

Q.3. A relation 'f' is defined by $f: x \rightarrow x^2 - 2$ i.e. $f(x) = x^2 - 2$, where $x \in \{-1, -2, 0, 2\}$ [2]

i) List the elements of f.

ii) Is f a function?

Q.4. A rail road curve is to be laid out on a circle. What radius should be used if the track is to change direction by 25° in a distance of 40 meters? [2]

Q.5. Solve the given inequality $|x - 5| < 2$ [2]

OR

Solve the system of linear inequations:

$$4x - 5 < 11, \quad -3x - 4 \geq 8$$

Q.6. Find the standard deviation of given data: 6, 10, 7, 13, 4, 12, 8, 12 [2]

Q.7. Find the domain and range of function $f(x) = \frac{1}{\sqrt{4x^2 - 9}}$ [4]

Q.8. If ω is a complex cube root of unity then evaluate: [4]

$$\frac{a + b\omega + c\omega^2}{c + a\omega + b\omega^2} + \frac{a + b\omega + c\omega^2}{b + c\omega + a\omega^2}$$

Q.9. Find the value of p such that the difference of the roots of the equation $x^2 - px + 10 = 0$ is 3. If the roots of $x^2 - px + 10 = 0$ are α and β . Find the quadratic equation whose roots are $(\alpha + \beta)^2$ and $\alpha^2\beta - \alpha\beta^2$ [4]

OR

Exhibit graphically the solution set of the following system of linear inequalities.

$$x + y \leq 5, 4x + y \geq 4, x + 5y \geq 5; x \leq 4; y \leq 3$$

Q.10. If $\xi = \{x: x \in \mathbb{N} \text{ and } x \leq 10\}$, $A = \{x: x \text{ is prime}\}$ and $B = \{x: x \text{ is a factor of } 24\}$: verify: [4]

i) $A - B = A \cap B'$

ii) $(A \cup B)' = A' \cup B'$

OR

For any sets A, B and C show that

$$(A \cup B \cup C) \cap (A \cap B' \cap C)' = B \cap C'$$

Q.11. If $z = \cos\theta + i \sin\theta$ then find the value of $\frac{1+z}{1-z}$; $|z|$; $|\bar{z}|$ [6]

Q.12. Prove that: [6]

$$\cos^2 x + \cos^2 \left(x + \frac{2\pi}{3}\right) + \cos^2 \left(x - \frac{2\pi}{3}\right) = \frac{3}{2}$$

OR

If $\sin x + \sin y = a$ and $\cos x + \cos y = b$ find:

(i) $\sin(x + y)$ (ii) $\cos(x + y)$ (iii) $\cos(x - y)$

Q.13. Calculate the mean deviation about the mean for the following frequency distribution. [6]

Class Interval	0-4	4-8	8-12	12-16	16-20	20-24	24-28	28-32
Frequency	4	6	8	5	2	3	4	6

OR

Calculate the standard deviation and variance of the following data:

Class Interval	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	3	7	12	15	8	3	2

Q.14. If α and β are the roots of the equation $x^2 - 7x + 4 = 0$ then :

[6]

- Show that $\alpha^3 = 53\alpha + 28$
- Find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$
- Find the equation having the root as $\frac{1}{\alpha}$ and $\frac{1}{\beta}$

SECTION - B [15 Marks]

Q.15. In subparts (i) to (iii) choose the correct option and in subparts (iv) to (v), answer the questions as instructed : [1×5=5]

i) Consider the following statements and choose the correct option:

Statement 1 : In three dimensional co-ordinate geometry, coordinate of any point on y-axis is of the form $(0, b, 0)$.

Statement 2 : Coordinate of any points on YZ-plane is of the form $(a, 0, 0)$.

Which of the following is correct ?

- Only Statement 1
 - Only Statement 2
 - Both Statements 1 and 2
 - Neither Statement 1 nor Statement 2
- ii) If $(1, -2, 5)$ and $(-3, -4, 9)$ are the end points of a diameter of a sphere; then the radius of sphere is :
- 6 units
 - 4 units
 - 3 units
 - 2 units
- iii) The length of perpendicular drawn from the point $P(-5, 4, -3)$ on x-axis is :
- 3 units
 - 4 units
 - $\sqrt{5}$ units
 - 5 units
- iv) Find the image of $(-4, 5, 6)$ in the yz-plane.
- v) Find the co-ordinates of the point P which is five sixth of the way from $A(-2, 0, 6)$ to $B(10, -6, -12)$

Q.16. In what ratio is the line segment joining the points $A(-2, 4, 7)$ and $B(3, -5, 8)$ is divided by the yz plane ? [2]

OR

Are the points $A(3, 6, 9)$, $B(10, 20, 30)$ and $C(25, -41, 5)$ the vertices of a right angled triangle ?

Q.17. If the origin is the centroid of a triangle ABC having vertices $A(x, 1, 3)$, $B(-2, y, -5)$ and $C(4, 7, z)$. Find the value of x, y, z . [4]

OR

Show that the points $(0, -1, -7)$, $(2, 1, -9)$ and $(6, 5, -13)$ are collinear. Also find the ratio in which the first point divides the join of other two points.

Q.18. If $A(3, 2, 0)$, $B(5, 3, 2)$ and $C(-9, 6, -3)$ are the vertices of a triangle and the internal bisector of $\angle BAC$ meets BC at D, find the co-ordinates of D. [4]

SECTION C - 15 Marks

Q.19. In subparts (i) to (ii) choose the correct options and in subparts (iii) to (iv), answer the questions as instructed. [1×5=5]

- i) If the median of $\frac{x}{5}, x, \frac{x}{4}, \frac{x}{2}, \frac{x}{3}$ ($x > 0$) is 8 find x .
- 8
 - 16
 - 24
 - 32
- ii) Read the following statements and choose the correct option:
- On adding a constant quantity in each term ; the mean of resultant set of terms will also increase by same constant.
 - On multiplying each term by a constant the new mean of revised terms alters by a^2 .
 - The median is not based on all the observations of the data.
 - Median can be calculated by graphical method also.

Which of the following is correct ?

- (a) Only (III) is correct
 - (b) Only (I) and (IV) are correct
 - (c) Only (I), (III) and (IV) are correct
 - (d) Only (III) and (IV) are correct
- iii) Find the mode of 7, 6, 10, 7, 5, 9, 3, 7, 5
- iv) If Q_1 and Q_3 are lower and upper quartiles, then quartile deviation is evaluated by which formula ?
- v) If the median and mean of asymmetric frequency distribution are 72 and 74 respectively then find the mode .

Q.20. Two samples of sizes 50 and 100 are given. The means of these samples respectively are 56 and 50 . Find the mean of size 150 by combining the two samples. [2]

OR

The marks of a students in a test were 13, 17, 20, 5, 3, 3, 18, 15 and 20. Find Q_1 and Q_3 ,

Q.21. Calculate the mode of the following data : [4]

Daily wages in (₹)	31-36	37-42	43-48	49-54	55-60	61-66
Number of workers	4	6	14	10	6	4

OR

The following table gives weekly consumption of electricity (in kwh) of 90 families. Find the median.

Weekly consumption	50-58	59-67	68-76	77-85	86-94	95-103
Number of families	15	15	23	20	9	8

Q.22. Find the values of f_1 and f_2 from the following distribution, given that the median is 28 and the total number of observations is 50. [4]

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	5	f_1	15	f_2	6

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