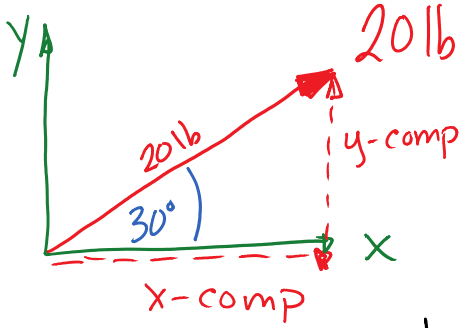
Summer 2013 Class 1

Thursday, May 30, 2013 2:24 PM

To define a force:

- Magnitude (units!)
- Direction
- Point of Application



we want to find the
x-component
y-component

$\sin\theta = \frac{opp}{hyp}$ $\tan = \frac{opp}{adj}$ $\cos\theta = \frac{adj}{hyp}$

therefore $\sin 30° = \frac{y\text{-comp}}{2016}$

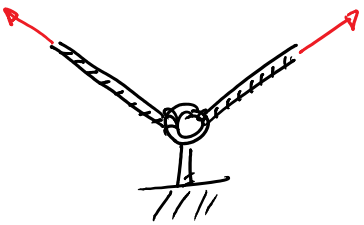
$\therefore$ y-comp $= 2016 \cdot \sin 30°$

$= 1016$

$\cos 30° = \frac{x\text{-comp}}{2016}$

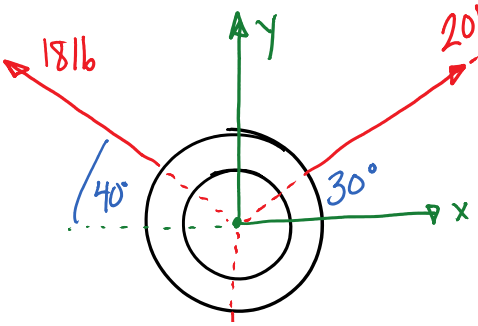
$\therefore$ x-comp $= 2016 \cdot \cos 30°$

$= 17.3\ 16$

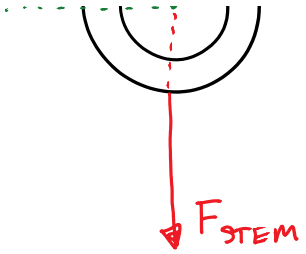


FREE BODY DIAGRAM (FBD)

- identify a body of interest
- disconnect the body from everything
- replace all of those connections with forces.



When all lines of action for a FBD meet at a common point you have a concurrent force system.



meet at a common point you have a concurrent force system.

y-comp of 20lb = 10lb

y-comp of 18lb = 18lb · SIN 40° = 11.6 lb

∴ total force pulling up = 10lb + 11.6lb = 21.6lb

∴ F_{STEM} must equal 21.6 pulling down

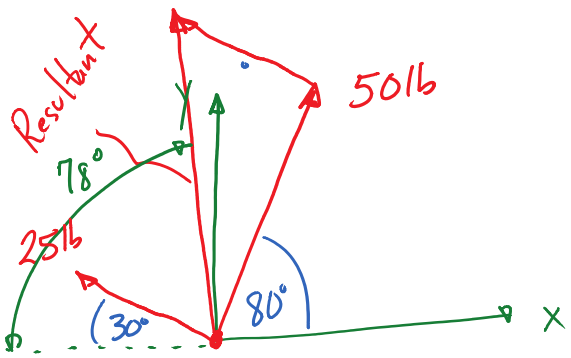
IN STATIC EQUILIBRIUM THE FORCES IN ANY DIRECTION (X, Y, Z) MUST ADD TO ZERO.

$\Sigma F_x = 0$ ← summation of forces in the x-direction equals zero.

$\Sigma F_y = 0$

$\Sigma F_z = 0$

equations of static equilibrium (plus 1 more)



Resultant

- the combination of two or more forces

$= \sqrt{(\Sigma x\text{-comp})^2 + (\Sigma y\text{-comp})^2}$

$\Sigma(x\text{-comps}) = 50_{lb} \cos 80° - 25lb \cdot \cos 30° = -13\,lb$

OR

$50_{lb} \cos 80° + 25lb \cdot \cos 150°$

$\Sigma(y\text{-comps}) = 50lb \cdot \sin 80° + 25lb \cdot \sin 30° = 61.7\,lb$

$\text{Resultant} = \sqrt{(-13lb)^2 + (61.7lb)^2}$

$$= 63 \text{ lb}$$

$$\theta = \tan^{-1} \frac{\Sigma(y\text{-comp})}{\Sigma(x\text{-comp})} = \tan^{-1} \frac{61.7 \text{ lb}}{-13 \text{ lb}}$$

$$= -78°$$