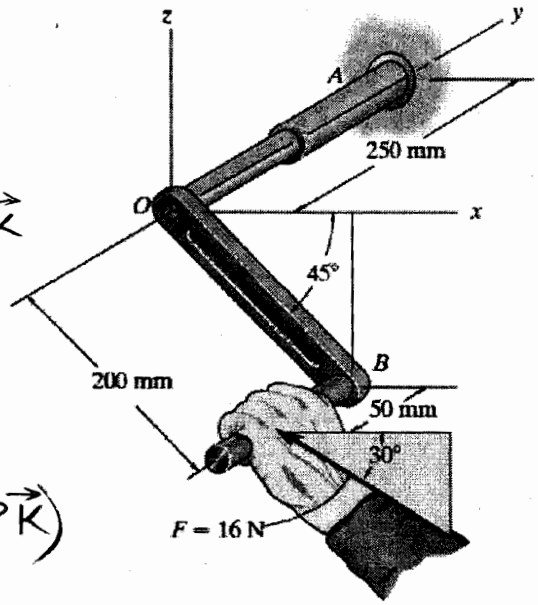
King Fahd University of Petroleum & Minerals
CIVIL ENGINEERING DEPARTMENT

CE 201 STATICS (Sections 1 & 2)

Second Semester 1432 / 2011 (102)

Name: Key ID #: _____	**Quiz # 4**	Score ___/10

Determine the magnitude of the moment that the force **F** exerts about the *y* axis of the shaft. Solve the problem using a Cartesian vector approach and using a scalar approach.



Cartesian Vector Approach

Position vector,

$$\vec{r}_{OB} = 0.2\cos 45^\circ \vec{i} + 0\vec{j} - 0.2\sin 45^\circ \vec{k}$$

$$= 0.1414\vec{i} - 0.1414\vec{k}$$

Force vector,

$$\vec{F} = 16(-\cos 30^\circ \vec{i} + 0\vec{j} + \sin 30^\circ \vec{k})$$

$$= -13.8560\vec{i} + 8\vec{k}$$

Unit vector along y-axis, $\vec{u}_y = 0\vec{i} + \vec{j} + 0\vec{k} = \vec{j}$

Moment about y-axis, $M_y = \vec{u}_y \cdot (\vec{r}_{OB} \times \vec{F})$

$$M_y = \begin{vmatrix} 0 & 1 & 0 \\ 0.1414 & 0 & -0.1414 \\ -13.8560 & 0 & 8 \end{vmatrix} = -1(0.1414\times 8 - 13.8560\times 0.1414)$$

$$\Rightarrow \boxed{M_y = 0.828\ \text{N.m}}$$

Scaler Approach:

$$M_y = \pm F_x \times (z) \pm F_z \times (x)$$

$$M_y = +16\cos 30^\circ \times (0.2\sin 45^\circ) - 16\sin 30^\circ \times (0.2\cos 45^\circ)$$

$$= 1.9595 - 1.1314$$

$$\Rightarrow \boxed{M_y = 0.828\ \text{Nm}}$$, as before

Note: Take care of the signs by inspection ↻ $+y$ = +ve ; ↺ $+y$ = -ve