$ $40x + 320 = 2x^2 + 16x$

$\therefore$ $2x^2 - 24x - 320 = 0$

$\therefore$ $x^2 - 12x - 160 = 0$

$\therefore$ $x^2 - 20x + 8x - 160 = 0$

$\therefore$ $x(x - 20) + 8(x - 20) = 0$

$\therefore$ $(x - 20)(x + 8) = 0$

$\therefore$ $x - 20 = 0$ or $x + 8 = 0$

$\therefore$ $x = 20$ or $x = -8$

But, number of balls cannot be negative.

$\therefore$ $x = 20$

$\therefore$ The number of blue balls in the bag is 20.

ii. Let the measures of angles of the triangle in an A.P. be
$a, a + d, a + 2d$, where a = first term, d = common difference.
Sum of the measures of angles of a triangle is 180°.

$\therefore$ $a + a + d + a + 2d = 180^\circ$

$\therefore$ $3a + 3d = 180^\circ$

$\therefore$ $a + d = \frac{180^\circ}{3}$

$\therefore$ $a + d = 60^\circ$ ...(i)

According to the given condition, the measure of smallest angle is five times of common difference

$\therefore$ $a = 5d$

Substituting $a = 5d$ in equation (i), we get

$5d + d = 60^\circ$

$\therefore$ $6d = 60^\circ$

$\therefore$ $d = \frac{60^\circ}{6} = 10^\circ$

$\therefore$ $a = 5d = 5(10^\circ) = 50^\circ$

$a + d = 50^\circ + 10^\circ = 60^\circ$

$a + 2d = 50^\circ + 2(10^\circ)$
$= 50^\circ + 20^\circ$
$= 70^\circ$

$\therefore$ The measures of all angles of the triangle are 50°, 60° and 70°.