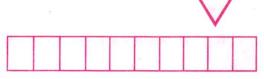
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Part-III

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

 $10 \times 2 = 20$

- I. Very short answer type questions.
 - (i) Attempt all the questions.
 - (ii) Each question carries TWO marks.
 - 1. If $f: Q \rightarrow Q$ defined by f(x) = 5x + 4, then find f^{-1} .
 - **2.** Find the domain of the real function $f(x) = \sqrt{4x x^2}$.
 - 3. If $\overline{a}=2\overline{i}+4\overline{j}-5\overline{k}$, $\overline{b}=\overline{i}+\overline{j}+\overline{k}$, $\overline{c}=\overline{j}+2\overline{k}$, then find a unit vector in the opposite direction of $\overline{a}+\overline{b}+\overline{c}$.
 - 4. If the vectors $-3\overline{i}+4\overline{j}+\lambda\overline{k}$ and $\mu\overline{i}+8\overline{j}+6\overline{k}$ are collinear vectors, then find λ and μ .

- 5. Find the area of the parallelogram $2\overline{i} 3\overline{j}$ and $3\overline{i} \overline{k}$ as adjacent sides.
- **6.** If $\sec \theta = x + \frac{1}{4x}$, prove that $\tan \theta + \sec \theta = 2x$.
- 7. Show that $\cos 100^{\circ} \cos 40^{\circ} + \sin 100^{\circ} \sin 40^{\circ} = \frac{1}{2}$.
- 8. If $\sinh x = \frac{1}{2}$, find the value of $\cosh 2x + \sinh 2x$.
- **9.** In $\triangle ABC$, a = 4, b = 5, c = 7, then find the value of $\cos(\frac{B}{2})$.
- 10. Find the square root of 3 + 4i.

SECTION - B

 $5 \times 4 = 20$

- **II.** Short answer type questions.
 - (i) Attempt ANY FIVE questions.
 - (ii) Each question carries FOUR marks.
 - 11. If \overline{a} , \overline{b} , \overline{c} are non coplanar vectors, then prove that the four points $-\overline{a}+4\overline{b}-3\overline{c}$, $3\overline{a}+2\overline{b}-5\overline{c}$, $-3\overline{a}+8\overline{b}-5\overline{c}$ and $-3\overline{a}+2\overline{b}+\overline{c}$ are coplanar.
 - 12. Prove by vector method, the angle between the two diagonals of a Cube is $\cos^{-1}(\frac{1}{3})$.
 - 13. If A is not an integral multiple of π , then prove that $\cos A \cdot \cos 2A \cdot \cos 4A \cdot \cos 8A = \frac{\sin 16 A}{16 \sin A}.$

- **14.** Solve $\sqrt{2}(\sin x + \cos x) = \sqrt{3}$.
- **15.** Prove that $\sin^{-1}(\frac{3}{5}) + \sin^{-1}(\frac{8}{17}) = \cos^{-1}(\frac{36}{85})$.
- **16.** Prove that $\cot A + \cot B + \cot C = \frac{a^2 + b^2 + c^2}{4\Delta}$
- 17. Show that $2^5 \cos^2 \theta \sin^4 \theta = \cos 6\theta 2\cos 4\theta \cos 2\theta + 2$

SECTION - C

 $5 \times 7 = 35$

- III. Long answer type questions.
 - (i) Attempt ANY FIVE questions.
 - (ii) Each question carries **SEVEN** marks.
 - **18.** If $f: A \to B$, $g: B \to C$ are bijections, then prove that $g \circ f: A \to C$ is a bijection.
 - **19.** By using Mathematical induction, show that $3.5^{2n+1} + 2^{3n+1}$ is divisible by 17. $n \in \mathbb{N}$.
 - **20.** Let $\overline{a} = i + j + k$, $\overline{b} = 2i j + 3k$, $\overline{c} = i j$ and $\overline{d} = 6i + 2j + 3k$. Express \overline{d} in terms of $\overline{b} \times \overline{c}$, $\overline{c} \times \overline{a}$ and $\overline{a} \times \overline{b}$.

21. If A, B, C are angles of a triangle, then prove that

$$\sin^2 \frac{A}{2} + \sin^2 \frac{B}{2} - \sin^2 \frac{C}{2} = 1 - 2\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$$
.

22. If a = 13, b = 14, c = 15, then show that

$$R = \frac{65}{8}$$
, $r = 4$, $r_1 = \frac{21}{2}$, $r_2 = 12$ and $r_3 = 14$.

23. On a tower AB of height 'h', there is a flag-staff BC at a point of d metres away from the foot of the tower. AB and BC are making equal angles. Show

that the height of the flag - staff is
$$h\left[\frac{d^2+h^2}{d^2-h^2}\right]$$
 metres.

24. Show that one value of $\left[\frac{1 + \sin \frac{\pi}{8} + i \cos \frac{\pi}{8}}{1 + \sin \frac{\pi}{8} - i \cos \frac{\pi}{8}} \right]^{8/3} = -1$