

M - 205

NOTE: Attempt all Questions.

- Question 1. (a) Let $\mathbf{a} = 3\mathbf{i} + 2\mathbf{j} - 5\mathbf{k}$ and $\mathbf{b} = 2\mathbf{i} + \mathbf{j} + 3\mathbf{k}$. Find $\text{comp}_{\mathbf{a}} \mathbf{b}$. [3]
(b) If the planes $ax + 2y + z = 4$ and $x - z = 1$ are perpendicular to each other, find a and also find the equation of their line of intersection. [3]
(c) Determine the angle between the vectors

$$\mathbf{a} = 3\mathbf{i} + 2\mathbf{j} - 5\mathbf{k}, \quad \mathbf{b} = 2\mathbf{i} + \mathbf{j} + 3\mathbf{k}.$$

[2]

- Question 2. (a) Find the distance of the point $P(2, 4, -5)$ from the line through points $Q(3, 5, -1)$ and $R(5, 2, 4)$. [3]
(b) Find the volume of the parallelepiped having adjacent sides $\overrightarrow{AB}$, $\overrightarrow{AC}$ and $\overrightarrow{AD}$ where $A(1, -1, 2)$, $B(3, 4, -5)$, $C(-3, 1, 1)$ and $D(1, 2, 4)$. [3]
(c) Determine whether the line

$$x = 3 + 8t, \quad y = 4 + 5t, \quad z = -3 - t$$

and the plane $x - 3y + 5z = 12$ are parallel. If not, find their point of intersection. [2]

- Question 3. (a) If the acceleration of a moving particle is given by
 $\mathbf{a}(t) = 6 \sin(t) \mathbf{i} + 3t \mathbf{j} + (t + 2) \mathbf{k}$,
find its velocity and position given that the initial velocity is
 $\mathbf{v}(0) = \mathbf{i} + \mathbf{k}$,
and the initial position is

$$\mathbf{r}(0) = 3\mathbf{j} + 2\mathbf{k}.$$

[6]

- (b) Find the domain of the function

$$f(x, y) = \frac{x^2 + y^2}{x^2 - y^2},$$

and find

$$\lim_{(x,y) \rightarrow (0,0)} f(x, y).$$

[3]