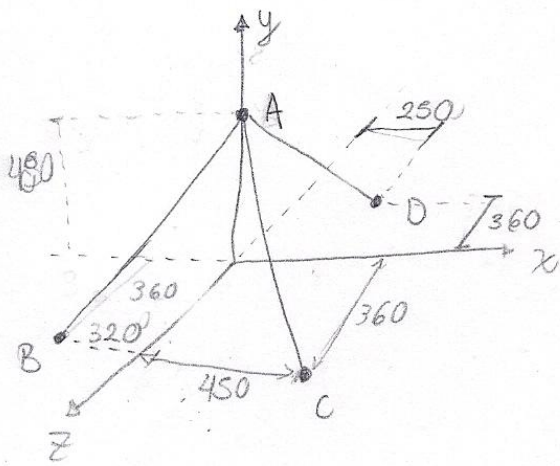


Problema 2.109.



$$T_{AC} = 60 \text{ N}$$

$$A = (0, 480, 0)$$

$$B = (-320, 0, 360)$$

$$D = (250, 0, -360)$$

$$C = (450, 0, 360)$$

$$\vec{AB} = (-320, 0, 360) - (0, 480, 0)$$

$$\vec{AB} = (-320, -480, 360)$$

$$\|\vec{AB}\| = \sqrt{(-320)^2 + (-480)^2 + (360)^2} = 680$$

$$\hat{u}_{AB} = (-320, -480, 360) \frac{1}{680}$$

$$\vec{T}_{AB} = T_{AB} (-0.471, -0.706, 0.530)$$

$$\vec{AC} = (450, -480, 360)$$

$$\|\vec{AC}\| = \sqrt{450^2 + 480^2 + 360^2} = 750$$

$$\vec{T}_{AC} = 60 (450, -480, 360) \frac{1}{750}$$

$$\vec{T}_{AC} = (36, -38.4, 28.8)$$

$$\vec{AD} = (250, -480, -360)$$

$$\|\vec{AD}\| = \sqrt{250^2 + 480^2 + 360^2} = 650$$

$$\hat{u}_{AD} = (250, -480, -360) \frac{1}{650}$$

$$\vec{T}_{AD} = T_{AD} (0.385, -0.739, -0.554)$$

Si el sistema está en equilibrio.

$$\sum \tau_x = 0 \quad -0.471 T_{AB} + 0.385 T_{AD} + 36 + 0 = 0 \quad \dots \text{ec. 1}$$

$$\sum \tau_y = 0 \quad -0.706 T_{AB} - 0.739 T_{AD} - 38.4 + P = 0 \quad \dots \text{ec. 2}$$

$$\sum \tau_z = 0 \quad 0.530 T_{AB} - 0.554 T_{AD} + 28.8 + 0 = 0 \quad \dots \text{ec. 3}$$

$$T_{AB} \quad T_{AD} \quad P$$

$$-0.471 + 0.385 + 0 = -36$$

$$-0.706 - 0.739 + 1 = 38.4$$

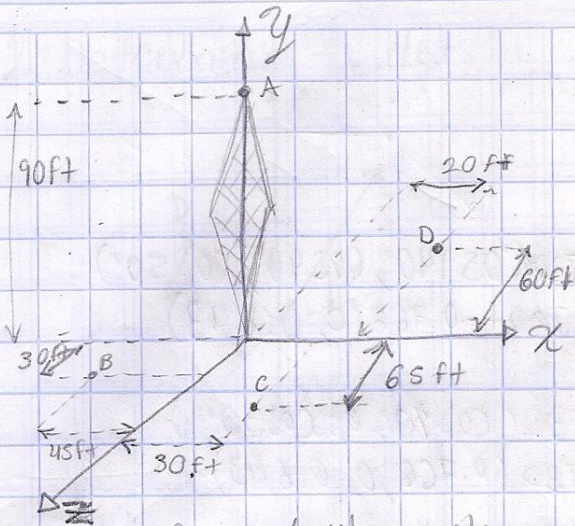
$$0.530 - 0.554 + 0 = 28.8$$

$$T_{AB} = 845.780 \text{ N}$$

$$T_{AD} = 573.342 \text{ N}$$

$$P = 846.565 \text{ N}$$

Problem 2.111



$$TAB = 630 \text{ lb}$$

$$A = (0, 90, 0)$$

$$B = (-45, 0, 30)$$

$$C = (30, 0, 65)$$

$$D = (20, 0, -60)$$

$$AB = (-45, -90, 30)$$

$$\|AB\| = \sqrt{(-45)^2 + (-90)^2 + (30)^2} = 105$$

$$TAB = 630 \left(\frac{-45, -90, 30}{105} \right)$$

$$* TAB = (-270, -540, 180)$$

Como el sistema esta en equilibrio

$$\sum F_x = 0 \quad \left(\frac{2}{11}\right)TAD + \left(\frac{30}{115}\right)TAC + 0 = 270$$

$$\sum F_y = 0 \quad -\left(\frac{9}{11}\right)TAD - \left(\frac{90}{115}\right)TAC + P = 540$$

$$\sum F_z = 0 \quad -\left(\frac{6}{11}\right)TAD + \left(\frac{65}{115}\right)TAC + 0 = -180$$

$$AC = (30, -90, 65)$$

$$\|AC\| = \sqrt{(30)^2 + (-90)^2 + (65)^2} = 115$$

$$TAC = TAC \left(\frac{30, -90, 65}{115} \right)$$

$$* TAC = TAC \left(\frac{30}{115}, -\frac{90}{115}, \frac{65}{115} \right)$$

TAD	TAC	P	TAB
$\frac{2}{11}$	$+\frac{30}{115}$	$+0$	$= 270$
$-\frac{9}{11}$	$-\frac{90}{115}$	$+P$	$= 540$
$-\frac{6}{11}$	$+\frac{65}{115}$	$+0$	$= -180$

$$AD = (20, -90, -60)$$

$$\|AD\| = \sqrt{(20)^2 + (-90)^2 + (-60)^2} = 110$$

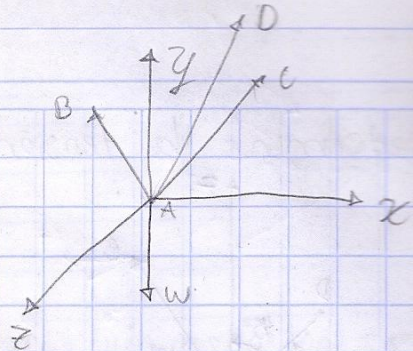
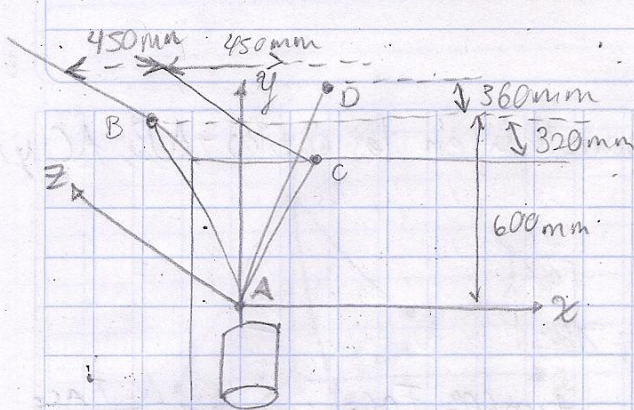
$$* TAD = TAD \left(\frac{20}{110}, -\frac{90}{110}, -\frac{60}{110} \right)$$

$$P = 1572.100 \text{ lb}$$

$$TAC = 467.420 \text{ lb}$$

$$TAD = 822.581 \text{ lb}$$

Problema 2.99.



$$\vec{T}_{AB} = 6 \text{ kN}$$

$$\vec{AB} = (-450, -600, 0) - (0, 0, 0)$$

$$\|\vec{AB}\| = \sqrt{(-450)^2 + (-600)^2} = 750$$

$$\vec{T}_{AB} = 6 \text{ kN} \frac{(-450, -600, 0)}{750}$$

$$= (-3.6, -4.8, 0)$$

$$\vec{AC} = (0, 600, -320)$$

$$\|\vec{AC}\| = \sqrt{600^2 + 320^2} = 680$$

$$\vec{T}_{AC} = T_{AC} \frac{(0, 600, -320)}{680}$$

$$\vec{AD} = (500, 600, 360)$$

$$\|\vec{AD}\| = \sqrt{500^2 + 600^2 + 360^2} = 860$$

$$\vec{T}_{AD} = T_{AD} \frac{(500, 600, 360)}{860}$$

$$\sum F_x = 0: -T_{AD} + \frac{500}{860} T_{AD} + 0 = 3.6 \dots \text{ec. 1}$$

$$\sum F_y = 0: T_{AC} \frac{600}{680} + \frac{600}{860} T_{AD} + W = 4.8 \dots \text{ec. 2}$$

$$\sum F_z = 0: T_{AC} \frac{320}{680} + \frac{360}{860} T_{AD} + 0 = 0 \dots \text{ec. 3}$$

de ec. 1:

$$\frac{500}{860} T_{AD} = 3.6$$

$$T_{AD} = \frac{3.6 \cdot 860}{500}$$

$$T_{AD} = 6.192 \text{ kN}$$

ahora en ec. 2

$$W = 4.8 - \frac{600}{860} T_{AD} - \frac{600}{680} T_{AC}$$

$$W = 13.98 \text{ kN}$$

ahora en ec. 3

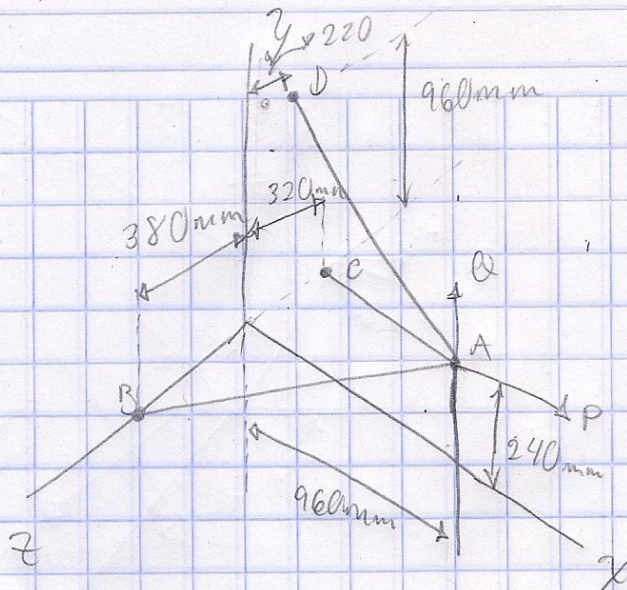
$$-\frac{320}{680} T_{AC} + \frac{360}{860} T_{AD} = 0$$

$$T_{AC} = -0.192 \left(\frac{360}{860} \right)$$

$$= \frac{-320}{680}$$

$$T_{AC} = 5.508 \text{ kN}$$

$$\begin{aligned} T_{AD} &= 6.192 \text{ kN} \\ T_{AC} &= 5.508 \text{ kN} \\ W &= 13.98 \text{ kN} \end{aligned}$$



$$P = 288 \text{ N} \quad Q = 576 \text{ N}$$

$$AB = (0, 0, 380) - (960, 240, 0) \\ = (-960, -240, 380)$$

$$\|AB\| = 1060$$

$$\vec{T}_{AB} = T_{AB} \frac{(-960, -240, 380)}{1060}$$

$$AC = (0, 0, -320) - (960, 240, 0) \\ = (-960, -240, -320)$$

$$\|AC\| = 1040$$

$$\vec{T}_{AC} = T_{AC} \frac{(-960, -240, -320)}{1040}$$

$$AD = (0, 960, -220) - (960, 240, 0) \\ = (-960, 720, -220)$$

$$\|AD\| = 1220$$

$$\vec{T}_{AD} = T_{AD} \frac{(-960, 720, -220)}{1220}$$

$$\sum F_x = 0 \quad -\frac{960}{1060} T_{AB} - \frac{960}{1040} T_{AC} - \frac{960}{1220} T_{AD} = -2880 \text{ N}$$

$$\sum F_y = 0 \quad -\frac{240}{1060} T_{AB} - \frac{240}{1040} T_{AC} + \frac{720}{1220} T_{AD} = 576 \text{ N}$$

$$\sum F_z = 0 \quad -\frac{380}{1060} T_{AB} - \frac{320}{1040} T_{AC} - \frac{220}{1220} T_{AD} = 0$$

$$\begin{array}{ccc} T_{AB} & T_{AC} & T_{AD} \\ -\frac{960}{1060} & -\frac{960}{1040} & -\frac{960}{1220} \end{array} = -2880$$

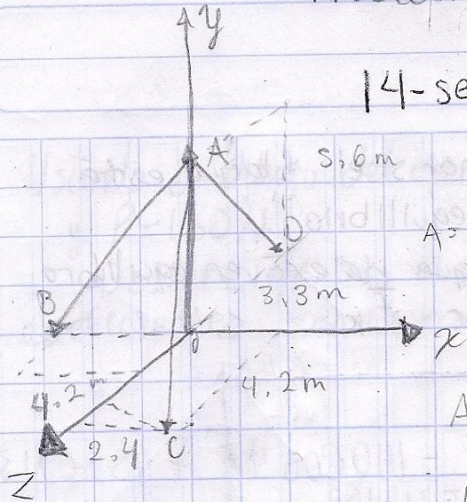
$$\begin{array}{ccc} -\frac{240}{1060} & -\frac{240}{1040} & + \frac{720}{1220} \end{array} = -576$$

$$\begin{array}{ccc} \frac{380}{1060} & -\frac{320}{1040} & -\frac{220}{1220} \end{array} = 0$$

$$\begin{array}{l} T_{AB} = 1431.001 \text{ N} \\ T_{AC} = 1560.023 \text{ N} \\ T_{AD} = 182.987 \text{ N} \end{array}$$

Problema 2.102

14-sep-2017



$$A = (0, 5.6, 0)$$

$$B = (-4.2, 0, 0)$$

$$C = (2.4, 0, 4.2)$$

$$D = (0, 0, 3.3)$$

A = 800N

$$\vec{AB} = (-4.2, 0, 0) - (0, 5.6, 0) = (-4.2, -5.6, 0)$$

$$\|\vec{AB}\| = 7$$

$$\vec{r}_{AB} = (-0.6, -0.8, 0)$$

$$\star T_{AB} = T_{AB}(-0.6, -0.8, 0)$$

$$\vec{AC} = (2.4, 0, 4.2) - (0, 5.6, 0) = (2.4, -5.6, 4.2)$$

$$\|\vec{AC}\| = 7.4$$

$$\vec{r}_{AC} = (0.3243, -0.757, 0.568)$$

$$\star T_{AC} = T_{AC}(0.324, -0.757, 0.568)$$

$$\|\vec{AD}\| = 6.5$$

$$\vec{r}_{AD} = (0, -0.8615, 0.50769)$$

$$\star T_{AD} = T_{AD}(0, -0.8615, 0.50769)$$

$$\sum F_x = 0 - 0.6T_{AB} + 0.324T_{AC} + 0 = 0 \dots \text{ec. 1}$$

$$\sum F_y = 0 - 0.8T_{AB} - 0.757T_{AC} - 0.8615T_{AD} = -800 \dots \text{ec. 2}$$

$$\sum F_z = 0 + 0.568T_{AC} - 0.50769T_{AD} = 0 \dots \text{ec. 3}$$

$$T_{AB} = 200.665 \text{ N}$$

$$T_{AC} = 371.602 \text{ N}$$

$$T_{AD} = 415.746 \text{ N}$$

T_{AB}	T_{AC}	T_{AD}	T_A
$-0.6 + 0.324 + 0 = 0$			↑
$-0.8 - 0.757 - 0.8615 = -800$			
$0 + 0.568 - 0.50769 = 0$			