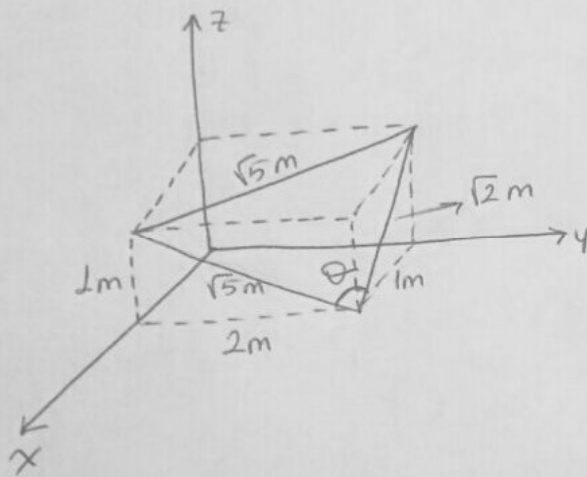
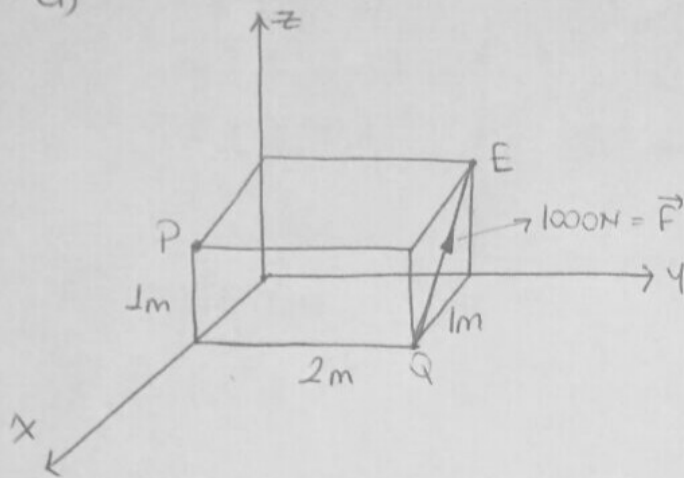


① a)



$$c^2 = a^2 + b^2 - 2ab \cos \theta$$

$$(\sqrt{5})^2 = (\sqrt{5})^2 + (\sqrt{2})^2 - 2 \cdot \sqrt{5} \cdot \sqrt{2} \cos \theta$$

$$5 = 5 + 2 - 2\sqrt{10} \cos \theta$$

$$2\sqrt{10} \cos \theta = 2$$

$$\cos \theta = \frac{1}{\sqrt{10}}$$

$$\theta = 71,56^\circ$$

$$\begin{aligned} \|\tau\| &= \|\vec{F}\| \cdot \|d\| \cdot \sin \theta \\ &= (1000 \text{ N}) (\sqrt{5} \text{ m}) (\sin 71,56^\circ) \\ &= 2121 \text{ Nm} \end{aligned}$$

$$\begin{array}{l} \textcircled{1} \text{ b) } P(1, 0, 1) \\ \quad Q(1, 2, 0) \\ \quad E(0, 2, 1) \end{array} \left. \vphantom{\begin{array}{l} P \\ Q \\ E \end{array}} \right\} \begin{array}{l} \overrightarrow{QP} = (1, 0, 1) - (1, 2, 0) \\ \quad = (0, -2, 1) \\ \overrightarrow{QE} = (0, 2, 1) - (1, 2, 0) \\ \quad = (-1, 0, 1) \end{array}$$

$$\overrightarrow{F} = (-1, 0, 1)$$

$$\overrightarrow{D} = (0, -2, 1)$$

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & -2 & 1 \\ -1 & 0 & 1 \end{vmatrix} = \hat{i} \begin{vmatrix} -2 & 1 \\ 0 & 1 \end{vmatrix} - \hat{j} \begin{vmatrix} 0 & 1 \\ -1 & 1 \end{vmatrix} + \hat{k} \begin{vmatrix} 0 & -2 \\ -1 & 0 \end{vmatrix}$$

$$= 2\hat{i} + \hat{j} + 2\hat{k}$$

$$(\cos \theta)_x = \frac{(1, 0, 0) \cdot (2, 1, 2)}{\sqrt{2^2 + 1^2 + 2^2}} = \frac{2}{3} \quad \theta_x = 48,19$$

$$(180 - \theta_x) = 132$$

$$(\cos \theta)_y = \frac{(0, 1, 0) \cdot (2, 1, 2)}{\sqrt{2^2 + 1^2 + 2^2}} = \frac{1}{3} \quad \theta_y = 70,5$$

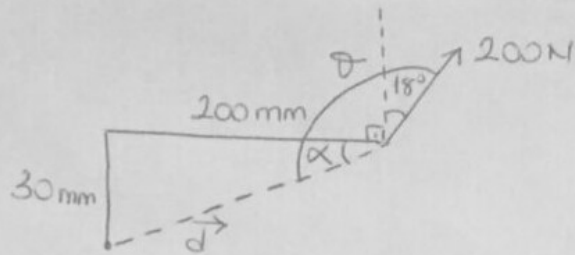
$$(180 - \theta_y) = 109$$

$$(\cos \theta)_z = \frac{(0, 0, 1) \cdot (2, 1, 2)}{\sqrt{2^2 + 1^2 + 2^2}} = \frac{2}{3} \quad \theta_z = 48,19$$

$$(180 - \theta_z) = 132$$

$$(132, 109, 132)$$

②



$$200 \text{ mm} = 0,2 \text{ m}$$

$$30 \text{ mm} = 0,03 \text{ m}$$

$$\tan \alpha = \frac{0,03}{0,2} = \frac{3}{20}$$

$$\arctan \frac{3}{20} = \alpha$$

$$\alpha = 8,5$$

$$\theta = 18^\circ + 90^\circ + 8,5^\circ = 116,5^\circ \quad d = \sqrt{(0,2)^2 + (0,03)^2}$$

$$= 0,20$$

$$\|T\| = \|\vec{F}\| \cdot \|d\| \sin \theta$$

$$= (200 \text{ N}) \cdot (0,20 \text{ m}) \cdot (\sin 116,5^\circ)$$

$$= 35,79 \text{ Nm}$$