

Vedanta

SEE MODEL QUESTION SET-3

Optional-I (Mathematics)

Time: 3 hours

Max. Marks: 100

Attempt all **the** questions:

Group-A [5 × (1+1) = 10]

- Write down the range of the function $y = \sin x$.
 - What does 'n' represent in the formula, $r = \left(\frac{b}{a}\right)^{\frac{1}{n+1}}$?
- Write the condition under which the function $f(x)$ is continuous at $x = a$.
 - If $A = [-10]$, what is the value of $|A|$?
- If the pair of lines represented by $ax^2 + 2hxy + by^2 = 0$, where a, b and h are constants, are coincident, write down the relation between a, b and h .
 - Which geometric figure will be formed if a plane intersects a cone parallel to its generator? Write it.
- Express $\sin A$ in terms of $\tan A/2$.
 - If the numerical value of $\tan A$ is negative, in which quadrants does A lie?
- If θ be the angle between the vectors \vec{a} and \vec{b} , write down the value of $\cos \theta$ in terms of dot product and product of magnitudes of vectors \vec{a} and \vec{b} .
 - Write down the coordinates of the inversion of a point P (x, y) with respect to the circle having centre at (h, k) and radius r .

Group-B [2 × (2 + 2) + 3 × (2 + 2 + 2) = 26]

- If $f = \{(1, 3), (0, 0), (-1, -3)\}$ and $g = \{(0, 2), (-3, -1), (3, 5)\}$, write gof in ordered pair form by representing in a mapping diagram.
 - If $f(x) = 6x + 1$ is a one to one onto function, find the value of $f^{-1}(-11)$.
 - Find the coordinates of the vertex of parabola $y = x^2 - 6x + 8$.
- If the determinant of transpose of the matrix $A = \begin{pmatrix} p \sin \theta & -\cos \theta \\ \cos \theta & \sin \theta \end{pmatrix}$ is 1, find the value of p .
 - Using Cramer's rule, find the value of D_1 and D_2 for system of $x + 2y = 11$ and $3x - y = 8$.
- Find the slopes of the line $5x + y + 2 = 0$ and the line passing through the point $(-1, 5)$ and origin then establish the relation between them.
 - Find the equation of a circle with centre $(2, 3)$ and passes through the point $(-2, 0)$.
- If $\tan \theta = \frac{3}{4}$ find the value of $\cos 2\theta$.
 - Express $\frac{\cos A}{1 + \cos A} \times \frac{\sin 2A}{1 + \cos 2A}$ in terms of sub-multiple angle of tangent.
 - Solve: $3\tan^2 \theta - 1 = 0$ ($0^\circ \leq \theta \leq 180^\circ$)
- If $\vec{a} + 2\vec{b}$ and $5\vec{a} - 4\vec{b}$ are perpendicular to each other and \vec{a} and \vec{b} are unit vectors, find the angle between \vec{a} and \vec{b} .
 - If the position vectors of M and N are $7\vec{i} + 2\vec{j}$ and $\vec{i} + 4\vec{j}$. Find the position vector of a point P such that $\overrightarrow{MP} = \overrightarrow{PN}$.
 - The coefficient of quartile deviation of a grouped data is 0.25 and the upper quartile is 60. Find the value of lower quartile.

Group-C (11 × 4 = 44)

11. Solve: $(x - 1)(2x^2 + 15x + 15) - 21 = 0$
12. Solve graphically the quadratic equation $x^2 - 2x - 8 = 0$. Also, find the intersecting points of the parabola and straight line.
13. A function $f(x)$ is defined by $f(x) = \begin{cases} kx^2 & \text{when } x \leq 2 \\ 5x - 2 & \text{when } x > 2 \end{cases}$. Find the value of k so that $f(x)$ is continuous at $x = 2$.
14. The total cost of 2 kg of apples and 5 kg of oranges is Rs 440. The cost of 1 kg of apples is same as the cost of 3 kg of oranges.
- Write the equations in matrix form.
 - Find the rates of cost of apples and orange by matrix method.
15. Find the single equation of the pair of straight lines which pass through the origin and perpendicular to the pair of straight lines represented by the homogeneous equation $x^2 + xy - 2y^2 = 0$.
16. Prove that: $\frac{1 - \cos \alpha + \cos \beta - \cos(\alpha + \beta)}{1 + \cos \alpha - \cos \beta - \cos(\alpha + \beta)} = \tan \frac{\alpha}{2} \cdot \tan \frac{\beta}{2}$
17. If A , B and C are the interior angles of a triangle ABC , prove that: $\sin \frac{A}{2} + \sin \frac{B}{2} + \sin \frac{C}{2} = 1 + 4 \sin \left(\frac{A+B}{4} \right) \sin \left(\frac{B+C}{4} \right) \sin \left(\frac{C+A}{4} \right)$
18. The angle of elevation of the top of an incomplete tower from a distance of 100m is 45° . What height should it be raised so that the angle of elevation of the may change to 60° ?
19. A square $ABCD$ with vertices $A(0, 3)$, $B(1, 1)$, $C(3, 2)$ and $D(2, 4)$ is mapped on to $\square A'B'C'D'$ by a 2×2 transformation matrix so that the vertices of $\square A'B'C'D'$ are $A'(6, -6)$, $B'(3, -1)$, $C'(7, -1)$ and $D'(10, -6)$. Find the 2×2 transformation matrix.

20. Find the mean deviation of the data given below from mean.

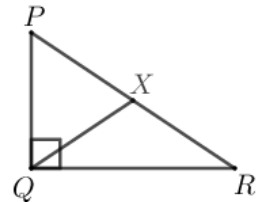
Age in years	0-4	0-8	0-12	0-16	0-20	0-24
No. of students	7	14	24	39	46	52

21. The monthly salary sheet of employees of a company is given below. Calculate the standard deviation and its coefficient of the data.

Salary (in Rs 000)	10-15	15-20	20-25	25-30	30-35
No. of workers	5	18	42	27	8

Group-D (4 × 5 = 20)

22. A person pays a loan of Rs 975 in monthly installments, each installment being less than a former by Rs 5. The amount of first installment is Rs 100. In how many installments will the entire amount be paid? Given reason.
23. In square $ABCD$, the coordinates of vertex A is $(1, 2)$ and the equation of diagonal BD is $x - 5y = 4$, find the equations of sides of square joining to the vertex A .
24. In the given right angled triangle PQR right angled at Q , X is the mid-point of PR , prove by vector method that $PX = QX = RX$.
25. A triangle with vertices $P(3, 5)$, $Q(4, 1)$ and $R(1, 0)$ is reflected successively about y -axis and the line $x = 5$. Find by stating the coordinates and graphically represent the images under transformations. Also, write a single transformation representing the above transformations.



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