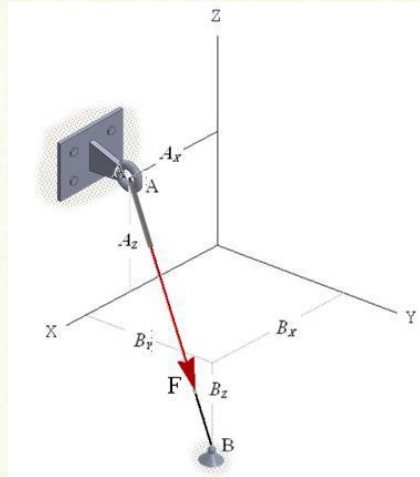
1. Given:



$A_x = 3$ ft
$A_z = 1$ ft
$B_x = 4$ ft
$B_y = 5$ ft
$B_z = 2$ ft

F = 500 lbs

find:

$\bar{F}$

Solution:

$A = (3,0,1) \quad B = (4,5,-2)$

$\vec{r}_{AB} = (4-3)\hat{i} + (5-0)\hat{j} + (-2-1)\hat{k} = 1\hat{i} + 5\hat{j} - 3\hat{k}$

$r_{AB} = \sqrt{1^2 + 5^2 + -3^2} = 5.916\text{ ft.}$

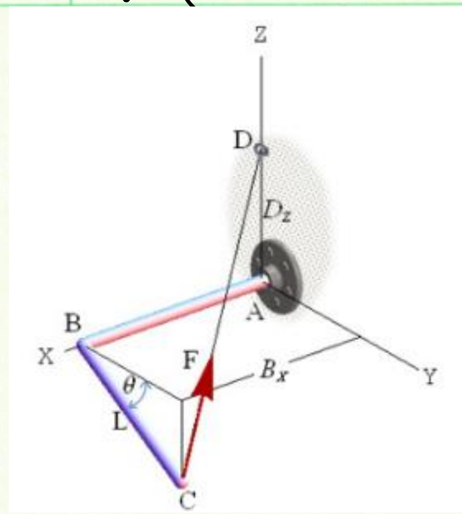
$\bar{U}_{AB} = \frac{1}{5.9}\hat{i} + \frac{5}{5.9}\hat{j} - \frac{3}{5.9}\hat{k} = .169\hat{i} + .846\hat{j} - .507\hat{k}$

$\bar{F} = F \cdot \bar{U}_{AB} = 500\langle .169, .845, -.507\rangle$

$\underline{\bar{F} = \langle 84.52, 422.58, -253.55\rangle \text{ lbs}} \leftarrow \bar{F}$

2. Given:

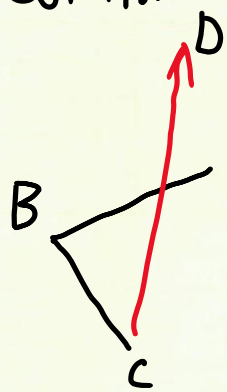
L = 20 m
B_x = 20 m
D_z = 16 m
Θ = 20°
F = 110 N



Find:

$\vec{F}$

Solution:



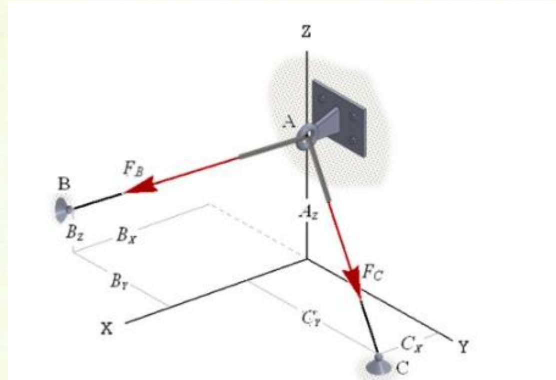
$$-20\sin(20) = C_z$$
$$20\cos(20) = C_y$$
$$20 = C_x$$

$$C = (20, 18.794, -6.84)$$
$$D = (0, 0, 16)$$
$$\vec{r}_{CD} = (-20, -18.794, 22.84)$$
$$r_{CD} = \sqrt{-20^2 + -18.794^2 + 22.84^2} = 35.7\text{ m}$$
$$\bar{U}_{CD} = \frac{-20}{35.7}\hat{i} - \frac{18.794}{35.7}\hat{j} + \frac{22.84}{35.7}\hat{k} = \langle -.56, -.526, .64 \rangle$$

$\bar{F} = F \cdot \bar{U}_{CD} = \langle -61.62, -57.9, 70.36 \rangle$ ← $\bar{F}$

3. Given:

$A_z = 5$ ft
$B_x = 4$ ft
$B_y = -2$ ft
$B_z = 3$ ft
$C_x = 2$ ft
$C_y = 5$ ft
$F_B = 750$ lbs
$F_C = 500$ lbs



Find:

$F_R, \alpha, \beta, \gamma$

Solution:

$A = (0,0,5)$ $B = (4,-2,3)$ $C = (2,5,0)$

$\vec{r}_{AB} = (4,-2,-2)$ $r_{AB} = \sqrt{4^2 + -2^2 + 2^2} = 4.899$ ft.

$U_{AB} = \frac{4}{4.89}\hat{i} - \frac{2}{4.89}\hat{j} + \frac{2}{4.89}\hat{k} = \langle .816, -.408, .408 \rangle$

$\bar{F}_{AB} = F_{AB} \cdot U_{AB} = \langle 612.37, -306.19, 306.19 \rangle$ lbs

$\vec{r}_{AC} = (2,5,-5)$ $r_{AC} = 7.348$ ft.

$U_{AC} = \frac{2}{7.35}\hat{i} + \frac{5}{7.35}\hat{j} - \frac{5}{7.35}\hat{k} = \langle .272, .68, -.68 \rangle$

$\bar{F}_{AC} = F_{AC} \cdot U_{AC} = \langle 136.08, 340.21, -340.21 \rangle$ lbs

$$\bar{F}_R = \tilde{F}_{AB} + \tilde{F}_{AC} = \langle 748.45, 34.02, -34.02 \rangle \text{ lbs}$$

$$F_R = \sqrt{748.45^2 + 34.02^2 + 34.02^2} = 750 \text{ lbs}$$

$$\alpha = \cos^{-1}\left(\frac{748.45}{750}\right) = 3.60^\circ$$

$$\beta = \cos^{-1}\left(\frac{34.02}{750}\right) = 87.4^\circ$$

$$\gamma = \cos^{-1}\left(\frac{-34.02}{750}\right) = 92.6^\circ$$