SECTION - A $10 \times 2 = 20$

VERY SHORT ANSWER TYPE QUESTIONS

Answer All questions. Each question carries 2 marks.

1. If $h(x) = 2x$, $g(x) = x^2$, $f(x) = 2$ then find $(f \circ g \circ h)(x)$.

2. Find the domain of $\sqrt{x^2 - 3x + 2}$.

3. Show that the points $-2\mathbf{a} + 3\mathbf{b} + 5\mathbf{c}$, $\mathbf{a} + 2\mathbf{b} + 3\mathbf{c}$, $7\mathbf{a} - \mathbf{c}$ are collinear where $\mathbf{a}, \mathbf{b}, \mathbf{c}$ are three non-coplanar vectors.

4. If $\mathbf{a} = 2\mathbf{i} + 5\mathbf{j} + \mathbf{k}$, $\mathbf{b} = 4\mathbf{i} + m\mathbf{j} + n\mathbf{k}$ and $\mathbf{a}, \mathbf{b}$ are collinear, find m, n.

5. If $\mathbf{a} = 2\mathbf{i} + t\mathbf{j} - \mathbf{k}$ and $\mathbf{b} = 4\mathbf{i} - 2\mathbf{j} + 2\mathbf{k}$, find the value of t, so that $\mathbf{a}$ and $\mathbf{b}$ are perpendicular.

6. If $\dfrac{\cos\alpha}{a} = \dfrac{\sin\alpha}{b}$, show that $a\cos 2\alpha + b\sin 2\alpha = a$.

7. Find the extreme values of $\cos x \cos\left(\dfrac{2\pi}{3} + x\right)\cos\left(\dfrac{2\pi}{3} - x\right)$.

8. If $u = \log\left[\tan\left(\dfrac{\pi}{4} + \dfrac{\theta}{2}\right)\right]$ then prove that $\cosh u = \sec\theta$.

9. If $\tan\left(\dfrac{A}{2}\right) = \dfrac{5}{6}$ and $\tan\left(\dfrac{C}{2}\right) = \dfrac{2}{5}$, determine the relation between a, b, c.

10. Show that the points in the Argand diagram represented by the complex numbers $-2 + 7i, -\dfrac{3}{2} + \dfrac{1}{2}i, 4 - 3i, \dfrac{7}{2}(1 + i)$ are the vertices of a rhombus.

SECTION - B $5 \times 4 = 20$

SHORT ANSWER TYPE QUESTIONS

Attempt any 5 questions. Each question carries 4 marks.

11. Prove by vector method that $\dfrac{x}{a} + \dfrac{y}{b} = 1$ is the equation of a straight line in intercept form.

12. Determine the value of λ, for which the volume of the parallelopiped having coterminus edges $\mathbf{i} + \mathbf{j}$, $3\mathbf{i} - \mathbf{j}$ and $3\mathbf{i} + \lambda\mathbf{k}$ is 16 cubic units.

13. Prove that $\cos\theta \cos(60^\circ + \theta) \cdot \cos(60^\circ - \theta) = \frac{1}{4}\cos 3\theta$ and hence deduce that $\cos 10^\circ \cos 30^\circ \cos 50^\circ \cos 70^\circ = 3/16$.

14. In the interval $0 \leq \theta \leq \pi/2$, solve $\sin\theta + \sin 4\theta + \sin 7\theta = 0$.

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

16. Show that $a\cos^2\frac{A}{2} + b\cos^2\frac{B}{2} + c\cos^2\frac{C}{2} = s + \frac{\Delta}{R}$

17. Show that $2^4\cos^5\theta = \cos 5\theta + 5\cos 3\theta + 10\cos\theta$.

SECTION - C

5 × 7 = 35

LONG ANSWER TYPE QUESTIONS

Attempt any 5 questions. Each question carries 7 marks.

18. If $f: A \to B$, $g: B \to C$, $h: C \to D$ are three functions, then prove that $h\circ(g\circ f) = (h\circ g)\circ f$.

19. Show that $49^n + 16n - 1$ is divisible by 64 for all positive integral values of n.

20. In a ΔABC, using vector method, prove that $\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$

21. If $A + B + C = 180^\circ$ then show 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 $r_1 = 8, r_2 = 12, r_3 = 24$, show that $a = 12, b = 16, c = 20$.

23. From the top of a hill 200 metres high, the angles of depression of the top and bottom of a pillar on the level ground are 30° and 60° respectively. find the height of the pillar.

24. If $\cos\alpha + \cos\beta + \cos\gamma = 0 = \sin\alpha + \sin\beta + \sin\gamma$, then show that
i) $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 3/2$ ii) $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 3/2$