Force and Interactions

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What is Force?

A **force** is a *push* or *pull* exerted on an object.
Force is a **vector quantity**, meaning it has both **magnitude** and **direction**.

Types of Forces

Contact Forces

- **Normal Force:** A force exerted on an object by a surface with which it is in contact. It always acts perpendicular ("normal") to the surface, regardless of its angle.
- **Friction Force:** Acts parallel to the surface, opposing the motion or the tendency of motion between two surfaces in contact.
- **Tension Force:** The pulling force transmitted through a rope, string, cable, or similar object. It acts along the length of the object, away from the object to which it is attached.
- **Long Range Force**

  These forces act even when objects are not in direct contact:

  - **Gravitational Force:** The attractive force between two masses. The gravitational force that Earth exerts on an object is known as its **weight**.
  - **Magnetic Force:** A force experienced by objects in the presence of a magnetic field, such as between magnets or between a magnet and a magnetic material.

Describing a Force

To describe a force $\vec{F}$, we must specify:

- The **magnitude** (strength) of the force.
- The **direction** in which the force is applied.

The SI unit of the magnitude of force is the newton N.

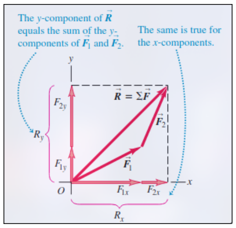
Superposition of Forces

When 2 forces $\vec{F_1}$ and $\vec{F_2}$ act on an object, the resulting force is the **sum** of the two forces: $\vec{F} = \vec{F_1} + \vec{F_2}$

In essence, any number of forces acting on an object have the same effect as a single force equal to the vector sum of he forces.

> **Diagram tips.**
> When drawing forces and components add a wiggly line to the original force. Otherwise, the diagram would include the same force twice. That is because you are including it once separated for each component and once as the sum of the components (the original force).

Net force: Sum of all the forces acting on an object.



$$\vec{R} = \sum_{i=1}^{n} \vec{F_i}.$$

$\vec{R}$ is the net force on the object.

With this, the magnitude of the net force is:

$$\vec{R} = \sqrt{R_x^2 + R_y^2}.$$

$R_x = \sum F_x$ and $R_y = \sum F_y$

With the net force, we can find the angle between it and the x-axis with the relation: $tan(\theta) = \frac{R_y}{R_x}$