SECTION - A

VERY SHORT ANSWER TYPE QUESTIONS $10 \times 2 = 20$

(Attempt 'ALL' questions. Each question carries '2' marks)

1. Find the inverse of the function $f: (0, \infty) \to R$ defined by $f(x) = \log_2 x$.
2. Find domain of the function $\frac{1}{(x^2 - 1)(x + 3)}$.
3. If the position vectors of A, B, C are $-2\mathbf{i} + \mathbf{j} - \mathbf{k}$, $2\mathbf{j} + 2\mathbf{k} - 4\mathbf{i}$, $6\mathbf{i} - 3\mathbf{j} - 13\mathbf{k}$ and $\vec{AB} = \lambda \vec{AC}$, find λ.
4. Find the vector equation of the line passing through the point $2\mathbf{i} + \mathbf{j} + 3\mathbf{k}$ and parallel to the vector $-4\mathbf{i} + 3\mathbf{j} - \mathbf{k}$.
5. Find the area of the triangle whose adjacent sides are $3\mathbf{i} + 4\mathbf{j}$, $-5\mathbf{i} + 7\mathbf{j}$
6. Show that $\frac{1}{\sin 10^\circ} - \frac{\sqrt{3}}{\cos 10^\circ} = 4$.
7. If $A + B + C = 180^\circ$, prove that $\tan A + \tan B + \tan C = \tan A \tan B \tan C$
8. If $x = \log\left[\cot\left(\frac{\pi}{4} + \theta\right)\right]$, prove that $\cosh x = sec\, 2\theta$.
9. Show that $\frac{\cos A}{a} + \frac{\cos B}{b} + \frac{\cos C}{c} = \frac{a^2 + b^2 + c^2}{2abc}$.
10. Find the square root of $3 + 4i$

SECTION - B

SHORT ANSWER TYPE QUESTIONS $5 \times 4 = 20$

(Attempt any 'FIVE' questions. Each question carries '4' marks)

11. Show that the vectors $3\mathbf{a} - 2\mathbf{b} - 4\mathbf{c}$, $-\mathbf{a} + 2\mathbf{c}$, $-2\mathbf{a} + \mathbf{b} + 3\mathbf{c}$ are linearly dependent, where $\mathbf{a}$, $\mathbf{b}$, $\mathbf{c}$ are non-coplanar vectors.
12. If $\mathbf{a} = (4, 3, 5)$ is the centre of the sphere and the sphere passes through the point $\mathbf{b} = (-1, -1, 2)$ then find the equation of the sphere.

13. If $\cot A + \cot B + \cot C = \sqrt{3}$ then show that ABC is an equilateral triangle.

14. Solve the equation of $1 + \sin^2\theta = 3 \sin\theta \cos\theta$

15. If $Cos^{-1}x + Cos^{-1}y + Cos^{-1}z = \pi$, prove that $x^2 + y^2 + z^2 + 2xyz = 1$.

16. If $\sin\theta = \frac{a}{b+c}$, then show that $\cos\theta = \frac{2\sqrt{bc}}{b+c}\cos\frac{A}{2}$

17. Show that $\cos 6\theta = 32\cos^6\theta - 48\cos^4\theta + 18\cos^2\theta - 1$

SECTION - C

LONG ANSWER TYPE QUESTIONS

5 × 7 = 35

(Attempt any 'FIVE' questions. Each question carries '7' marks)

18. f from R into R is defined as $f(x) = x$, if $x > 2$
$= 5x - 2$, if $x \le 2$
Show that f is onto but not one one

19. Show that $x^n - y^n$ is divisible by $x - y$ for all $n \in N$ by way of mathematical induction.

20. If **a**, **b**, **c** are three vectors, prove that
i) $(\mathbf{a} \times \mathbf{b}) \times \mathbf{c} = (\mathbf{c} \cdot \mathbf{a})\,\mathbf{b} - (\mathbf{c} \cdot \mathbf{b})\,\mathbf{a}$
ii) $\mathbf{a} \times (\mathbf{b} \times \mathbf{c}) = (\mathbf{a} \cdot \mathbf{c})\,\mathbf{b} - (\mathbf{a} \cdot \mathbf{b})\,\mathbf{c}$

21. If $A + B + C = 180^\circ$, then prove that $\sin^2 A + \sin^2 B - \sin^2 C = 2\sin A \sin B \cos C$.

22. Show that $\frac{ab - r_1 r_2}{r_3} = \frac{bc - r_2 r_3}{r_1} = \frac{ca - r_3 r_1}{r_2} = r$.

23. A pillar of 10 metres height is mounted on a spire. From a point on the level ground, the angles of elevation of the top and foot of the pillar are 75° and 45° respectively. Find the height of the spire.

24. Solve $x^9 - x^5 + x^4 - 1 = 0$.