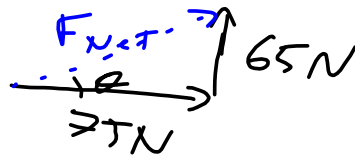
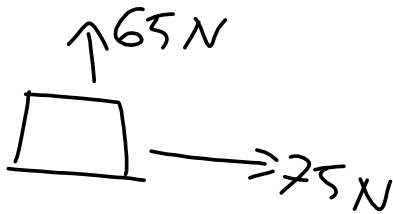


Homework



$$F_{\text{net}}^2 = (65 \text{ N})^2 + (75 \text{ N})^2$$

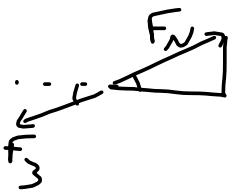
$$= 99 \text{ N}$$

$$\tan \theta = \frac{65}{75}$$

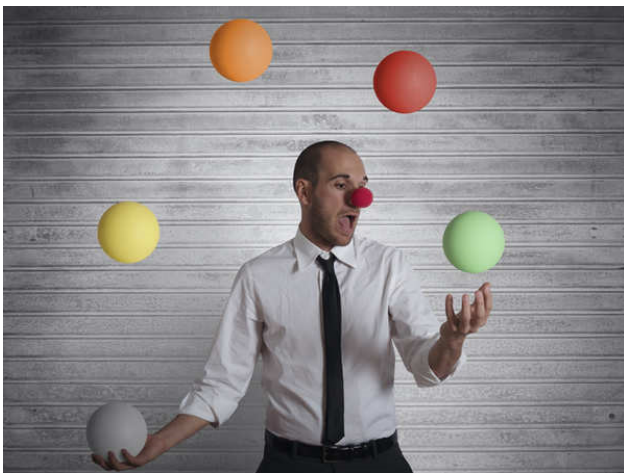
$$\theta = \tan^{-1}\left(\frac{65}{75}\right) = 41^\circ$$

$$F_{\text{net}} = 99 \text{ N} [E 41^\circ N]$$

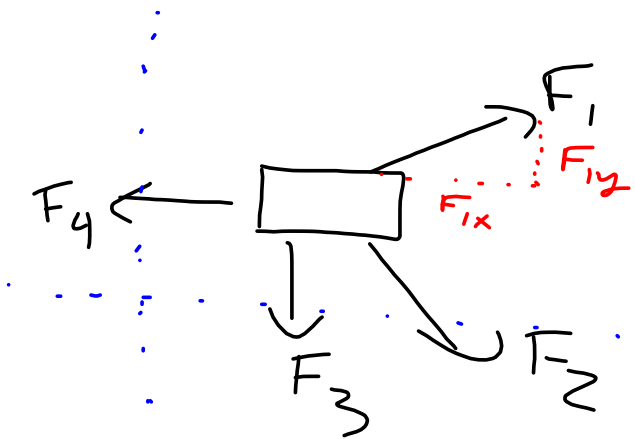
$$F_3 = 99 \text{ N} [W 41^\circ S]$$



Juggling



<https://economictimes.indiatimes.com/magazines/panache/a-work-od-like-no-other-take-up-juggling-to-relieve-stress-boost-concentration/slide-show/1543873.cms>



Working in Multiple Dimensions

Is like juggling. You can only deal with one dimension at a time.

In a multidimensional problems, we break the problem into a series of one dimensional problems.

How To Work With 2D Problems

- Draw in 2 axes that are perpendicular to each other (these axes represent the directions that we will sum the forces in)
- Decompose the vectors so the components point along either axis using Sine and Cosine functions.
- Sum the forces along each axis. (This will give the components of the net force)
- Sum the perpendicular components of the net force using Pythagorean Theorem and the Tangent function.

Determining the Force That Establishes Equilibrium:

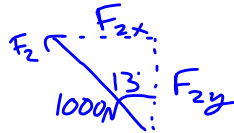
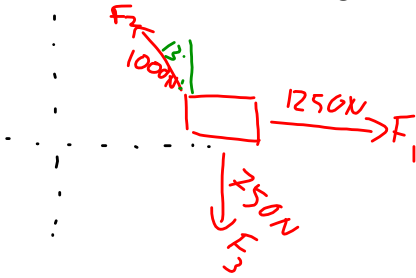
- Determine the net force from all other forces.
- The equilibrium force is equal in magnitude to the net force but in the opposite direction.

Example:

Three lions are fighting over a gazelle. One lion is pulling with a force of 1250 N [E]. The second Lion is pulling with a force of 1000 N [N13°W]. The Third Lion is pulling with a force of 750 N [S].

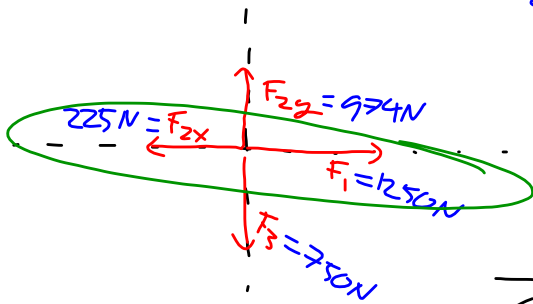
- What is the net force on the gazelle?

- What Force would a fourth lion need to exert so there was no net force on the gazelle?



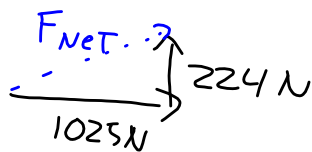
$$F_{2x} = 1000 \text{ N} \sin 13^\circ = 225 \text{ N}$$

$$F_{2y} = 1000 \text{ N} \cos 13^\circ = 974 \text{ N}$$



$$\begin{array}{l} \underline{x} \\ \Sigma F_x = 1250 \text{ N} - 225 \text{ N} \\ = 1025 \text{ N [E]} \end{array}$$

$$\begin{array}{l} \underline{y} \\ \Sigma F_y = 974 \text{ N} - 750 \text{ N} \\ = 224 \text{ N [N]} \end{array}$$



$$F_{net}^2 = (1025 \text{ N})^2 + (224 \text{ N})^2$$

$$F_{net} = 1049 \text{ N}$$

$$\Sigma F = 1049 \text{ N [E } 12.3^\circ \text{ N]}$$

$$\tan \theta = \frac{224 \text{ N}}{1025 \text{ N}}$$

$$\theta = \tan^{-1} \left(\frac{224}{1025} \right)$$

$$F_4 = 1049 \text{ N [W } 12.3^\circ \text{ S]}$$

$$= 12.3^\circ$$

Practice:

Newton's First Law in 2D sheet