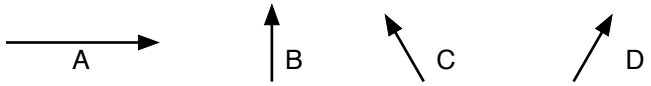
Vector Addition

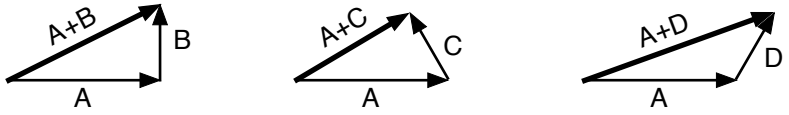
Using the equations in physics, we add or subtract things and we multiply or divide things. We can do all of that with vector quantities as well. For now, we will just deal with addition of vectors. A common word used to indicate the result of adding up some vectors is *resultant*.

Resultant The sum of two or more vectors. You can think of this as the one vector that can replace the two or more vectors you have added up.

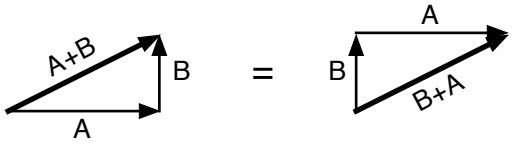
Adding vectors is easy. Just think about the penny lab with which we started this unit. To add vectors, simply imagine drawing one vector, and then right where the first vector ended, draw the next vector. The resultant is the total change, so the resultant is a vector that starts at the origin of the first vector and ends a the end of the second vector. For example, given the following vectors



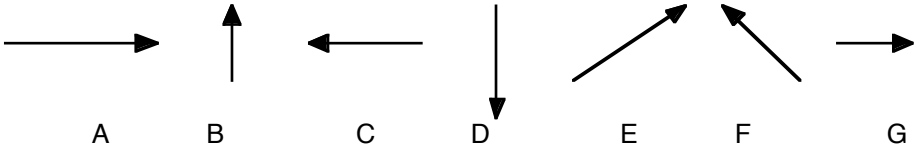
We would add vectors **A** and **B**, and the vectors **A** and **C**, and the vectors **A** and **D** as follows:



Also, remember that the order you add vectors doesn't matter, which means that **A** + **B** = **B** + **A**:



1. Before we break out the rulers and protractors, here is a little practice with just quick sketches. Some vectors are shown in the picture below. For each problem, sketch how you would add the given vectors.



a. $\vec{A}+\vec{B}$ b. $\vec{A}+\vec{D}$ c. $\vec{D}+\vec{G}$ d. $\vec{B}+\vec{C}$

e. $\vec{C}+\vec{E}$ f. $\vec{F}+\vec{G}$ g. $\vec{E}+\vec{F}$

2. Imagine you have two vectors, one of magnitude 3 and the other of magnitude 4, but you don't know anything about their actual directions.
   a. What is the largest possible resultant these vectors could have? What would be true about their directions?

   b. What is the smallest possible resultant they could have? What would be true about their directions now?

   *c. If their resultant had a magnitude of 5, what would be true about their directions?

Vector Addition

You will need a ruler and protractor to do these!

3. What is the resultant for these pairs of displacement vectors?

a. 7 km E + 3 km S

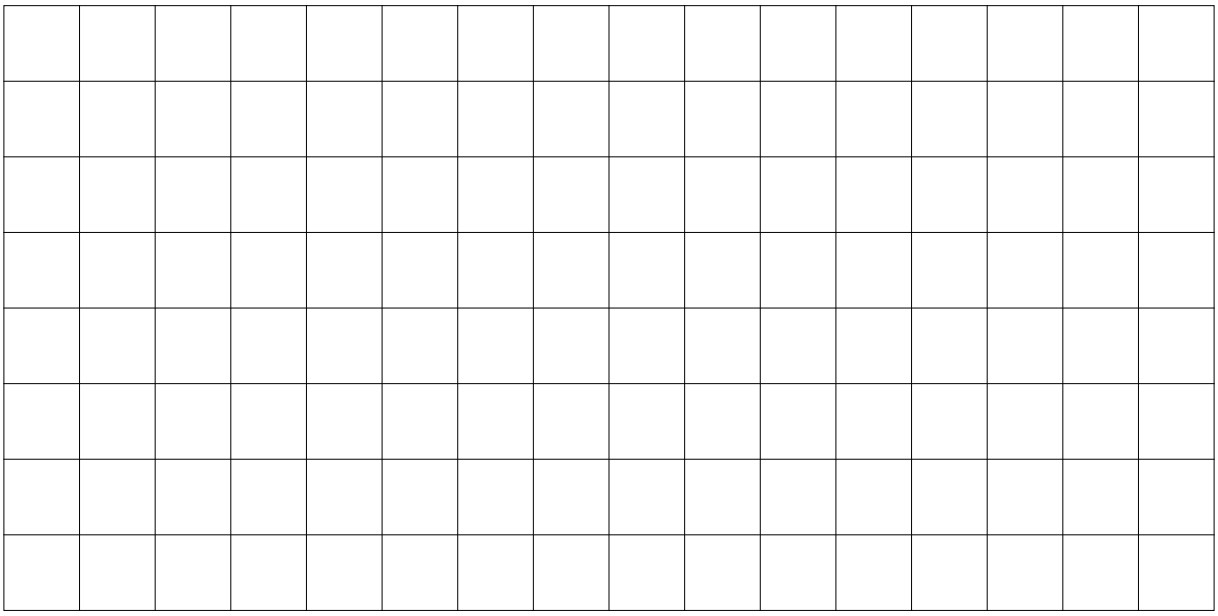
Scale: _____cm = _____ km

Mag: _____ Dir: _____

b. 5 km S + 6 km 30º North of East

Scale: _____cm = _____ km

Mag: _____ Dir: _____



3. What is the resultant for these pairs of displacement vectors?

a. 5 km N + 4 km E + 3 km S

Scale: _____cm = _____ km

Mag: _____ Dir: _____

b. 8 km 30º S of E + 6 km 20º W of N

Scale: _____cm = _____ km

Mag: _____ Dir: _____