



Total No. of Questions : 24

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Part - III
MATHEMATICS - PAPER - I (A)
(English Version)

Time : 3 Hours

Max. Marks : 75

Note : This question paper consists of Three Sections - A, B and C.

SECTION - A



I. Very Short Answer Type Questions.

10x2=20

- (i) Answer all the questions.
(ii) Each question carries two marks.

1. Find the domain of the real valued function f(x) = 1 / sqrt(1-x^2).



2. If A={1, 2, 3, 4} and f: A -> R is a function defined by f(x) = (x^2 - x + 1) / (x + 1), then find the range of f.

3. Find the co-factors of the elements 2, -5 in the matrix [-1 0 5; 1 2 -2; -4 -5 3].



4. If [x-1 2 5-y; 0 z-1 7; 1 0 a-5] = [1 2 3; 0 4 7; 1 0 0] then find the values of x, y, z and a.

5. Find a vector in the direction of vector a=i-2j that has magnitude 7 units.

6. Find the vector equation of the line joining the points 2i+j+3k and -4i+3j-k.

7. Find the angle between the planes r.(2i-j+2k)=3 and r.(3i+6j+k)=4.

8. Find the maximum and minimum values of 3 sin x - 4 cos x.



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II

9. If $\tan 20^\circ = \lambda$, then show that $\frac{\tan 160^\circ - \tan 110^\circ}{1 + \tan 160^\circ \cdot \tan 110^\circ} = \frac{1 - \lambda^2}{2\lambda}$.

10. Show that $\tan h^{-1}\left(\frac{1}{2}\right) = \frac{1}{2} \log_e 3$.



SECTION - B

II. Short Answer Type Questions.

5x4=20

- (i) Answer any five questions.
 (ii) Each question carries four marks.

11. If $A = \begin{bmatrix} 2 & -4 \\ -5 & 3 \end{bmatrix}$ then find $A + A'$ and AA' .

12. If the points whose position vectors are $3i - 2j - k$, $2i + 3j - 4k$, $-i + j + 2k$ and $4i + 5j + \lambda k$ are coplanar, then show that $\lambda = -\frac{146}{17}$.



13. Find the volume of the tetrahedron whose vertices are $(1, 2, 1)$, $(3, 2, 5)$, $(2, -1, 0)$ and $(-1, 0, 1)$.

14. Prove that $\sin^2 \theta + \sin^2 \left(\theta + \frac{\pi}{3}\right) + \sin^2 \left(\theta - \frac{\pi}{3}\right) = \frac{3}{2}$.

15. Solve $\tan \theta + 3 \cot \theta = 5 \sec \theta$.

16. Prove that $\cos \left(2 \tan^{-1} \frac{1}{7}\right) = \sin \left(2 \tan^{-1} \frac{3}{4}\right)$.



17. Prove that $\frac{a}{bc} + \frac{\cos A}{a} = \frac{b}{ca} + \frac{\cos B}{b} = \frac{c}{ab} + \frac{\cos C}{c}$.

**SECTION - C****5x7=35****III. Long Answer Type Questions.**

- (i) Answer *any five* questions.
 (ii) Each question carries *seven* marks.



18. Let $f: A \rightarrow B$ be a bijection. Then prove that $fof^{-1} = I_B$ and $f^{-1}of = I_A$.

19. Using mathematical induction, prove that

$$\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \dots + \frac{1}{(2n-1)(2n+1)} = \frac{n}{2n+1}, \text{ for all } n \in \mathbf{N}.$$

20. Solve the following system of equations by using matrix inversion method.

$$\begin{aligned} x+y+z &= 1, \\ 2x+2y+3z &= 6, \\ x+4y+9z &= 3. \end{aligned}$$



21. Show that $\begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(ab+bc+ca)$.

22. Find the shortest distance between the skew lines $r = (6i+2j+2k) + t(i-2j+2k)$ and $r = (-4i-k) + s(3i-2j-2k)$.

23. If $A+B+C = \pi$, then prove that

$$\cos^2 \frac{A}{2} + \cos^2 \frac{B}{2} + \cos^2 \frac{C}{2} = 2 \left(1 + \sin \frac{A}{2} \sin \frac{B}{2} \sin \frac{C}{2} \right).$$



24. Show that $\cos A + \cos B + \cos C = 1 + \frac{r}{R}$.

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