## DPP – 3

## Vector

**1** Let $\vec{P} = \vec{L} - \alpha\vec{I} = i + 2\hat{j} + 3\hat{k} - \alpha(4\hat{i} + 5\hat{j} + 6\hat{k})$

$\vec{p} = (1 - 4\alpha)\hat{i} + (2 - 5\alpha)\hat{j} + (3 - 6\alpha)\hat{K}$

$\vec{P} \cdot \vec{L} = 0$

$(1 - 4\alpha) + 2(2 - 5\alpha) + 3(3 - 6\alpha) = 0$

$1 - 4\alpha + 4 - 10\alpha + 9 - 18\alpha = 0$

$-32\alpha + 14 = 0$

$32\alpha = 14$

$\alpha = \dfrac{7}{16}$

**2.** $\vec{a} = \hat{i} + \hat{j} + 3\hat{k}$

$\vec{b} = \hat{i} + \hat{j}$

$\hat{i} + \hat{j} \rightarrow$ component of $\vec{a}$ along $\vec{b}$

$3\hat{k} \rightarrow$ Component of $\vec{a} \perp$ to $\vec{b}$

**3.** (a) $\vec{r} = \vec{a} - \vec{b} + \vec{c}$

$\vec{a} = 5\hat{i} + 4\hat{j} - 6\hat{k}$

$\vec{b} = -2\hat{i} + 2\hat{j} + 3\hat{k}$

$\vec{c} = 4\hat{i} + 3\hat{j} + 2\hat{k}$

$\vec{r} = (5i + 4j - 6\hat{k}) - (-2\hat{i} + 2\hat{j} + 3k) + (4\hat{i} + 3\hat{j} + 2\hat{k})$

$\vec{r} = 11\hat{i} + 5\hat{j} - 7\hat{k}$

(b) $\cos\ Y = \frac{r_z}{r} = \frac{-7}{\sqrt{11^2+5^2+(-7)^2}} = \frac{-7}{\sqrt{195}}$

$Y = \cos^{-1}\left(\frac{-7}{\sqrt{195}}\right)$

(c) $a = \sqrt{5^2 + 4^2 + (-6)^2} = \sqrt{25 + 16 + 36} = \sqrt{77}$

$b = \sqrt{4 + 4 + 9} = \sqrt{17}$

$\vec{a} \cdot \vec{b} = -10 + 8 - 18 = -20$

$\vec{a} \cdot \vec{b} = abcos$

$-20 = \sqrt{77} \cdot \sqrt{17}\cos\ \theta$

$\cos\ \theta = \frac{-20}{\sqrt{1305}}$ $\theta = \cos^{-1}\left(\frac{-20}{\sqrt{1309}}\right)$

**4.** $\vec{v} = 2\hat{i} + 3\hat{j} - 4\hat{k}$ and $\vec{a} = -\hat{i} + 2\hat{j} + k$

$\vec{v} \cdot \vec{a} = v\,a\cos\ \theta$

$-2+6-4 = \mathrm{v\,a\cos\,\theta}$

$\cos\,\theta = 0\ \theta = 90^\circ$

$\theta = \frac{\pi}{2} = \frac{n\pi}{4}\ n = 2$

**5.** $\vec{A} = \hat{\imath} + \hat{\jmath} - 2\hat{k}$

$\vec{B} = \hat{\imath} - \hat{\jmath} + \hat{k}$

$\vec{C} = 2\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$

$(\alpha\vec{A} + \beta\vec{B}) \perp \vec{C}$

$(\alpha\hat{\imath} + \alpha\hat{\jmath} - 2\alpha k) + (\beta\hat{\imath} - \beta\hat{\jmath} + \beta\hat{k}) = \alpha\vec{A} + \beta\vec{B}$

$\alpha\vec{A} + \beta\vec{B} = (\alpha+\beta)\hat{\imath} + (\alpha-\beta)\hat{\jmath} + (\beta - 2\alpha)\hat{k}$

$(\alpha\vec{A} + \beta\vec{B}) \cdot \vec{C} = 0$

$2(\alpha+\beta) - 3(\alpha-\beta) + 4(\beta-2\alpha) = 0$

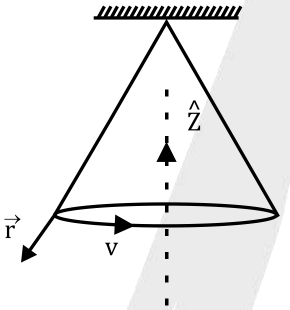
$2\alpha + 2\beta - 3\alpha + 3\beta + 4\beta - 8\alpha = 0$

$-9\alpha + 9\beta = 0$

$9\alpha = 9\beta$

$\frac{\alpha}{\beta} = 1:1$

**6.** $\vec{r} \cdot \vec{z}$ is always zero this is the




**7.** $\vec{A} = 2x\hat{L} + x\hat{y} + \sqrt{2}x\hat{k}$

$\cos\,\beta = \frac{x}{\sqrt{4x^2 + x^2 + 2x^2}} = \frac{x}{\sqrt{7x^2}} = \frac{1}{\sqrt{7}}$

$\beta = \cos^{-1}\left(\frac{1}{\sqrt{7}}\right)$

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**8.** $\vec{A} = 2\hat{\imath} + 3\hat{\jmath} - \hat{k}\ \vec{B} = 3\hat{\imath} - 2\hat{\jmath} - 2\hat{k}\ \&\ \vec{C} = p\hat{\imath} + p\hat{\jmath} + 2p\hat{k}$

$\vec{A} - \vec{B} = -\hat{\imath} + 5\hat{\jmath} + \hat{k}$

$(\vec{A} - \vec{B}) \cdot \vec{C} = |\vec{A} - \vec{B}| \cdot |c|\cos\,\theta$

$-P + 5p + 2p = \sqrt{1 + 2s + 1} \cdot \sqrt{p^2 + p^2 + 4p^2}\cos\,\theta$

$6p = 3\sqrt{3} \cdot p\sqrt{6}\cos\ \theta$

$\cos\ \theta = \frac{\sqrt{2}}{3}$

$\theta = \cos^{-1}\left(\frac{\sqrt{2}}{3}\right)$

**9.** $\vec{r} \cdot \vec{a} = ra\cos\ \theta$

$r\cos\ \theta = \frac{(\vec{r}\cdot\vec{a})}{a} \cdot \hat{a} = \frac{(\vec{r}\cdot\vec{a})\vec{a}}{a^2}$

**10.** Unit vector: Magnitude is one & giver disin.

statement -1→ false

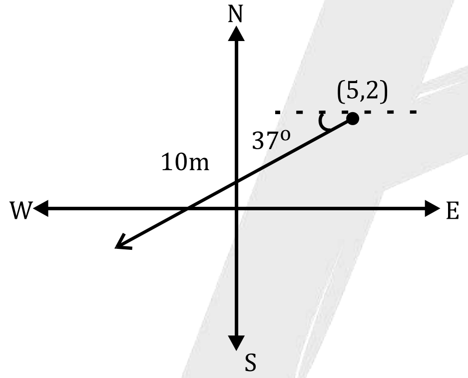
Statement-2 true

**11.** $\vec{r_1} = 5i + 2j$

$[-10\cos\ 37i, -10\sin\ 37j]$

final position $= (5 - 10\cos\ 37)i, (9 - 10\sin\ 37\hat{j})$

$= (-3i, -4\hat{j})$




**12.** $\vec{S} = -\hat{k} + 50\hat{i} - 25j - 9\hat{k}$

$\bar{S} = 50\hat{i} - 25\hat{j} - 10k$