Newton's Laws of Motion

Inertia: Tendency of all matter to remain at rest or move w/ a constant velocity.

Newton's 1st Law: All matter will continue to remain at rest (or move with constant v) unless acted upon by an external, unbalanced force.

Newton's 2nd Law: The acceleration of an object is directly proportional to the applied force and inversely proportional to the mass

$a \propto F$ (both go up or both go down)

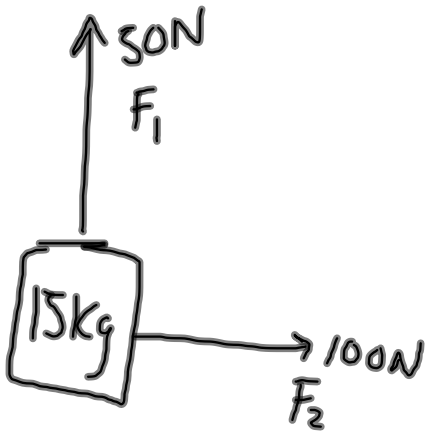
(one goes up, the other goes down) $a \propto \frac{1}{m}$

$$* \boxed{F = ma} *$$

Force is a vector and the object accelerates in the direction of the force

Newton's 3rd Law: For every action there is an equal and opposite reaction.

Addition and Subtraction of Forces



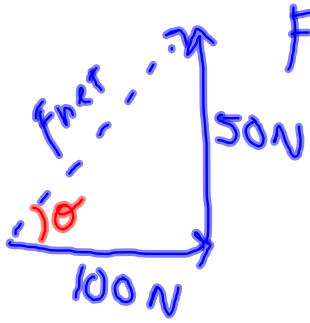
$\vec{F_1} = (0, +50)$

$\vec{F_2} = (+100, 0)$

$\vec{F_{net}} = \vec{F_1} + \vec{F_2}$

$= (0, +50) + (+100, 0)$

$\vec{F_{net}} = (+100, +50)$



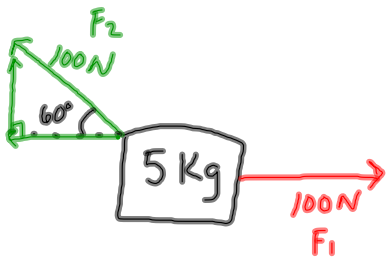
$\vec{F_{net}} = \sqrt{100^2 + 50^2}$

$\theta = \tan^{-1}\left(\frac{opp}{adj}\right)$

$= \tan^{-1}\left(\frac{50}{100}\right)$

$\vec{F_{net}} = 111.8\,N$

$\theta = 26.5°$ NE



Find F_{net} and direction

① Resolve into components

$\vec{F_1} = (+100, 0)$

$\vec{F_2} = (-100\cos 60, +100\sin 60)$

$= (-50, +86.6)$

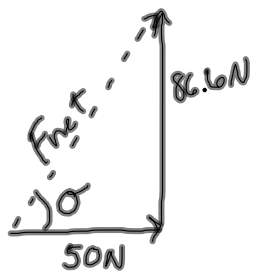
② $a^2+b^2=c^2$ to Find F_{net}

$F_{net} = \vec{F_1} + \vec{F_2}$

$= (+100, 0) + (-50, +86.6)$

$F_{net} = (+50, +86.6)$

$= \sqrt{50^2 + 86.6^2}$



$* \boxed{F_{net} = 99.5\ N} *$

$\theta = \tan^{-1}\left(\frac{86.6}{50}\right) = 60°\ NE$

b) Find mag + direction of accel.

$F = ma$

$\frac{99.5}{5} = \frac{5a}{5}$

$* \boxed{a = 20\ m/s^2\ @\ 60°\ NE} *$

<u>Weight</u>: force of gravity on an object.

$$\boxed{W = mg}$$

W = weight (measured in N)
m = mass
$g = 9.81 m/s^2$