Forces and Newton's Laws

Newton's Laws:

Newton's 1st law: An object at rest will remain at rest, an object in motion will remain in motion in a straight line at a constant speed unless acted upon by an unbalanced force.

Newton's 2nd law: $\sum \vec{F} = m\vec{a}$

Newton's 3rd law: For every action there is an equal but opposite reaction

⇒ Note that $\sum \vec{F} = m\vec{a}$ is really two equations, one for the x-component and one for the y-component:

$$\sum F_x = ma_x \quad \text{and} \quad \sum F_y = ma_y$$

⇒ The unit of force is the Newton (N). 1 N = 1 kg m/s^2

Some Particular Forces:

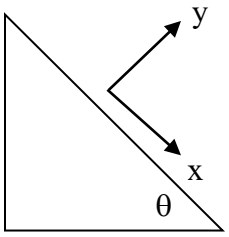
Weight: w = mg

Tension: you must solve for tension (T) using Newton's 2nd law

Normal Force: you must solve for the normal force (F_N) using Newton's 2nd law

Static Friction: $0 \le f_s \le f_{s,max}$ where $f_{s,max} = \mu_s F_N$

Kinetic Friction: $f_k = \mu_k F_N$



Inclined Planes:

⇒ For inclined planes, we usually define the x-axis parallel to the incline and the y-axis perpendicular to the incline.

⇒ The weight then needs to be broken up into a component parallel to the incline (w_x) and a component perpendicular to the incline (w_y)

$w_x = mg \sin\theta$

$w_y = mg \cos\theta$