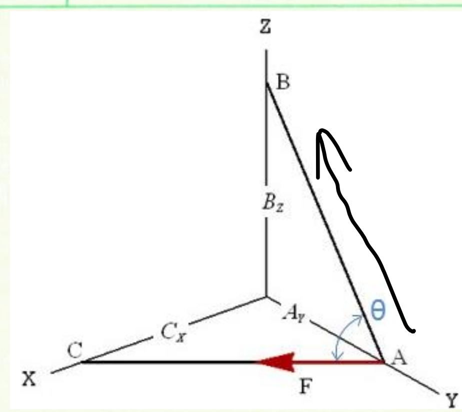
5/5/21 ME 201 HD 2.3 Seth Hoffman

1. Given:



$F = 259\ N$

$A_y = 7\ m \quad C_x = 15\ m$

$B_z = 12\ m$

Find:

θ

Solution:

$A = (0, -7, 12)$

$\cos\theta = \dfrac{\vec{A} \cdot \vec{F}}{|A|\,|F|}$

$F = (15, -7, 0)$

$$\frac{\langle 0, -7, 12 \rangle \cdot \langle 15, -7, 0 \rangle}{\left|\sqrt{-7^2 + 12^2}\right| \sqrt{15^2 + -7^2}}$$

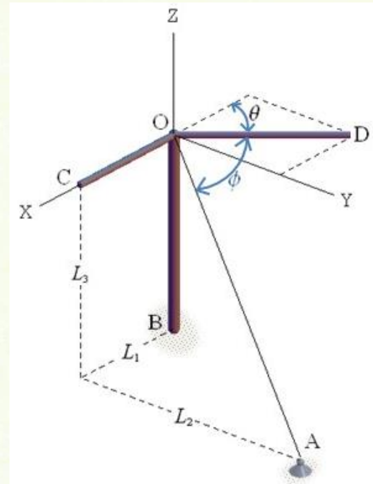
A

$\cos^{-1}\left(\dfrac{49}{202}\right) = 77.7^\circ = \theta \leftarrow \theta$

2. Given: $L_1 = 16\text{ ft}$

$L_2 = 10\text{ ft}$ $L_3 = 14\text{ ft}$

$\theta = 65^\circ$



Find:

ϕ

Solution:

To start things off, we do not have a length for OD, but we can come up with our own imaginary length of the components of OD because the angle will always be the same regardless of the components. Just as long as the angle is maintainted

$\tan\theta = \frac{o}{a}$ $a = 1\text{ ft}\ (OD_x)$

$a\tan\theta = o$ $1\tan 65 = 2.1445\text{ ft}$

$A = \langle 16, 10, -14 \rangle$

$D = \langle -1, 2.14, 0 \rangle$

$$\theta = \cos^{-1}\left(\frac{\vec{A}\cdot\vec{D}}{|A|\cdot|D|}\right) = \frac{16(-1) + (10\cdot 2.14) + -14(0)}{\sqrt{16^2+10^2+-14^2}\sqrt{-1^2+2.14^2}}$$

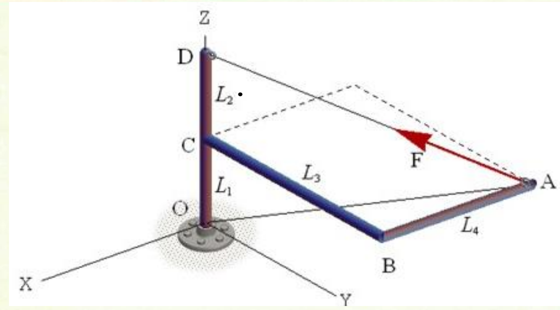
$\phi = 84.37^\circ \longleftarrow \phi$

3. Given: $L_1 = 1m$

$F_{AD} = 125N$ $\quad L_2 = 2m$

$L_3 = 4m$

$L_4 = 2m$



Find:

F_{AD}

Solution:

$$A = (-2, 4, 1)$$

$$\vec{F}_{AD} = (F_{AD} \vec{U}_{AD}) U_{AD} \quad D = (0, 0, 3) = \langle 2, -4, 2 \rangle$$

$$U_{AD} = \frac{\vec{r}_{AD}}{r_{AD}} = \frac{\langle 2, -4, 2 \rangle}{\sqrt{2^2 + -4^2 + 2^2}} = \langle .408, -.817, .408 \rangle$$

$$U_{AD} = \frac{\vec{r}_{AD}}{r_{AD}} = \frac{\langle 2, -4, -1 \rangle}{\sqrt{2^2 + 4^2 + -1^2}} = \langle .436, -.872, -.218 \rangle$$

$$\vec{F}_{AD} = \langle 51.03, -102.06, 51.03 \rangle =$$