SOLUTION

Q.1. (A) Four alternative answers are given for every subquestion. Choose the correct alternative and write its alphabet with subquestion number. [4]

(1) Which one is the quadratic equation?

(a) $\frac{5}{x} - 3 = x^2$ (b) $x(x + 5) = 2$

(c) $n - 1 = 2n$ (d) $\frac{1}{x^2}(x + 2) = x$

(2) First four terms of an A.P. are ________, whose first term is –2 and common difference is –2.

(a) –2, 0, 2, 4 (b) –2, 4, –8, 16

(c) –2, –4, –6, –8 (d) –2, –4, –8, –16

(3) For simultaneous equations in variables x and y, $D_x = 49$, $D_y = -63$, $D = 7$, then what is the value of y?

(a) 9 (b) 7 (c) –7 (d) –9

(4) Which number cannot represent a probability?

(a) 1.5 (b) $\frac{2}{3}$ (c) 15% (d) 0.7

Ans. (1) – (b), (2) – (c), (3) – (d), (4) – (a)

Q.1. (B) Solve the following subquestions. [4]

(1) To draw a graph of $4x + 5y = 19$, find y when $x = 1$.

Solution:

$$4x + 5y = 19$$

$$\therefore \quad 4 \times 1 + 5y = 19 \quad \text{(If } x = 1\text{)}$$

$$\therefore \quad 4 + 5y = 19$$

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

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

Ans. $y = 3$

(2) Determine whether 2 is a root of quadratic equation $2m^2 - 5m = 0$.

Solution:

$$2m^2 - 5m = 0$$

$$\text{LHS} = 2m^2 - 5m$$

$$= 2(2)^2 - 5 \times 2 \quad \text{(Put m = 2)}$$

$$= 8 - 10$$

$$= -2$$

$$\therefore \quad \text{LHS} \neq \text{RHS}$$

Ans. 2 is not a root of the given equation.

(3) Write second and third terms of an A.P. whose first term is 6 and common difference is –3.

Solution:

$t_1 = a = 6$ and $d = -3$

$t_2 = t_1 + d = 6 + (-3) = 6 - 3 = 3$

$t_2 = t_2 + d = 3 + (-3) = 3 - 3 = 0$

Ans.The second and third terms of the A.P. are 3 and 0, respectively.

(4) Two coins are tossed simultaneously. Write the sample space 'S'.

Solution:

Two coins are tossed simultaneously.

$\therefore$ S = {HH, HT, TH, TT}

Q.2. (A) Complete the following activities and rewrite them. (Any *two*) [4]

(1) Complete the activity to find the value of the determinant.

Activity:

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

$$= \boxed{} - 18$$

$$= \boxed{}$$

Solution:

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

$$= \boxed{18} - 18$$

$$= \boxed{0}$$

(2) Complete the following activity to find the 19th term of an A.P., 7, 13, 19, 25, ...:

Activity:

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

Here first term a = 7; t_{19} = ?

$t_n = a + \left(\boxed{}\right) d$ .... (formula)

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

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

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

Solution:

Complete the following activity to find the 19th term of an A.P., 7, 13, 19, 25, ...:

Activity:

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

Here first term $a = 7$; $t_{19} = ?$

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

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

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

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

(3) If one die is rolled, then to find the probability of an event to get prime number on upper face, complete the following activity.

Activity:

One die is rolled.

'S' is sample space.

$S = \{ \boxed{} \}$

$\therefore \quad n(S) = 6$

Event A : Prime number on the upper face.

$A = \{ \boxed{} \}$

$\therefore \quad n(A) = 3$

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

$\therefore \quad P(A) = \boxed{}$

Solution:

One die is rolled.

'S' is sample space.

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

$\therefore \quad n(S) = 6$

Event A : Prime number on the upper face.

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

$$\therefore \quad n(A) = 3$$

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

$$\therefore \quad P(A) = \boxed{\frac{1}{2}}$$

Q.2. (B) Solve the following sub questions. (Any *four*) [8]

(1) To solve the following simultaeous equations by Cramer's rule, find the values of D_x and D_y.

$$3x + 5y = 26$$

$$x + 5y = 22$$

Solution:

$3x + 5y = 26$; $x + 5y = 22$

$$Dx = \begin{vmatrix} 26 & 5 \\ 22 & 5 \end{vmatrix} = 26 \times 5 - 5 \times 22$$

$$= 130 - 110$$

$$= 20$$

$$Dy = \begin{vmatrix} 3 & 26 \\ 1 & 22 \end{vmatrix} = 3 \times 22 - 26 \times 1$$

$$= 66 - 26$$

$$= 40$$

Ans. D_x = 20 and D_y = 40

(2) A box contains 5 red, 8 blue and 3 green pens. Rutuja wants to pick a pen at random. What is the probability that the pen is blue?

Solution:

Box contains 5 red, 8 blue and 3 green pens.

$n(S)$ = {5 red pens, 8 red pens, 3 green pens}

$n(S)$ = 16

Let A be the event of getting a blue pen.

$\therefore \quad A = \{8 \text{ blue pens}\}$

$\therefore \quad n(A) = 8$

$\therefore \quad p(A) = \dfrac{n(A)}{n(S)} = \dfrac{8}{16} = \dfrac{1}{2}$

Ans. The probability of picking a blue pen is $\dfrac{1}{2}$.

(3) Find the sum of first '*n*' even natural numbers.

Solution:

The first *n* even natural numbers are 2, 4, 6, 8, ..., *n*.

This is an A.P.

Here, $a = 2$, $d = t_2 - t_1 = 4 - 2 = 2$

The sum of the first *n* even natural numbers is

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

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

$$= \frac{n}{2}(4 + 2n - 2)$$

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

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

$$= n(n + 1)$$

Ans. The sum of the first n even natural numbers is n(n + 1).

(4) Solve the following quardatic equation by factorisation method:

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

Solution:

$x^2 + x - 20 = 0$

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

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

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

$\therefore \quad x + 5 = 0$ or $x - 4 = 0$

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

Ans. The solution of the equation is (–5, 4).

(5) **Find the values of $(x + y)$ and $(x - y)$ of the following simultaneous equations:**

$$49x - 57y = 172$$
$$57x - 49y = 252$$

Solution:

$$\begin{array}{rrl} & 49x - 57y = 172 & \quad ...(i) \\ + & 57x - 49y = 252 & \quad ...(ii) \\ \hline & 106x - 106y = 424 & \quad ...[\text{Adding (i) and (ii)}] \end{array}$$

$\therefore \quad x - y = 4$ ...(Dividing by 106)

$$\begin{array}{rrl} & 49x - 57y = 172 & \quad ...(i) \\ - & 57x - 49y = 252 & \quad ...(ii) \\ & - \quad + \quad\quad - & \\ \hline & -8x - 8y = -80 & \quad ...[\text{Subtracting (ii) from (i)}] \end{array}$$

$\therefore \quad x + y = 10$ ...(Dividing by –8)

Ans. $x + y = 10$ **and** $x - y = 4$

Q.3. (A) Complete the following activity and rewrite it. (Any *one*) [3]

(1) One of the roots of equation $kx^2 - 10x + 3 = 0$ is 3. Complete the following activity to find the value of k.

Activity:

One of the roots of equation

$$kx^2 - 10x + 3 = 0 \text{ is } 3.$$

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

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

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

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

$\therefore \quad k = \boxed{}$

Solution:

One of the roots of equation

$$kx^2 - 10x + 3 = 0 \text{ is } 3.$$

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

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

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

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

$\therefore \quad k = \boxed{3}$

(2) A card is drawn at random from a pack of well shuffled 52 playing cards. Complete the following activity to find the probability that the card drawn is –

Event A : The card drawn is an ace.

Event B : The card drawn is a spade.

Activity:

'S' is the sample space.

$\therefore \quad n(S) = 52$

Event A : The card drawn is an ace.

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

$P(A) = \boxed{}$ .... (Formula)

$\therefore \quad P(A) = \dfrac{\boxed{}}{52}$

$\therefore \quad P(A) = \dfrac{\boxed{}}{13}$

Event B : The card drawn is a spade.

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

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

$\therefore \quad P(B) = \dfrac{\boxed{}}{4}$

Solution:

'S' is the sample space.

$\therefore \quad n(S) = 52$

Event A : The card drawn is an ace.

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

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

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

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

Event B : The card drawn is a spade.

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

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

$\therefore \quad P(B) = \dfrac{\boxed{1}}{4}$

Q.3. (B) Solve the following subquestions. (Any *two*) [6]

(1) Solve the simultaneous equations by using graphical method :

$$\boldsymbol{x + 3y = 7}$$

$$\boldsymbol{2x + y = -1}$$

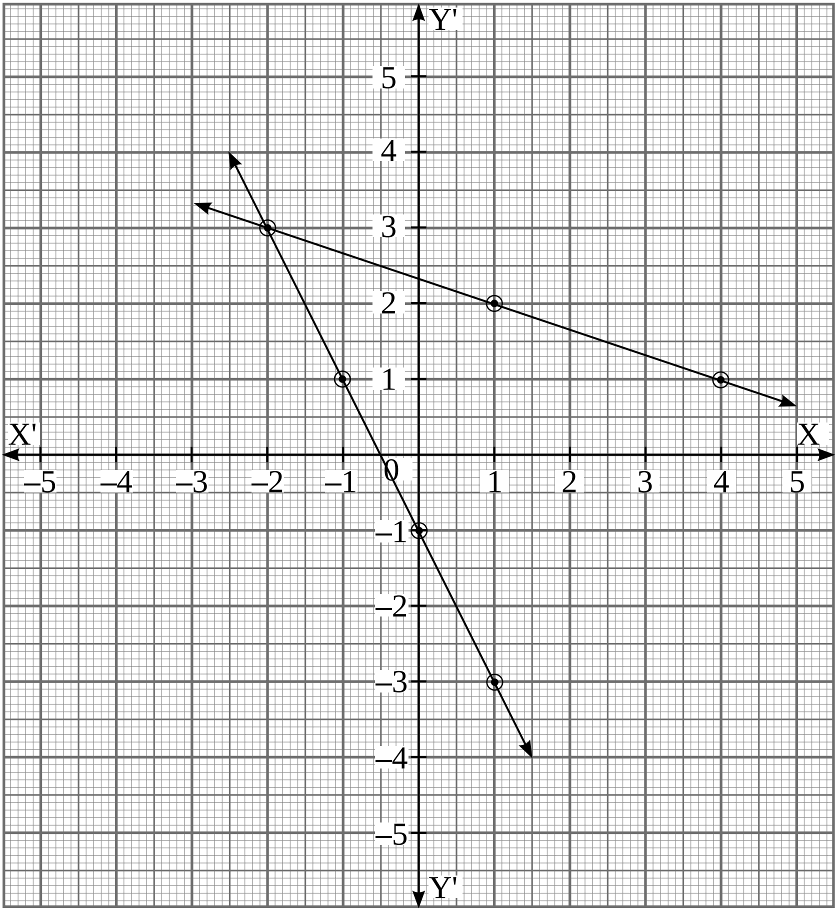
Solution:

$x + 3y = 7$ $\qquad$ $2x + y = -1$

$x = 7 - 3y$ $\qquad$ $y = -1 - 2x$

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

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



Ans. (–2, 3) is the solution of the given equations.

(2) There is an auditorium with 27 rows of seats. There are 20 seats in the first row, 22 seats in the second row, 24 seats in the third row and so on. Find how many total seats are there in the auditorium?

Solution:

Here $t_1 = 20$, $t_2 = 22$, $t_3 = 24$, ...

∴ The A.P.: 20, 22, 24,......

$a = 20$, $d = 2$, $n = 27$, $s_{27} = ?$

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

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

$$= \frac{27}{2}[40 + 26 \times 2]$$

$$= \frac{27}{2}[40 + 52]$$

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

$$= 27 \times 46$$

$$S_{27} = 1242$$

Ans. There are 1242 seats in the audiforium.

(3) Sum of the present ages of Manish and Savita is 31 years. Manish's age 3 years ago was 4 times the age of Savita at that time. Find their present ages.

Solution:

Let the present age of Manish be x and that of Savita be y.

According to the first condition,

$x + y = 31$ ...(1)

Three years ago, Mainsh's age was $(x - 3)$ and Savita's age was $(y - 3)$.

$\therefore$ According to the second condition,

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

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

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

$$\therefore \quad x - 4y = -9 \quad \text{...(ii)}$$

Subtract equation (ii) from (i):

$$\begin{array}{lrcrl} & x + y & = & 31 & \text{...(i)} \\ - & x - 4y & = & -9 & \text{...(ii)} \\ & - \quad + & & + & \\ \hline & 5y & = & 40 & \end{array}$$

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

$\therefore$ $\boxed{y = 8}$

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

$$x + 8 = 31$$

$\therefore$ $x = 31 - 8$

$\therefore$ $\boxed{x = 23}$

Ans. The present ages of Manish and Savita are 23 years and 8 years, respectively.

(4) Solve the following quadratic equation using formula:

$$\mathbf{x^2 + 10x + 2 = 0}$$

Solution:

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

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

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad \text{...(formula)}$$

$$= \frac{-10 \pm \sqrt{10^2 - 4 \times 1 \times 2}}{2 \times 1}$$

$$= \frac{-10 \pm \sqrt{100 - 8}}{2}$$

$$= \frac{-10 \pm \sqrt{92}}{2}$$

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

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

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

Q.4. Solve the following subquestions. (Any *two*) **[8]**

(1) If 460 is divided by a natural number, then quotient is 2 more than nine times the divisor and remainder is 5. Find the quotient and divisor.

Solution:

Let the divisor be x.

Then, quotient = $9x + 2$ and reminder = 5.

We know that

$$\text{Dividend} = \text{Divisor} \times \text{Quotient} + \text{Reminder}$$

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

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

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

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

Here, a = 9, b = 2 and c = –455

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad \text{...(formula)}$$

$$= \frac{-2 \pm \sqrt{2^2 - 4 \times 9 \times -455}}{2 \times 9}$$

$$= \frac{-2 \pm \sqrt{4 + 16380}}{18}$$

$$= \frac{-2 \pm \sqrt{16384}}{18}$$

$$= \frac{-2 \pm 128}{18}$$

$$\therefore \quad x = \frac{-2 \pm 128}{18} \text{ or } x = \frac{-2 - 128}{18}$$

$$\therefore \quad x = \frac{126}{18} \text{ or } x = \frac{-130}{18}$$

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

But $\frac{65}{9}$ is not a natural number.

$$\therefore \quad x = 7$$

$\therefore$ Quotient = $9x + 2 = 9 \times 7 + 2 = 65$

Ans. Divisor = 7 and quotient = 65

(2) If the 9th term of an A.P. is zero, then prove that the 29th term is double the 19th term.

Solution:

If $t_9 = 0$, then prove that $t_{29} = 2t_{19}$.

We know that

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

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

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

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

$\therefore \quad t_{19} = a + (19 - 1)\,d$

$\therefore \quad t_{19} = -8d + 18d \quad$ ...[From (i)]

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

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

$\therefore \quad t_{29} = -8d + 28d \quad$ ...[From (ii)]

$\therefore \quad t_{29} = 20d$

$= 2 \times 10d$

$= 2 \times t_{19} \quad$ ...[From (ii)]

Hence, it is proved that $t_{29} = 2t_{19}$.

(3) The perimeter of an isosceles triangle is 24 cm. The length of its congruent sides is 13 cm less than twice the length of its base. Find the lengths of all sides of the triangle.

Solution:

Let the congruent sides be x cm and base be y cm.

According to the first condition,

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

According to the second condition,

$x = 2y - 13$

$\therefore \quad x - 2y = -13 \quad$ ...(ii)

Multiplying equation (ii) by 2, we get

$2x - 4y = -26 \quad$ ...(iii)

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

$\quad\; - \quad - \quad\quad -$

$-5y = -50 \quad$ ...[Subtracting (i) from (iii)]

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

$\therefore \quad y = 10$

Substituting $y = 10$ in equation (i),

$2x + 10 = 24$

$\therefore \quad 2x = 24 - 10$

$\therefore \quad x = \frac{14}{2}$

$\therefore \quad x = 7$

Ans. Legth of congrument sides is 7cm and base is 10 cm.

Q.5. Solve the following subquestions. (Any *one*)

(1) A bag contains 8 red and some blue balls. One ball is drawn at random from the bag. If ratio of probability of getting red ball and blue ball is 2:5, then find the number of blue balls.

Solution:

Let the number of blue balls be x,

S = {8 red balls, x blue balls}

$\therefore \quad n(S) = (8 + x)$

Let R be the event of getting a red ball.

$n(R) = 8$

$P(R) = \frac{n(R)}{n(S)} = \frac{8}{8 + x}$

Let B be the event of getting a blue ball.

$n(B) = x$

$P(R) = \frac{n(B)}{n(S)} = \frac{x}{8 + x}$

According o the given condition,

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

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

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

$$\therefore \quad 40 = 2x$$

$$\therefore \quad x = 20$$

Ans. The number of blue balls is 20.

(2) Measures of angles of a triangle are in A.P. The measure of smallest angle is five times of common difference. Find the measures of all angles of a triangle.

(Assume the measures of angles as *a*, *a* + *d*, *a* + 2*d*.)

Solution:

Let the angles be a, a + d, a + 2d.

$\therefore \quad a + a + d + a + 2d = 180°$ (sum of all angles in a triangle)

$\therefore \quad 3a + 3d = 180°$

$\therefore \quad a + d = 60$ ...(i) (Dividing by 3)

According to the given condition,

$a = 5d$ ...(ii)

Substituting value of a from equation (ii) in equation (i),

$$5d + d = 60$$

$$\therefore \quad 6d = 60$$

$$\therefore \quad d = \frac{60}{6}$$

$$\therefore \quad d = 10$$

Substituting d = 10 in equation (ii),

$$a = 5 \times 10$$

$$\therefore \quad a = 50°$$

$$a + d = 50 + 10 = 60°$$

$$a + 2d = 50 + 2 \times 10 = 70°$$

Ans. The measures of the angles of the given triangle are 50°, 60° and 70°.

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