Vectors

It is a directed line segment.

An example, $\vec{PQ} = \langle x_2 - x_1, y_2 - y_1, z_2 - z_1 \rangle$

The length or magnitude of $\vec{PQ}$ is $|\vec{PQ}| = \sqrt{(x_2 - x_1)^2, (y_2 - y_1)^2, (z_2 - z_1)^2}$

Given $\vec{u}, \vec{v}$

$\vec{u} + \vec{v} = \langle u_1 + v_1, u_2 + v_2, u_3 + v_3 \rangle$

$\vec{u} - \vec{v} = \langle u_1 - v_1, u_2 - v_2, u_3 - v_3 \rangle$

Properties

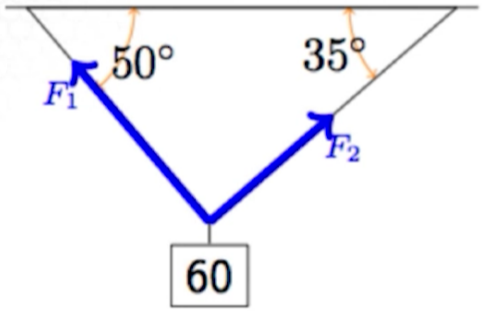
Definition: Vector Addition

Let **u**, **v** and **w** be vectors and a and b be scalars.

1. $\mathbf{u} + \mathbf{v} = \mathbf{v} + \mathbf{u}$
2. $(\mathbf{u} + \mathbf{v}) + \mathbf{w} = \mathbf{u} + (\mathbf{v} + \mathbf{w})$
3. $\mathbf{u} + \mathbf{0} = \mathbf{u}$
4. $\mathbf{v} + (\text{-}\mathbf{v}) = \mathbf{0}$
5. $0\mathbf{v} = \mathbf{0}$
6. $1\mathbf{v} = \mathbf{v}$
7. $a(b\mathbf{v}) = (ab)\mathbf{v}$
8. $a(\mathbf{u} + \mathbf{v}) = a\mathbf{u} + a\mathbf{v}$
9. $(a + b)\mathbf{v} = a\mathbf{v} + b\mathbf{v}$

Example:

A 60-N weight is suspended by two wires as shown below. Find the forces $\mathbf{F}_1$ and $\mathbf{F}_2$ acting in both wires.



Solution ›

$$\vec{F}_1 = \|\vec{F}_1\| \langle -\cos 50^\circ, \sin 50^\circ \rangle$$

$$\vec{F}_2 = \|\vec{F}_2\| \langle \cos 35^\circ, \sin 35^\circ \rangle$$

$$\rightarrow \quad \vec{F}_1 + \vec{F}_2 = \langle 0, 60 \rangle$$

$$\|\vec{F}_2\| = \frac{\|\vec{F}_1\| \cos 50^\circ}{\cos 35^\circ}$$

$$-\|\vec{F}_1\| \cos 50^\circ + \|\vec{F}_2\| \cos 35^\circ = 0$$

$$\|\vec{F}_1\| \sin 50^\circ + \|\vec{F}_2\| \sin 35^\circ = 60$$

$$\|\vec{F}_1\| \approx 49.34 \text{ N} \qquad \|\vec{F}_2\| = 38.71$$