

$$= \frac{-1+6+30}{\sqrt{1+4+36}\sqrt{1+9+25}} \frac{35}{\sqrt{35}\sqrt{41}} = \frac{\sqrt{35}}{\sqrt{41}}$$

$$\therefore \cos^2 A = \frac{35}{41}$$

4. If $\vec{a} = \vec{i} - \vec{j} - \vec{k}$ and $\vec{b} = \lambda\vec{i} - 3\vec{j} + \vec{k}$ and the orthogonal projection of \vec{b} on \vec{a} is $\frac{4}{3}(\vec{i} - \vec{j} - \vec{k})$,

then $\lambda =$

[EAMCET 2007]

- 1) 0 2) 2 3) 12 4) -1

Ans: 2

Sol. Orthogonal projection of \vec{b} on $\vec{a} = \frac{(\vec{b} \cdot \vec{a})\vec{a}}{|\vec{a}|^2}$

$$\left(\frac{\lambda+3-1}{3}\right)(\vec{i}-\vec{j}-\vec{k}) = \frac{4}{3}(\vec{i}-\vec{j}-\vec{k}) \Rightarrow \lambda = 2$$

5. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ and $|\vec{a}| = 3, |\vec{b}| = 4$ and $|\vec{c}| = \sqrt{37}$, then the angle between \vec{a} and \vec{b} is

[EAMCET 2006]

- 1) $\frac{\pi}{4}$ 2) $\frac{\pi}{2}$ 3) $\frac{\pi}{6}$ 4) $\frac{\pi}{3}$

Ans: 4

Sol. $\vec{a} + \vec{b} = -\vec{c}$ Squaring o.b.s

$$|\vec{a}|^2 + |\vec{b}|^2 + 2|\vec{a}||\vec{b}|\cos(\vec{a}, \vec{b}) = |\vec{c}|^2$$

$$9 + 16 + 24\cos(\vec{a}, \vec{b}) = 37$$

$$\cos(\vec{a}, \vec{b}) = \frac{1}{2} \Rightarrow (\vec{a}, \vec{b}) = \frac{\pi}{3}$$

6. $\vec{a} \cdot \vec{k} = \vec{a} \cdot (2\vec{i} + \vec{j}) = \vec{a} \cdot (\vec{i} + \vec{j} + 3\vec{k}) = 1 \Rightarrow \vec{a}$

[EAMCET 2006]

- 1) $\vec{i} - \vec{k}$ 2) $\frac{1}{3}(3\vec{i} + \vec{j} - 3\vec{k})$ 3) $\frac{1}{3}(\vec{i} + \vec{j} + \vec{k})$ 4) $\frac{1}{3}(3\vec{i} - 3\vec{j} + \vec{k})$

Ans: 4

Sol. Let $\vec{a} = a_1\vec{i} + a_2\vec{j} + a_3\vec{k}$

$$\vec{a} \cdot \vec{i} = 1 \Rightarrow a_1 = 1$$

$$\vec{a} \cdot (2\vec{i} + \vec{j}) = 1 \Rightarrow 2a_1 + a_2 = 1 \Rightarrow a_2 = 1 - 2 = -1$$

$$\vec{a} \cdot (\vec{i} + \vec{j} + 3\vec{k}) = 1 \Rightarrow a_1 + a_2 + 3a_3 = 1$$

$$\Rightarrow 3a_3 = 1 \Rightarrow a_3 = \frac{1}{3}$$

$$\therefore \vec{a} = \frac{1}{3}[3\vec{i} - 3\vec{j} + \vec{k}]$$

7. If the vector $\vec{a} = 2\vec{i} + 3\vec{j} + 6\vec{k}$ and \vec{b} are collinear and $|\vec{b}| = 21$, then $\vec{b} =$ **[EAMCET 2005]**

1) $\pm(2\vec{i} + 3\vec{j} + 6\vec{k})$ 2) $\pm 3(2\vec{i} + 3\vec{j} + 6\vec{k})$ 3) $(\vec{i} + \vec{j} + \vec{k})$ 4) $\pm 21(2\vec{i} + 3\vec{j} + 6\vec{k})$

Ans: 2

Sol. $\vec{a} = t(\vec{b})$

$$|\vec{a}| = |t||\vec{b}| \Rightarrow |t| = \frac{7}{21} = \frac{1}{3}$$

$$t = \pm \frac{1}{3} \quad \therefore \vec{b} = \pm 3(\vec{a})$$

8. If the vectors $\vec{i} + 3\vec{j} + 4\vec{k}, \lambda\vec{i} - 4\vec{j} + \vec{k}$ are orthogonal to each other, then $\lambda =$ **[EAMCET 2004]**

1) 5 2) -5 3) 8 4) -8

Ans: 3

Sol. $\vec{a} \cdot \vec{b} = 0 \Rightarrow \lambda - 12 + 4 = 0 \Rightarrow \lambda = 8$

9. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a} = \vec{b} + \vec{c}$ and the angle between \vec{b} and \vec{c} is $\frac{\pi}{2}$: here **[EAMCET 2003]**

$$a = |\vec{a}|, b = |\vec{b}|, c = |\vec{c}|$$

1) $a^2 = b^2 + c^2$ 2) $b^2 = c^2 + a^2$ 3) $c^2 = a^2 + b^2$ 4) $2a^2 - b^2 = c^2$

Ans: 1

Sol. $a^2 = (b + c)^2$

$$a^2 = b^2 + c^2 + 2(b \cdot c)$$

$$\Rightarrow a^2 = b^2 + c^2 (\because (b \cdot c) = \pi/2)$$

10. If $\vec{a} \cdot \vec{i} = \vec{a} \cdot (\vec{i} + \vec{j}) = \vec{a} \cdot (\vec{i} + \vec{j} + \vec{k})$ then $\vec{a} =$ **[EAMCET 2002]**

1) \vec{i} 2) \vec{j} 3) \vec{k} 4) $\vec{i} + \vec{j} + \vec{k}$

Ans: 1

Sol. By verification $\vec{a} = \vec{i}$

11. The orthogonal projection of \vec{a} on \vec{b} is

[EAMCET 2002]

- 1) $\frac{(\vec{a} \cdot \vec{b})\vec{a}}{|\vec{a}|^2}$ 2) $\frac{(\vec{a} \cdot \vec{b})\vec{b}}{|\vec{b}|^2}$ 3) $\frac{\vec{a}}{|\vec{a}|}$ 4) $\frac{\vec{b}}{|\vec{a}|}$

Ans: 2

Sol. $(\vec{a} \cdot \vec{b}) \frac{\vec{b}}{|\vec{b}|^2}$

12. If θ is an acute angle and the vector $(\sin \theta)\vec{i} + (\cos \theta)\vec{j}$ is perpendicular to the vector $\vec{i} - \sqrt{3}\vec{j}$ then $\theta =$

[EAMCET 2000]

- 1) $\frac{\pi}{6}$ 2) $\frac{\pi}{5}$ 3) $\frac{\pi}{4}$ 4) $\frac{\pi}{3}$

Ans: 4

Sol. The given vectors are \perp er then $(\sin \theta \vec{i} + \cos \theta \vec{j}) \cdot (\vec{i} - \sqrt{3}\vec{j}) = 0$

$$\sin \theta - \sqrt{3} \cos \theta = 0 \Rightarrow \tan \theta = \sqrt{3}$$

$$\sin \theta - \sqrt{3} \cos \theta = 0 \Rightarrow \tan \theta = \sqrt{3} \Rightarrow \theta = \frac{\pi}{3}$$

13. If two out of the three vector $\vec{a} + \vec{b} + \vec{c}$ are unit vectors $\vec{a} + \vec{b} + \vec{c} = 0$ and

$$2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{a} \cdot \vec{c}) + 3 = 0, \text{ then the third vector is of length}$$

[EAMCET 2000]

- 1) 3 2) 2 3) 1 4) 0

Ans: 3

Sol. $\vec{a} + \vec{b} + \vec{c} = 0 \Rightarrow (\vec{a} + \vec{b} + \vec{c})^2 = 0$

$$\therefore a^2 + b^2 + c^2 + 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}) = 0$$

$$1 + 1 + c^2 - 3 = 0 \Rightarrow c^2 = 1$$

$$\therefore |\vec{c}| = 1$$

