

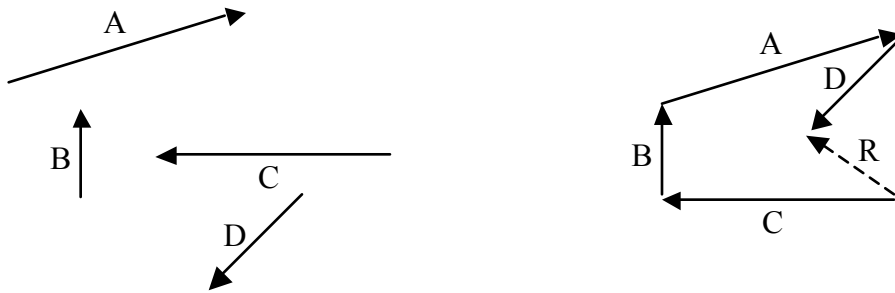
Physics

Adding Vectors Graphically

1. Move one or more vectors until they “chain up” head to tail (in any order).

Warning! You may **slide** vectors around, but no changing any vector’s **length** or **direction**!

2. Draw the resultant (\vec{R}) from the **tail** of the **first** vector in your chain to the **head** of the **last** vector.



Adding Vectors Analytically

1. Break each vector down into perpendicular components (e.g., $\vec{A} = \vec{A}_x + \vec{A}_y$), perhaps by measurement:

$$\vec{A} = \langle 10, 3 \rangle \quad \vec{B} = \langle 0, 4 \rangle \quad \vec{C} = \langle -10, 0 \rangle \quad \vec{D} = \langle -4, -4 \rangle$$

2. Sum the first component of each vector **algebraically** (keeping track of the signs) to compute the first component of the resultant (e.g., \vec{R}_x):

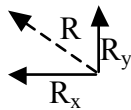
$$\vec{R}_x = \vec{A}_x + \vec{B}_x + \vec{C}_x + \vec{D}_x = (10) + (0) + (-10) + (-4) = -4$$

Note: An algebraic sum is legal because all of these components are parallel to one another.

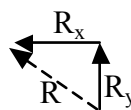
3. Repeat **Step #2** to compute the other component(s) of \vec{R} :

$$\vec{R}_y = \vec{A}_y + \vec{B}_y + \vec{C}_y + \vec{D}_y = (3) + (4) + (0) + (-4) = 3 \quad \vec{R} = \langle -4, 3 \rangle$$

4. Build a graphical version of \vec{R} (if necessary) by adding its components **graphically**:



This can be done directly since the components are perpendicular.



However, the general method works as well.