BASIC MATHEMATICS

Duration: 2 Hours   **Total Marks: 50**

Instructions:
- I.   Figures to the right indicate maximum marks
- II.   Start each answer on a fresh page
- III.   All questions are compulsory
- IV.   Calculators are not allowed

Q.1 Attempt the following

A. Match the following   **Marks (1X5)**

A	B
i. Volume of a sphere	a) $\sin x$
ii. Derivative of $\cos x$	b) $4\pi r^2$
iii. Integral of $\cos x$	c) $b = \frac{a+c}{2}$
iv. Total surface area of a sphere	d) $b = \sqrt{ac}$
v. a, b, c are in G.P then	e) $\frac{1}{x}$
	f) $\frac{4}{3}\pi r^3$
	g) $-\sin x$

B. Fill in the blanks   **Marks (1X5)**

- a.   Improper divisors of 3 are ....
- b.   The ratio of 4km and 500m is......................
- c.   G.C.D of 26 and 24=.........................
- d.   Two numbers are in the ratio 7:5.If their difference is 6, the two numbers are.........................
- e.   Determinant of the matrix $\begin{bmatrix} -4 & 0 \\ 8 & -2 \end{bmatrix}$ =.........................

Q.2 Answer the following questions (any two)   **Marks (5X2)**

A. Evaluate the following integrals

- i. $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{\sin x}{\cos^2 x} dx$
- ii. $\int \frac{a + b \sin x}{\cos^2 x} dx$

B. Find the equation of the line through (7, -3) and parallel to the line through (-1,2) and (5, 11).

C. If the sum of the first 20 terms of an A.P is 610 and the firs term is 2 find the common difference.

Q.3 Answer the following (any two)   **Marks (5X2)**

A. Prove that
i. $\cos 3\theta = 4\cos^3 \theta - 3 \cos \theta$
ii. $\sin 3\theta = 3 \sin \theta - 4 \sin^3 \theta$

B. Solve the following simultaneous equations by using Cramer's rule
$2x + 7y = 65 \, , 10x - y = 1$

C. Find the product $\begin{bmatrix} 2 & -4 & 5 \\ 0 & 3 & 4 \end{bmatrix} \begin{bmatrix} 3 & -1 \\ 3 & -2 \\ 2 & 2 \end{bmatrix}$

Q.4 Answer the following (any two)   **Marks (5X2)**

A. Evaluate the following limits
i. $\lim_{x \to a} \frac{x^2 - a^2}{x - a}$
ii. $\lim_{x \to 2} \frac{3 \sin x - \sin 3y}{y^3}$

B. Write $z = -\sqrt{3} - i$ in polar form.

C. Discuss the continuity of the following function at $x = 2$ and $x = 4$

$$f(x) = \begin{cases} x^2 - 4 & 0 \le x \le 2 \\ 3x + 2 & 2 < x \le 4 \\ x^2 - 1 & 4 < x \le 6 \end{cases}$$

Q.5 Answer the following (any two)   **Marks (5X2)**

A. Differentiate the following with respect to x
i. $\sin^{12} x$
ii. $\sin x \cos x$

B. Find the sum of first n terms of the sequence $2, 5, 8, 11, \cdots$ and hence find the sum of first 10 terms.

C. If $\vec{a} = a_1 \hat{\imath} + a_2 \hat{\jmath} + a_3 \hat{k}$ and $\vec{b} = b_1 \hat{\imath} + b_2 \hat{\jmath} + b_3 \hat{k}$ find $\vec{a} \times \vec{b}$ and $\vec{a} \cdot \vec{b}$.
Also verify that $\vec{a} \times \vec{b} = -\vec{b} \times \vec{a}$

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