

MATHEMATICS PART-I

Time allowed : 2 Hours

Maximum marks : 40

General Instructions :

- (i) All questions are compulsory.
- (ii) Use of calculator is not allowed.
- (iii) The numbers to the right of the questions indicate full marks.
- (iv) In case of MCQ's Q. No. 1(A) only the first attempt will be evaluated and will be given credit.
- (v) For every MCQ, the correct alternative (A), (B), (C) or (D) of answers with subquestion number is to be written as an answer.

SECTION-A

Q.1. (A) For every subquestion 4 alternative answers are given. Choose the correct answer and write the alphabet of it : [4]

(i) In the format of GSTIN there are _____ alpha-numerals.

- (A) 15 (B) 10 (C) 16 (D) 9

Answer : (A) 15

(ii) From the following equations, which one is the quadratic equation ?

- (A) $\frac{5}{x} - 3 = x^2$ (B) $x(x+5) = 4$ (C) $n - 1 = 2n$ (D) $\frac{1}{x^2}(x+2) = x$

Answer : (B) $x(x+5) = 4$

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

- (A) 7 (B) -7 (C) $\frac{1}{7}$ (D) $-\frac{1}{7}$

Answer : (A) 7

(iv) If $n(A) = 2$, $P(A) = \frac{1}{5}$, then $n(S) = ?$

- (A) $\frac{2}{5}$ (B) $\frac{5}{2}$ (C) 10 (D) $\frac{1}{3}$

Answer : (C) 10

Q.1. (B) Solve the following subquestions :

[4]

(i) Find second and third term of an A.P. whose first term is -2 and common difference is -2.

Answer : Given, First term, $a = -2$

Common difference, $d = -2$

We know that, Second term $= a + d$

$$= -2 + (-2)$$

$$= -4$$

and,

Third term $= a + 2d$

$$= -2 + 2(-2)$$

$$= -2 - 4$$

$$= -6$$

\therefore Second term is -4 and third term is -6.

Ans.

- (ii) 'Pawan Medicals' supplies medicines. On some medicines the rate of GST is 12%, then what is the rate of CGST and SGST ?

Answer :

$$\text{Rate of GST} = 12\%$$

$$\begin{aligned}\text{Rate of CGST} &= \text{Rate of SGST} = \frac{\text{Rate of GST}}{2} \\ &= \frac{12\%}{2} \\ &= 6\%\end{aligned}$$

$$\therefore \text{Rate of CGST} = \text{Rate of SGST} = 6\%$$

- (iii) Find the values of a and b from the quadratic equation $2x^2 - 5x + 7 = 0$.

Answer : The given quadratic equation is

$$2x^2 - 5x + 7 = 0$$

Comparing the given quadratic equation with

$$ax^2 + bx + c = 0$$

\therefore The values of

$$a = 2 \text{ and } b = -5$$

- (iv) If $15x + 17y = 21$ and $17x + 15y = 11$, then find the value of $x + y$.

Answer : The given equations are

$$15x + 17y = 21 \quad \dots(1)$$

$$17x + 15y = 11 \quad \dots(2)$$

Adding equations (1) and (2)

$$15x + 17y = 21$$

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

$$\hline 32x + 32y = 32$$

Dividing both sides by 32, we get

$$x + y = 1$$

Q. 2. (A) Complete and write any two activities from the following :

- (i) Complete the following table to draw the graph of $2x - 6y = 3$:

x	-5	<input type="text"/>
y	<input type="text"/>	0
(x, y)	<input type="text"/>	<input type="text"/>

Solution :

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

- (ii) First term and common difference of an A.P. are 6 and 3 respectively. Find S_{27} .

Solution :

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

$$S_{27} = ?$$

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

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

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

$$= 27 \times 45$$

$$S_{27} = \text{ }$$

Solution :

First term = $a = 6$, common difference = $d = 3$,

$$S_{27} = ?$$

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

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

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

$$= 27 \times 45$$

$$S_{27} = 1215$$

Ans.

- (iii) A card is drawn from a well shuffled pack of 52 playing cards. Find the probability of the event, the card drawn is a red card.

Solution :

Suppose 'S' is sample space.

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

Event A : Card drawn is a red card.

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

$$\therefore n(A) = \text{ }$$

$$\therefore p(A) = \frac{\text{ }}{n(S)} \text{ - Formula}$$

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

$$\therefore p(A) = \text{ }$$

Solution :

Suppose 'S' is sample space.

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

Event A : Card drawn is a red card.

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

$$\therefore n(A) = 26$$

$$\therefore p(A) = \frac{n(A)}{n(S)} \quad \text{Formula}$$

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

$$\therefore p(A) = \frac{1}{2}$$

Ans.

Q. 2. (B) Solve any four subquestions from the following :

[8]

(i) Find the value of the determinant :

$$\begin{vmatrix} 7 & 5 \\ 5 & 3 \\ 3 & 1 \\ 2 & 2 \end{vmatrix}$$

Solution :

$$\begin{vmatrix} 7 & 5 \\ 5 & 3 \\ 3 & 1 \\ 2 & 2 \end{vmatrix} = \frac{7}{10} - \frac{5}{2}$$

$$= \frac{7-5(5)}{10}$$

$$= \frac{-18}{10}$$

$$= \frac{-9}{5}$$

Ans.

(ii) Solve the quadratic equation by factorisation method: $x^2 - 15x + 54 = 0$.

Solution : The given quadratic equation is

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

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

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

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

$$\Rightarrow (x-9) = 0 \quad \text{or} \quad (x-6) = 0$$

$$\therefore x = 9 \quad \text{or} \quad x = 6$$

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

Ans.

(iii) Decide whether the following sequence is an A.P. If so, find the 20th term of the progression :

$$-12, -5, 2, 9, 16, 23, 30, \dots$$

Solution : Here $a = t_1 =$ first term $= -12$, $t_2 = -5$,

$$\text{Common difference} = d = t_2 - t_1$$

$$d = -5 - (-12)$$

$$= -5 + 12$$

$$\therefore d = 7$$

We know that,

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

Here, $n = 20$, $a = -12$, $d = 7$

$$\therefore t_{20} = -12 + (20-1)7$$

$$= -12 + 133$$

$$t_{20} = 121$$

∴ 20th term of the progression is 121.

Ans.

(iv) A two digit number is formed with digits 2, 3, 5, 7, 9 without repetition. What is the probability that the number formed is an odd number?

Solution : Simple space S : to form two digit number from 2, 3, 5, 7, 9

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

$$∴ n(S) = 20$$

Event A : Number formed is an odd number even numbers are such that whose unit place is 0, 2, 4, 6, 8. One of these numbers should be in even number.

In the given numbers 2, 3, 5, 7, 9 only 2 is the even number whose unit place is 2.

$$∴ \text{Sample space of even numbers} = \{32, 52, 72, 92\}$$

$$∴ n(\text{Even numbers}) = 4$$

$$∴ n(\text{Odd numbers}) = n(S) - 4$$

$$= 20 - 4$$

$$= 16$$

$$∴ n(A) = 16$$

$$p(A) = \frac{n(A)}{n(S)}$$

$$= \frac{16}{20} = \frac{4}{5}$$

Ans.

(v) If $L = 10$, $f_1 = 70$, $f_0 = 58$, $f_2 = 42$, $h = 2$, then find the mode by using formula.

Solution :

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

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

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

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

$$= 10 + \frac{3}{5}$$

$$= \frac{50 + 3}{5}$$

$$= \frac{53}{5}$$

$$\text{Mode} = \frac{53}{5}$$

Ans.

Q. 3. (A) Complete and write any *one* activity from the following :

[3]

(i)

Age group (in years)	No. of persons	Measure of Central Angle
20-25	80	$\frac{\boxed{}}{200} \times 360^\circ = \boxed{}$

25-30	60	$\frac{60}{200} \times 360^\circ = \square$
30-35	35	$\frac{35}{200} \times \square = 63$
35-40	25	$\frac{25}{200} \times 360^\circ = \square$
Total	200	\square

Solution :

Age group (in years)	No. of persons	Measure of Central Angle
20-25	80	$\frac{80}{200} \times 360^\circ = 144^\circ$
25-30	60	$\frac{60}{200} \times 360^\circ = 108^\circ$
30-35	35	$\frac{35}{200} \times 360^\circ = 63^\circ$
35-40	25	$\frac{25}{200} \times 360^\circ = 45^\circ$
Total	200	360°

Ans

- (ii) Shri Shantilal has purchased 150 shares of FV ₹ 100, for MV of ₹ 120. Company has paid dividend at 7%, then to find the rate of return on his investment, complete the following activity :

Solution :

FV = ₹ 100; Number of shares = 150

Market value = ₹ 120

1. Sum investment = MV × No. of Shares

$$= \square \times \square$$

$$\therefore \text{Sum investment} = ₹ 18,000$$

2. Dividend per share =
- $\frac{\text{FV} \times \text{Rate of dividend}}{100}$

$$= \square \times \frac{\square}{100}$$

$$= ₹ 7$$

$$\therefore \text{Total dividend received} = 150 \times 7 = \square$$

3. Rate of return =
- $\frac{\text{Dividend income}}{\text{Sum invested}} \times 100$

$$= \frac{1050}{18000} \times 100$$

$$= \square$$

Solution :

FV = ₹ 100; Number of shares = 150

Market value = ₹ 120

$$\begin{aligned} 1. \quad \text{Sum investment} &= \text{MV} \times \text{No. of Shares} \\ &= 120 \times 150 \end{aligned}$$

$$\therefore \text{Sum investment} = ₹ 18,000$$

$$2. \quad \text{Dividend per share} = \text{FV} \times \text{Rate of dividend}$$

$$= 100 \times \frac{7}{100}$$

$$= ₹ 7$$

$$\therefore \text{Total dividend received} = 150 \times 7 = 1050$$

$$3. \quad \text{Rate of return} = \frac{\text{Dividend income}}{\text{Sum invested}} \times 100$$

$$= \frac{1050}{18000} \times 100$$

$$= 5.83$$

Ans.

Q. 3. (B) Attempt any two subquestions from the following :

[6]

(i) A balloon vendor has 2 red, 3 blue and 4 green balloons. He wants to choose one of them at random to give it to Pranali. What is the probability of the event that Pranali gets :

1. a red balloon.

2. a blue balloon.

Solution : Available balloons are 2 red, 3 blue and 4 green.

Sample space S : One balloon to be choose on random basis,

$$\therefore n(S) = 2 + 3 + 4 = 9$$

1. Event A : Probability that a red balloon is chosen

$$\therefore n(A) = 2$$

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

$$p(A) = \frac{2}{9}$$

2. Event B : Probability that a blue balloon is chosen

$$\therefore n(B) = 3$$

$$\therefore p(B) = \frac{n(B)}{n(S)}$$

$$= \frac{3}{9} = \frac{1}{3}$$

$$\therefore p(B) = \frac{1}{3}$$

Probability that a red balloon is choosen is $\frac{2}{9}$ and probability that a blue balloon is chosen is $\frac{1}{3}$.

Ans.

(ii) The denominator of a fraction is 4 more than twice its numerator. Denominator becomes 12 times the numerator, if both the numerator and the denominator are reduced by 6, find the fraction.

Solution : Suppose numerator is x , then denominator will be $2x + 4$

$$\therefore \text{Fraction is } \frac{x}{2x+4}$$

According to the given information we can write,

$$\frac{x-6}{(2x+4)-6} = \frac{1}{12}$$

$$\frac{x-6}{2x-2} = \frac{1}{12}$$

$$12(x-6) = 2x-2$$

$$12x - 72 = 2x - 2$$

$$12x - 2x - 72 + 2 = 0$$

$$10x - 70 = 0$$

$$x = \frac{70}{10} = 7$$

$$x = 7$$

But fractions

$$\frac{x}{2x+4} = \frac{7}{2(7)+4}$$

$$= \frac{7}{14+4} = \frac{7}{18}$$

∴ The fraction is $\frac{7}{18}$.

Ans.

(iii) A milk centre sold milk to 50 customers. The table below gives the number of customers and the milk they purchased. Find the mean of the milk sold by direct method :

Milk sold (litre)	No. of customers
1 - 2	17
2 - 3	13
3 - 4	10
4 - 5	7
5 - 6	3

Solution :

Class interval milk sold (litre)	Class mark x_i	Frequency f_i (no. of customers)	Frequency \times classmark $f_i x_i$
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		$\Sigma f_i = 50$	$\Sigma f_i x_i = 141$

$$\text{Mean} = \bar{X} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

$$\text{Mean} = \bar{X} = \frac{141}{50} = 2.82$$

∴ Mean of milk sold by direct method is 2.82.

(iv) In an A.P. sum of three consecutive terms is 27 and their products is 504. Find the terms. (Assume that three consecutive terms in an A.P. are $a-d$, a , $a+d$.)

Ans.

Answer : Assume that the three consecutive terms are $a - d$, a , and $a + d$.
According to first condition,

$$(a - d) + a + (a + d) = 27$$

\therefore

$$3a = 27$$

\therefore

$$a = 9$$

According to second condition,

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

Putting the value of $a = 9$ in above equation, we get

\therefore

$$(9 - d)(9)(9 + d) = 504$$

\therefore

$$(9^2 - d^2) \times 9 = 504$$

\therefore

$$(81 - d^2) = 56$$

\therefore

$$81 - d^2 = 56$$

\therefore

$$d^2 = 81 - 56$$

\therefore

$$d^2 = 25$$

\therefore

$$d = 5$$

\therefore

$$\text{First term} = a - d = (9 - 5) = 4$$

$$\text{Second term} = a = 9$$

$$\text{Third term} = a + d = 9 + 5 = 14$$

\therefore The three terms are 4, 9, 14.

Ans.

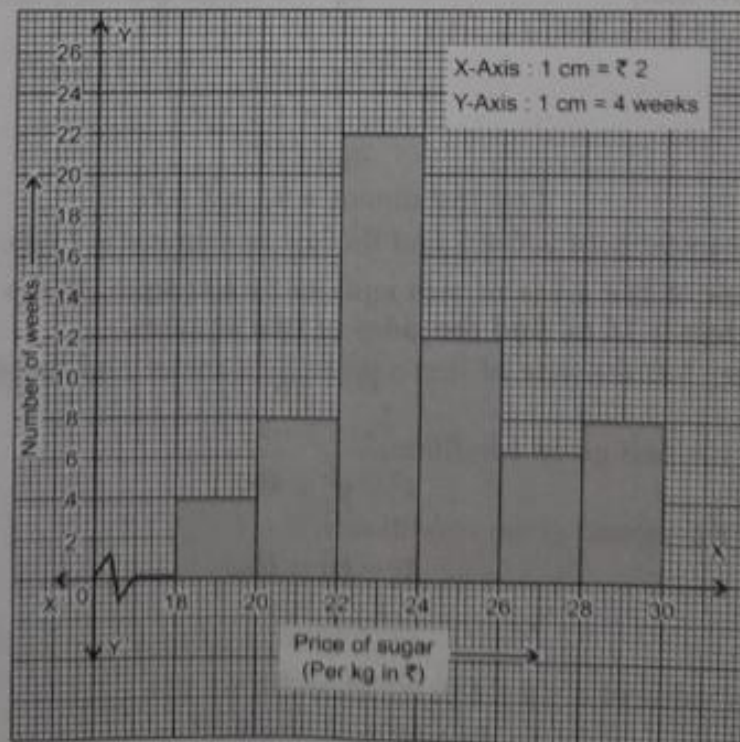
[8]

Q. 4. Attempt any two subquestions from the following :

(i) Represent the following data by histogram :

Price of Sugar (per kg in ₹)	Number of weeks
18-20	4
20-22	8
22-24	22
24-26	12
26-28	6
28-30	8

Answer :



- (ii) One person borrows ₹ 4,000 and agrees to repay with a total interest of ₹ 500 in 10 instalments. Each instalment being less than the preceding instalment by ₹ 10. What should be the first and the last instalments?

Answer : Number of instalments, $n = 10$

Let the first instalment be ₹ a

As per the given data each further instalment is less than the preceding one by ₹ 10.

∴ These instalments are in A.P.

∴ First term = a ,
and common difference, $d = -10$

Here the negative sign indicates that the next term of A.P. is less than that the preceding term.

∴ Repayment of loan is as below :

$$S_n = \text{Loan} + \text{Total interest}$$

$$S_n = 4000 + 500$$

$$S_n = 4500$$

$$\text{Here } n = 10$$

$$\text{We know that, } S_n = \frac{n}{2} [2a + (n-1)d]$$

$$\therefore 4500 = \frac{10}{2} [2a + (10-1)(-10)]$$

$$\therefore 4500 = 5 [2a - 90]$$

$$\therefore 4500 = 10a - 450$$

$$\therefore 10a = 4500 + 450$$

$$\therefore a = \frac{4950}{10} = 495$$

$$\therefore \text{first instalment} = a = ₹ 495$$

The last instalment is the 10th instalment

$$\therefore n = 10$$

$$\text{We know that, } a_n = a + (n-1)d$$

$$\text{Here } n = 10, a = 495, d = -10$$

$$\therefore a_{10} = 495 + (10-1)(-10)$$

$$= 495 - 90$$

$$a_{10} = 405$$

$$\text{Last instalment} = a_{10} = ₹ 405$$

∴ First instalment is ₹ 495 and the last instalment is ₹ 405. Ans

- (iii) The sum of the areas of two squares is 400 sq.m. If the difference between their perimeters is 16 m, find the sides of two squares.

Answer : Let the side of first square be x metre and the side of second square be y metre

As per the first given condition,

$$\therefore x^2 + y^2 = 400 \quad \dots(i)$$

As per the second given condition,

$$4x - 4y = 16$$

$$\therefore x - y = 4$$

$$\therefore x = y + 4 \quad \dots(ii)$$

Put the value of $x = y + 4$ in equation (i), we get

$$\therefore (y + 4)^2 + y^2 = 400$$

$$\therefore y^2 + 8y + 16 + y^2 = 400$$

$$\therefore 2y^2 + 8y + 16 - 400 = 0$$

$$\therefore 2y^2 + 8y - 384 = 0$$

Dividing both sides by 2 we get

$$y^2 + 4y - 192 = 0$$

$$\therefore y^2 + 16y - 12y - 192 = 0$$

$$\therefore y(y + 16) - 12(y + 16) = 0$$

$$\therefore (y + 16)(y - 12) = 0$$

$$\therefore (y + 16) = 0 \quad \text{or} \quad (y - 12) = 0$$

$$\therefore y = -16 \quad \text{or} \quad y = 12$$

But side of square is never negative

$$\therefore y \neq -16$$

$$\therefore y = 12$$

Putting the value of $y = 12$ in equation (ii), we get

$$x = 12 + 4 = 16$$

\therefore Side of first square, $x = 16$ m and side of second square, $y = 12$ m.

Ans.

Q. 5. Attempt any *one* subquestion from the following :

[3]

(i) Convert the following equations into simultaneous equations and solve :

$$\sqrt{\frac{x}{y}} = 4, \quad \frac{1}{x} + \frac{1}{y} = \frac{1}{xy}$$

Answer : The given equations are $\sqrt{\frac{x}{y}} = 4, \quad \frac{1}{x} + \frac{1}{y} = \frac{1}{xy}$

$$\sqrt{\frac{x}{y}} = 4$$

Taking square on both the sides

$$\left(\sqrt{\frac{x}{y}}\right)^2 = (4)^2$$

$$\therefore \frac{x}{y} = 16$$

$$\therefore x = 16y$$

$$\therefore x - 16y = 0 \quad \dots(i)$$

Now, $\frac{1}{x} + \frac{1}{y} = \frac{1}{xy}$

$$\therefore \frac{y+x}{xy} = \frac{1}{xy}$$

$$\therefore y + x = 1$$

$$\therefore x + y = 1 \quad \text{(multiplying both sides by } xy) \quad \dots(ii)$$

The two simultaneous equations formed are

$$x - 16y = 0$$

and

$$x + y = 1$$

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

$$\begin{array}{r} x - 16y = 0 \\ x + y = 1 \\ \hline -17y = -1 \\ 17y = 1 \\ y = \frac{1}{17} \end{array}$$

Putting the value of $y = \frac{1}{17}$ in equation (ii), we get

$$\begin{array}{r} x + \frac{1}{17} = 1 \\ 17x + 1 = 17 \\ 17x = 17 - 1 = 16 \\ x = \frac{16}{17} \end{array}$$

$\therefore (x, y) = \left(\frac{16}{17}, \frac{1}{17}\right)$ is the solution of the simultaneous equation. Ans.

- (ii) A dealer sells a toy for ₹ 24 and gains as much percent as the cost price of the toy. Find the cost price of the toy.

Answer : Selling price of the toy = ₹ 24

Let the cost price of the toy be ₹ x

$$\text{Gain\%} = x\% \text{ (Given)}$$

$$\text{Gain\%} = \left(\frac{\text{Selling price} - \text{Cost price}}{\text{Cost price}} \right) \times 100$$

$$\therefore x = \left(\frac{24 - x}{x} \right) \times 100$$

$$\therefore x^2 = 2400 - 100x$$

$$\therefore x^2 + 100x - 2400 = 0$$

$$\therefore x^2 + 120x - 20x - 2400 = 0$$

$$\therefore x(x + 120) - 20(x + 120) = 0$$

$$\therefore (x + 120)(x - 20) = 0$$

$$\therefore (x + 120) = 0 \quad \text{or} \quad (x - 20) = 0$$

$$\therefore x = -120 \quad \text{or} \quad x = 20$$

$x \neq -120$, because cost cannot be negative

$$\therefore x = 20$$

$$\therefore \text{Cost price} = ₹ 20$$

\therefore The cost price of the toy is ₹ 20.

Ans.