

# EGM 3420C - Engineering Mechanics

## Statics Review 1 Problems

### Problem 6

The boom  $ABC$  is subjected to a force  $F = 8 \text{ kN}$  downward at  $C$  and is supported by a ball and socket at  $A$  and the cables  $BD$  and  $BE$ .

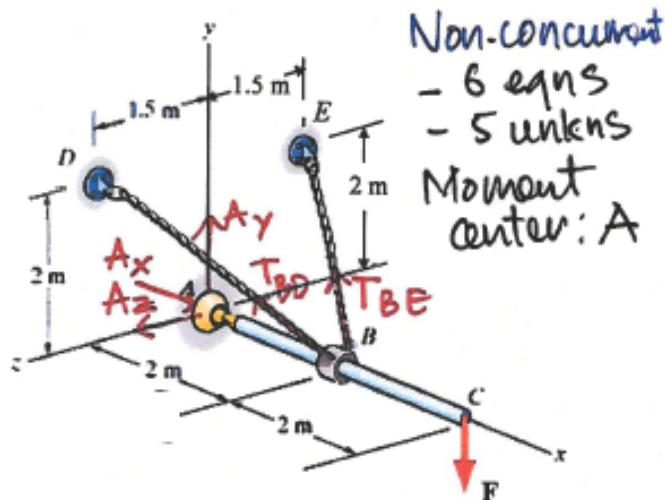
Determine the tension in the cables and the reactions at  $A$ .

$$B(2,0,0) \quad C(4,0,0)$$

$$D(0,2,1.5) \quad E(0,2,-1.5)$$

$$\hat{u}_{BD} = \frac{[-2 \quad 2 \quad 1.5]}{\sqrt{3.202}} = [-.624 \quad .624 \quad .469]$$

$$\hat{u}_{BE} = \frac{[-2 \quad 2 \quad -1.5]}{\sqrt{3.202}} = [-.624 \quad .624 \quad -.469]$$



Forces, moment rxns	$\vec{r}_A$	$\vec{F}$	Moments, $\vec{r} \times \vec{F}$
rxns@A	$[0 \quad 0 \quad 0]$	$[A_x \quad A_y \quad A_z]$	$[0 \quad 0 \quad 0]$
$F = 8 \text{ kN}$	$[4 \quad 0 \quad 0]$	$[0 \quad -8 \quad 0]$	$[0 \quad 0 \quad -32]$
$T_{BD}$	$[2 \quad 0 \quad 0]$	$[-.624 \quad .624 \quad .469] T_{BD}$	$[0 \quad -.938 \quad 1.248] T_{BD}$
$T_{BE}$	$[2 \quad 0 \quad 0]$	$[-.624 \quad .624 \quad -.469] T_{BE}$	$[0 \quad .938 \quad 1.248] T_{BE}$

$$\sum M_y = 0 = -938T_{BD} + .938T_{BE} \Rightarrow T_{BD} = T_{BE} \quad \left\{ \begin{array}{l} T_{BD} = T_{BE} \\ T_{BD} = 12.82 \text{ kN} \end{array} \right.$$

$$\sum M_z = 0 = -32 + 1.248T_{BD} + 1.248T_{BE}$$

$$\sum F_x = 0 \Rightarrow A_x = +.624(T_{BD} + T_{BE}) \Rightarrow A_x = 16.00 \text{ kN}$$

$$\sum F_y = 0 \Rightarrow A_y = 8 - .624(T_{BD} + T_{BE}) \Rightarrow A_y = -8.00 \text{ kN}$$

$$\sum F_z = 0 \Rightarrow A_z = -.469T_{BD} + .469T_{BE} \Rightarrow A_z = 0$$

**ANSWER:**

$$T_{BD} = T_{BE} = 12.82 \text{ kN}; A = [16.00 \quad -8.00 \quad 0] \text{ kN}$$