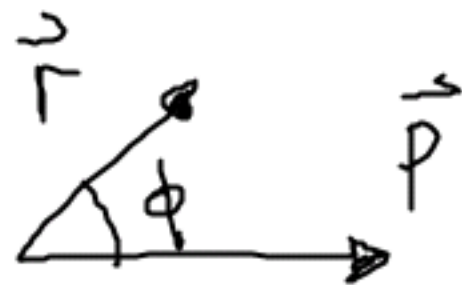


1-

a)

$$\vec{L} = \vec{r} \times \vec{p}$$



$$L = m r v \text{ Sen } \phi$$



Si $m=0$

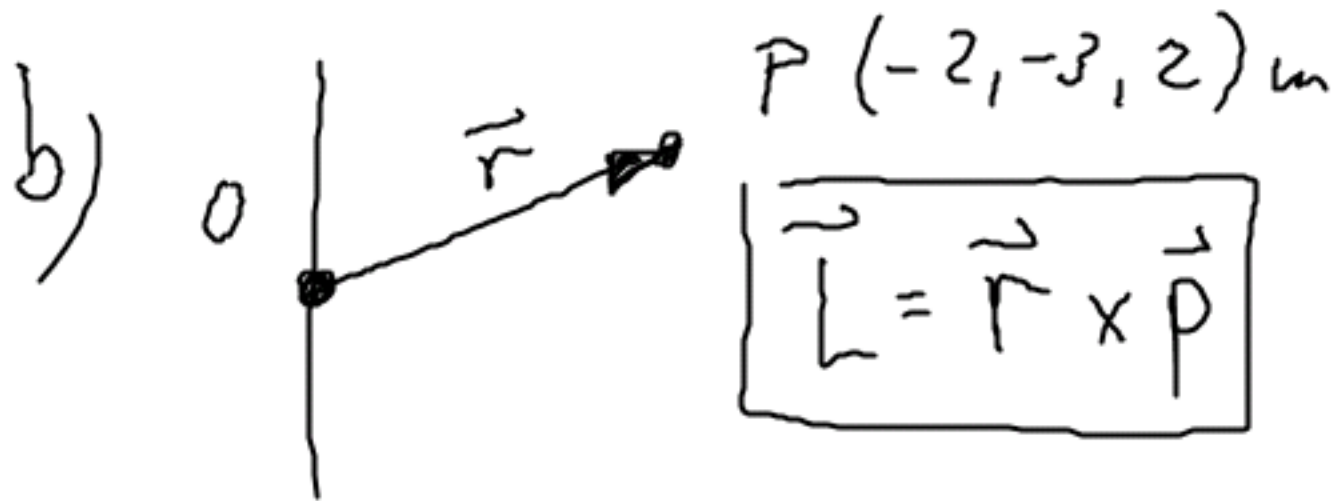
Si $r=0$

Si $v=0$

Si $\text{Sen } \phi = 0$

$\phi = 0$ $\vec{r} \parallel \vec{p}$

$\phi = 180$ antip.



$$\vec{p} = m \vec{v} = 173'2 \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \text{ kg} \cdot \text{m/s}$$

$$\vec{r} = \vec{OP} = P - O = (-2, -3, 2) \text{ m}$$

$$\vec{v} \left\{ \begin{array}{l} v = 25 \text{ m/s} \\ \hat{i} + \hat{j} + \hat{k} = (1, 1, 1) \\ \hat{u}_v = \frac{1}{\sqrt{3}} (1, 1, 1) \end{array} \right.$$

$$\vec{v} = v \hat{u}_v = \left(16'6, 16'6, 16'6 \right) \text{ m/s}$$

$$\vec{L} = \vec{r} \times \vec{p} = m \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ r_x & r_y & r_z \\ v_x & v_y & v_z \end{vmatrix}$$

$$\vec{L} = 1732 \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -2 & -3 & 2 \\ 1 & 1 & 1 \end{vmatrix} = (-866, 692.8, 1732)$$

$\text{Kg} \cdot \text{m}^2 / \text{s}$

$$L = 1122.5 \text{ Kg} \cdot \text{m}^2 / \text{s}$$

$$\textcircled{2-} \quad a) \quad \vec{R} = \sum_{i=1}^4 \vec{F}_i = (-5, 3, 1) \text{ N}$$

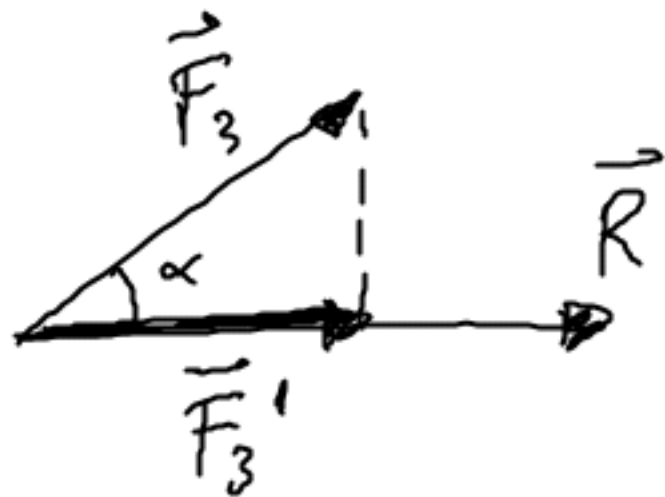
$$\underline{F_2 = 3,74 \text{ N}}$$

$$R = 5,92 \text{ N}$$

$$\cos \alpha = \frac{\vec{R} \cdot \vec{F}_2}{R F_2} = -0,9$$

$$\underline{\alpha = 154,62^\circ}$$

b)



$$\vec{F}_3' = F_3 \cdot \hat{u}_R$$

$$\vec{F}_3' = \underline{\underline{(-3.86, 2.31, 0.77) \text{ N}}}$$

$$\hat{u}_R = \frac{\vec{R}}{R} = \frac{1}{\sqrt{35}} (-5, 3, 1)$$

$$F_3' = F_3 \cos \alpha = \cancel{F_3} \cdot \frac{\vec{R} \cdot \vec{F}_3}{\cancel{R} \cancel{F_3}} = \underline{\underline{4.56 \text{ N}}}$$

3-

$m = 30 \text{ kg}$

$$a) \quad \vec{r}(t) = (6t - 2, 3t^3 - 4t, -2t^2 - 1) \text{ m}$$

$$\vec{v}(t) = \frac{d\vec{r}}{dt} = (6, 9t^2 - 4, -4t) \text{ m/s}$$

$$\vec{a}(t) = \frac{d\vec{v}}{dt} = (0, 18t, -4) \text{ m/s}^2$$

$$\vec{p} = m\vec{v} = (180, 270t^2 - 120, -120t) \text{ kg} \cdot \text{m/s}$$

$$\vec{F} = \frac{d\vec{p}}{dt} = (0, 540t, -120) \text{ N}$$

$$b) \quad W = \int \vec{F} \cdot d\vec{r} = \int_3^5 \vec{F} \cdot \vec{v} \cdot dt =$$

$$\vec{F}(t) = (0, +540t, -120) \text{ N}$$

$$\boxed{\frac{d\vec{r}}{dt} = \vec{v}} \rightarrow d\vec{r} = \vec{v} dt$$

$$\vec{v}(t) = (6, 9t^2 - 4, -4t) \text{ m/s}$$

$$= \int_3^5 (4860t^3 - 1680t) dt$$

$$= \left. \frac{4860}{4} t^4 - \frac{1680}{2} t^2 \right|_3^5$$

$$= \boxed{6,48 \cdot 10^5 \text{ J}}$$

$$b) [W] = M L^2 T^{-2}$$