

## Questions 19 to 22

The vectors  $\mathbf{a}$  and  $\mathbf{b}$  are given in terms of Cartesian unit vectors  $\mathbf{i}$ ,  $\mathbf{j}$  and  $\mathbf{k}$  by

$$\mathbf{a} = \mathbf{i} - 2\mathbf{j} + 3\mathbf{k},$$

$$\mathbf{b} = \mathbf{i} - \mathbf{j} - \mathbf{k}.$$

19 Select the option which is the magnitude of the vector  $\mathbf{a}$ .  $\sqrt{1^2 + 2^2 + 3^2} = \sqrt{1+4+9} = \sqrt{14}$

20 Select the option which is the value of  $\mathbf{a} \cdot \mathbf{b}$ .  $1 + 2 - 3 = 0$

Options for Questions 19 and 20

- A -4    B 0    C 2    D 6  
E 14    F  $\sqrt{2}$     G  $\sqrt{6}$     H  $\sqrt{14}$

21 Select the option which is the vector  $\mathbf{a} - 2\mathbf{b}$ .  $(1, -2, 3) + (2, +2, +2) = (-1, 0, 5)$

22 Select the option which is the vector  $\mathbf{a} \times \mathbf{b}$ .  $(2+3, 3+1, -1+2) = (5, 4, 1)$

Options for Questions 21 and 22

- A  $-\mathbf{i} - 4\mathbf{j} + \mathbf{k}$     B  $-\mathbf{i} + 4\mathbf{j} + \mathbf{k}$     C  $-\mathbf{i} - 4\mathbf{j} + 5\mathbf{k}$   
D  $5\mathbf{i} + 4\mathbf{j} + \mathbf{k}$     E  $5\mathbf{i} + 4\mathbf{j} + 3\mathbf{k}$     F  $5\mathbf{i} + 4\mathbf{j} + 5\mathbf{k}$   
G  $-\mathbf{i} + 5\mathbf{k}$     H  $-\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$

## Question 23

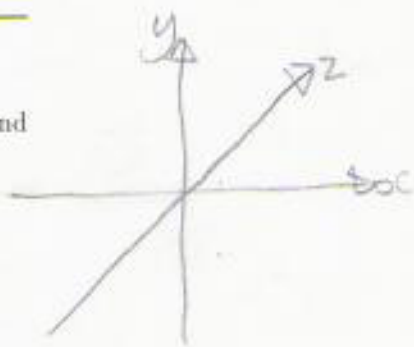
Choose the option which is the angle (in radians) between the positive  $y$ -axis and the unit vector

$$\mathbf{e} = \frac{1}{2}\mathbf{i} - \frac{1}{\sqrt{2}}\mathbf{j} - \frac{1}{2}\mathbf{k}.$$

Options

- A  $\frac{1}{6}\pi$     B  $\frac{1}{4}\pi$     C  $\frac{1}{3}\pi$     D  $\frac{1}{2}\pi$   
E  $\frac{2}{3}\pi$     **F**  $\frac{3}{4}\pi$     G  $\frac{5}{6}\pi$     H  $\pi$

$$\frac{\sqrt{\frac{1}{4} + \frac{1}{2} + \frac{1}{4}}}{\sqrt{\frac{1}{4} + \frac{1}{2} + \frac{1}{4}}} = \frac{\sqrt{1}}{\sqrt{1}} = 1$$



## Question 24

If, at a certain point on the Earth's surface, the vector  $\mathbf{a}$  points to the East and the vector  $\mathbf{b}$  points to the South, which of the following options is the direction of the vector  $\mathbf{a} \times \mathbf{b}$ ?

Options

- A North    B South    C East  
D West    **E** Vertically up    **F** Vertically down

