

1. If  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are the position vectors of the points  $A(2, 3, -4)$ ,  $B(3, -4, 5)$  and  $C(3, 2, -3)$  respectively, then  $|\vec{a} + \vec{b} + \vec{c}|$  is equal to

- (A)  $\sqrt{113}$   
 (B)  $\sqrt{185}$   
 (C)  $\sqrt{203}$   
 (D)  $\sqrt{209}$

2. Find the distance of the point  $(a, b, c)$  from the x-axis.

3. (a) If

$$\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k} \quad (1)$$

and

$$\vec{b} = 5\hat{i} - 3\hat{j} - 4\hat{k}, \quad (2)$$

then find the ratio

$$\frac{\text{projection of vector } \vec{a} \text{ on vector } \vec{b}}{\text{projection of vector } \vec{b} \text{ on vector } \vec{a}} \quad (3)$$

- (b) Let  $\hat{a}$  and  $\hat{b}$  be two unit vectors. If the vectors

$$\vec{c} = \hat{a} + 2\hat{b} \quad (4)$$

and

$$\vec{d} = 5\hat{a} - 4\hat{b} \quad (5)$$

are perpendicular to each other, then find the angle between the vectors  $\vec{a}$  and  $\vec{b}$ .

4. Show that  $|\vec{a}|\vec{b} + |\vec{b}|\vec{a}$  is perpendicular to  $|\vec{a}|\vec{b} - |\vec{b}|\vec{a}$ , for any two non-zero vectors  $\vec{a}$  and  $\vec{b}$ .
5. Prove that three points  $\vec{A}$ ,  $\vec{B}$  and  $\vec{C}$  with position vectors  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  respectively are collinear if and only if

$$(\vec{b} \times \vec{c}) + (\vec{c} \times \vec{a}) + (\vec{a} \times \vec{b}) = 0 \quad (6)$$