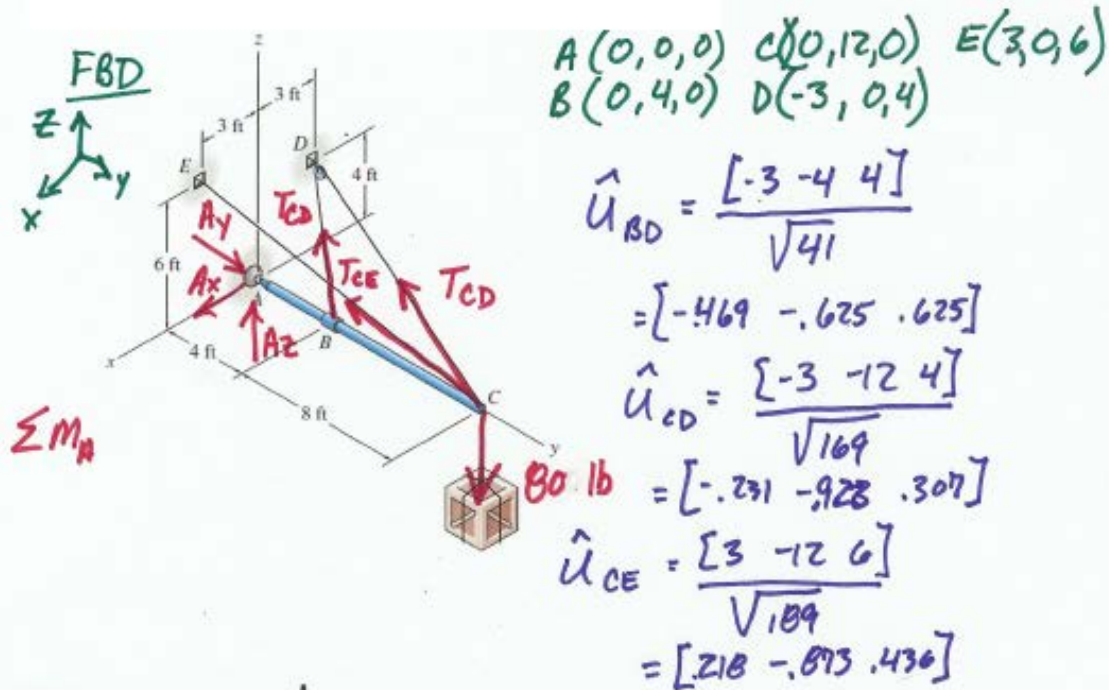


### 3D Equilibrium II Problem 2

The boom AC is supported by a ball-and-socket joint and the two cables BCD and CE. Cable BDC is continuous and passes over a pulley at D. Calculate the tension in the cables and the reactions at A if the crate has a weight of 80 lbs.



FORCES MOMENT REACTIONS	$\vec{r}_{AF}$	$\vec{F}$	MOMENTS & $\vec{r} \times \vec{F}$
$\vec{A}$	$[0 \ 0 \ 0]$	$[A_x \ A_y \ A_z]$	$[0 \ 0 \ 0]$
$\vec{F}_{CE}$	$[0 \ 12 \ 0]$	$[.218 \ -.873 \ .436] F_{CE}$	$[5.232 \ 0 \ -2.616] F_{CE}$
$\vec{F}_{BD}$	$[0 \ 4 \ 0]$	$[-.469 \ -.625 \ .625] F_{BD}$	$[2.5 \ 0 \ 1.876] F_{BD}$
$\vec{F}_{CD}$	$[0 \ 12 \ 0]$	$[-.231 \ -.928 \ .307] F_{CD}$	$[3.684 \ 0 \ 2.772] F_{CD}$
80	$[0 \ 12 \ 0]$	$[0 \ 0 \ -80]$	$[-960 \ 0 \ 0]$

RECOGNIZE  $|\vec{F}_{BD}| = |\vec{F}_{CD}|$

$$\sum M_x = 0 \Rightarrow 0 + 5.232 F_{CE} + 2.5 F_{BD} + 3.684 F_{CD} - 960 = 0$$

$$5.232 F_{CE} + 6.184 F_{BD} = 960 \quad (1)$$

$$\sum M_z = 0 \Rightarrow 0 - 2.616 F_{CE} + 1.876 F_{BD} + 2.772 F_{CD} = 0$$

$$-2.616 F_{CE} + 4.648 F_{BD} = 0 \quad (2)$$

SOLVE 1 & 2  $|\vec{F}_{BD}| = |\vec{F}_{CD}| = 62.0 \text{ lb}$ ,  $|\vec{F}_{CE}| = 110 \text{ lb}$

$$\sum \vec{F} = 0 \Rightarrow \vec{A} = [19.37 \ 192 \ -25.8] \text{ lb}$$