

**SEE NEW MODEL QUESTION 2076
ISSUED BY CDC (SET 1)**

Subject: Optional Mathematics

F.M.: 100

Time: 3 hours

P.M. : 40

Attempt all the questions

Group 'A'

[10 × 1 = 10]

1. (a) Define trigonometric function.
(b) What is the arithmetic mean between two numbers a and b ?
2. (a) Write a set of numbers which is continuous in number line.
(b) If matrix $A = \begin{pmatrix} p & q \\ r & s \end{pmatrix}$, what is the value of $|A|$?
3. (a) If the slopes of two straight lines are m_1 and m_2 respectively and θ be the angle between them, write the formula for $\tan \theta$.
(b) Which geometric figure will be formed if a plane intersects a cone parallel to its base?
4. (a) Express $\sin 2A$ in terms of $\tan A$.
(b) Define angle of elevation.
5. (a) What is the scalar product of two vectors \vec{a} and \vec{b} if the angle between them is θ ?
(b) In an inversion transformation if P' is image of P and r is radius of inversion circle with center O , write the relation of $OP \cdot OP'$ and r .

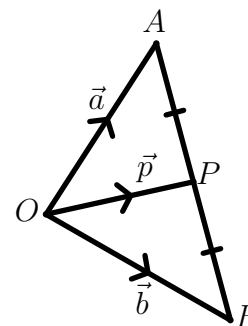
Group 'B'

[13 × 2 = 26]

6. (a) Find $f^{-1}(x)$ if $f(x) = 4x + 5$.
(b) If $g(x) = 2x - 1$ and $f(x) = 4x$, find the value of $g \circ f(x)$.
(c) What will be the points of intersection of the curve $f(x) = x^2 - 1$ and $f(x) = 3$?
7. (a) If $A = \begin{pmatrix} 2 & -1 \\ 3 & 1 \end{pmatrix}$, find $|A|$ and write A^{-1} is defined or not.

(b) According to Cramer's rule, find the values of D_1 and D_2 for $ax + by = c$ and $px + qy = r$.

8. (a) Find the slopes of two straight lines $3x + 4y + 5 = 0$ and $6x + 8y + 7 = 0$ and write the relationship between them.
(b) Find the single equation for the pair of lines represented by $3x + 2y = 0$ and $2x - 3y = 0$.
9. (a) Convert $\sin 6A \cdot \cos 4A$ into sum or difference of sine or cosine.
(b) Express $\frac{\sin A}{1 + \cos A}$ in terms of sub-multiple angle of tangent.
(c) If $2 \sin 2\theta = \sqrt{3}$, find the value of θ . ($0^\circ \leq \theta \leq 180^\circ$)
10. (a) Find the angle between two vectors \vec{a} and \vec{b} if $|\vec{a}| = 2$, $|\vec{b}| = 12$ and $\vec{a} \cdot \vec{b} = 12$
(b) From the given figure find \vec{AP} and express \vec{p} in terms of \vec{a} and \vec{b} .



(c) If the standard deviation of a set of data is 0.25, find its variance.

Group 'C'

[11 × 4 = 44]

11. Solve: $x^3 - 3x^2 - 4x + 12 = 0$
12. Optimize: $P = 5c + 4y$ under the given constraints:
 $x - 2y \leq 1, x + y \leq 4, x \geq 0, y \geq 0$

13. For a real valued function $f(x) = 2x + 3$
- (a) Find the values of $f(2.95), f(2.99), f(3.01), f(3.05)$ and $f(3)$.
- (b) Is this function continuous at $x = 3$?
14. By using matrix method, solve the following system of equations: $3x + 5y = 11, 2x - 3y = 1$.
15. Find the single equation of pair of straight lines passing through the origin and perpendicular to the lines represented by $2x^2 - 5xy + 2y^2 = 0$.
16. Find the value of: $\sin 20^\circ \cdot \sin 30^\circ \cdot \sin 40^\circ \cdot \sin 80^\circ$
17. If $A + B + C = \pi$, prove that:
 $\sin^2 A - \sin^2 B + \sin^2 C = 2 \sin A \cos B \sin C$
18. From a point at the ground level in front of a tower, the angle of elevations of the top and bottom of flagstaff $6m$ high situated at the top of a tower are observed 60° and 45° respectively. Find the height of the tower and the distance between the base of the tower and point of observation.
19. Find the 2×2 matrix which transforms a unit square to a parallelogram $\begin{pmatrix} 0 & 3 & 4 & 1 \\ 0 & 0 & 1 & 1 \end{pmatrix}$.

20. Find the mean deviation from mean and its coefficient from given data.

Marks obtained	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
No. of students	2	3	6	5	4

21. Find the standard deviation and coefficient of variation from given data.

Marks obtained	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24
No. of students	7	7	10	15	7	6

Group 'D'

[4 × 5 = 20]

22. A contractor on construction job specifies a penalty for delay of completion beyond a certain date as: Rs 200 for the first day, Rs 250 for the second day, Rs 300 for the third day and so on. The penalty for each succeeding day being Rs 50 more than that of the preceding day. How much money the contractor has to pay as penalty, if he has delayed the work by 30 days?
23. On a wheel, there are three points $(5, 7), (-1, 7)$ and $(5, -1)$ located such that the distance from a fixed point to these points is always equal. Find the coordinate of the fixed point and then derive the equation representing the locus that contains all three points.
24. By using vector method, prove that the quadrilateral formed by joining the midpoints of adjacent sides of a quadrilateral is a parallelogram.
25. The coordinates of vertices of a quadrilateral $ABCD$ are $A(1, 1), B(2, 3), C(4, 2)$ and $D(3, -2)$. Rotate this quadrilateral about origin through 180° . Reflect this image of quadrilateral about $y = x$. Write the name of transformation which denotes the combined transformation of above two transformations
