

5. a. Find $\frac{dy}{dx}$ when $x = 2at$ and $y = 2at^2$

(b) Evaluate : $\int \sin 2x \cdot \sin 3x \, dx$

(c) Determine the interval in which the function $f(x) = \frac{1}{2}x^2 - x$ is increasing or decreasing.

Group 'B'

5 × 2 × 4 = 40

6. a. For any non-empty subsets A, B, C of universal set U, prove that:
 $A - (B \cup C) = (A - B) \cap (A - C)$

Or

Define absolute value of a real number. Also prove that

$$|x| - |y| \leq |x + y|, \forall x, y \in \mathbb{R}$$

b. Sketch the graph of $f(x) = (x-1)^2$ indicating its characteristics.

7. a. Solve for general values of θ :

$$\sin \theta + \sin 2\theta + \sin 3\theta = \cos \theta + \cos 2\theta + \cos 3\theta$$

Or

If $a=2$, $b=\sqrt{6}$ and $c=\sqrt{3}-1$, find the angles of the triangle ABC.

(b) Prove that:
$$\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ac & bc & c^2+1 \end{vmatrix} = 1+a^2+b^2+c^2$$

8. a. Solve by inverse matrix or row equivalent method:

$$x - y = 0, \quad 2x - y + 4z = 18, \quad -3x + z + 2 = 0$$

b. Find the equation whose roots are reciprocal of the roots of $x^2 - x + 1 = 0$

9. a. Prove that the circles $x^2 + y^2 + 2ax + c^2 = 0$ and $x^2 + y^2 + 2by + c^2 = 0$

touch each other if $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c^2}$

b. Evaluate :
$$\lim_{x \rightarrow \theta} \frac{x \cos \theta - \theta \cos x}{x - \theta}$$

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