

Vector Addition
Useful Concepts and Formulas
Center for Academic Program Support

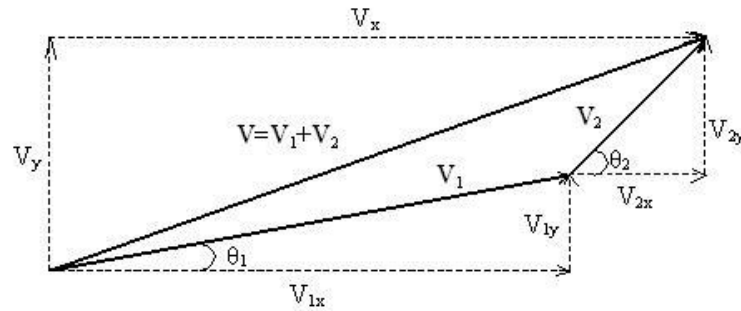


FIG. 1: Graphical addition of vectors \mathbf{V}_1 and \mathbf{V}_2 . The components of $\mathbf{V} = \mathbf{V}_1 + \mathbf{V}_2$ are $V_x = V_{1x} + V_{2x}$ and $V_y = V_{1y} + V_{2y}$.

Here is a brief summary of how to add two or more vectors using components.

1. Draw a diagram, adding the vectors graphically. See FIG. 1.
2. Resolve each vector into its x and y components, showing each component along its appropriate (x or y) axis as a (dashed) arrow.
3. Calculate each component (when not given) using sines and cosines. If θ_1 is the angle vector \mathbf{V}_1 makes with the x axis, then

$$V_{1x} = V_1 \cos \theta_1, \quad V_{1y} = V_1 \sin \theta_1$$

Pay careful attention to the signs: any component that points along the negative x or y axis gets a negative sign.

4. Add the x components together to get the x component of the resultant vector. Similarly for y :

$$\begin{aligned} V_x &= V_{1x} + V_{2x} + \text{any others} \\ V_y &= V_{1y} + V_{2y} + \text{any others} \end{aligned}$$

This is the answer: the components of the resultant vector.

5. If you want to know the magnitude and direction of the resultant vector use the equations:

$$V = \sqrt{V_x^2 + V_y^2}, \quad \tan \theta = \frac{V_y}{V_x}$$

The vector diagram you already drew helps to obtain the correct position (quadrant) of the angle θ .

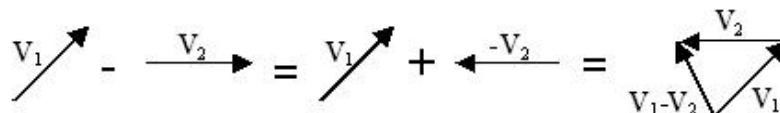


FIG. 2: A graphical depiction of vector subtraction.