SEE – 2080 (2024)

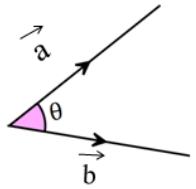
Optional- I (Mathematics)

Time: 3 hours F.M.: 75

Answer all the questions.

Group-A 10 × 1 = 10

1. Write the period of the function $f(x) = \tan x$.
2. What do you mean by remainder theorem?
3. Write $\lim_{x \to a^+} f(x)$ in sentence.
4. Define inverse matrix.
5. For what condition, the straight lines $y = m_1x + c_1$ and $y = m_2x + c_2$ will be perpendicular?
6. Name the conic section which is formed when a plane intersects a cone parallel to the generator of the cone?
7. Express $\sin A$ in terms of $\tan\frac{A}{2}$.
8. Write $\cos\alpha + \cos\beta$ into product form.
9. From the given figure, find the formula to find $\cos\theta$.



10. Write a 2 × 2 transformation matrix associated with an enlargement with scale factor k and centre at origin.

Group-B 8× 2 = 16

11. If $x + 2$ is a factor of $x^3 - (k + 6)x^2 + 2kx + 40$, find the value of k.
12. Find the sum of series $1 + 6 + 11 + \ldots + 76$
13. If the matrices $\begin{pmatrix} 4 & 5 \\ 6 & 7 \end{pmatrix}$ and $\begin{pmatrix} -\frac{7}{2} & \frac{5}{2} \\ x & -2 \end{pmatrix}$ are inverse matrix to each other, calculate the value of x.
14. Find the obtuse angle between the lines $2x - y + 3 = 0$ and $x - 3y + 4 = 0$
15. Prove that: $\tan\theta + 2\cot 2\theta = \cot\theta$
16. Prove that: $2\cos 65°.\cos 25° = \cos 40^o$
17. If $\vec{a} = -4\vec{i} + 3\vec{j}$ and $\vec{b} = 3m\vec{i} + (5m - 2)\vec{j}$ are perpendicular to each other then find the value of m.
18. In a continuous distribution, if the first quartile is 20 and coefficient of quartile deviation is 0.5, find the third quartile and semi-inter quartile range of the distribution.

Group-C 11 × 3 = 33

19. If $f(x) = 4x + 5$ and $f\circ g(x) = 8x + 17$, find the value of $g^{-1}(7)$.
20. Find the maximum value of the objective function $P = 2x + y + 10$ under the constraints $x + y \leq 5$, $x - y \geq 1$ and $y \geq 0$.
21. Examine the continuity or discontinuity of $f(x) = \frac{3x + 1}{2}$ at $x = 5$ by calculating left hand limit, right hand limit and functional value.

22. Solve the equations $2x - 3y - 7 = 0$ and $4y - 3x = -10$ by using Cramer's rule.

23. Find the equation of a circle concentric with the circle having equation $2x^2 + 2y^2 + 4x - 2y + 1 = 0$ and passing through the point $(4, -2)$.

24. Give that $A + B + C = 90°$, prove the given identities:

$\cos(B + C - A) + \cos(C + A - B) + \cos(A + B - C) = 4\cos A \cos B \cos C$

25. Solve: $\frac{\sin 2A + \sin 5A - \sin A}{\cos 2A + \cos 5A + \cos A} = \sqrt{3}$ $(0^o \le A \le 360^o)$

26. Two buses, stopped on the same side of a tower, are at the distances of 120 m and 60 m from the foot of the tower. The angles of depressions of the buses from the top of a tower are found to be complementary. Find the height of the tower.

27. Find the inversion of points A (6, -1) and B (4, 5) with respect to the circle $(x - 2)^2 + (y - 3)^2 = 16$.

28. From the data given below, find the mean deviation from the mean and its coefficient.

Marks obtained	20-30	30-40	40-50	50-60	60-70
No. of students	2	3	6	5	4

29. Calculate the coefficient of variation from the data given below.

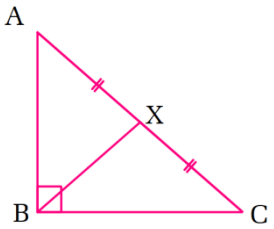
Daily wages (in Rs)	100-300	300-500	500-700	700-900
No. of employees	7	10	12	11

Group-D $4 \times 4 = 16$

30. Three numbers whose sum is 21 are in GP. If 2, 3 and 1 are added to them respectively, the numbers are in AP. Find the numbers.

31. If an angle between the pair of lines represented by $2x^2 + kxy + 3y^2 = 0$ is 45°, then find the positive value of k and also find the separate equations of the lines.

32. In right angled triangle ABC right angles at B; AX = CB. Prove by using vector method that AX = BX = CX.



33. R_1 denotes an rotation through $+90^o$ about origin and R_2 denotes a reflection on $y + x = 0$. Find the single transformation equivalent to the combined transformation $R_1 o R_2$. Also, find the image of trapezium ABCD having vertices A (3, 2) , B (-1, 2), C (0, 4) , D (2, 4) under the combined transformation $R_1 o R_2$ and present both the trapeziums on the same graph paper.

THE END