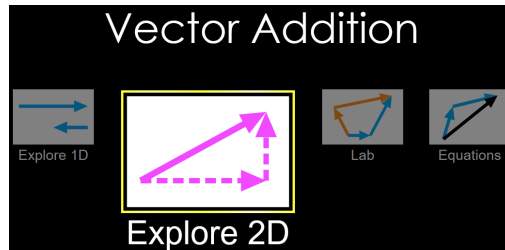


Vector Addition Activity

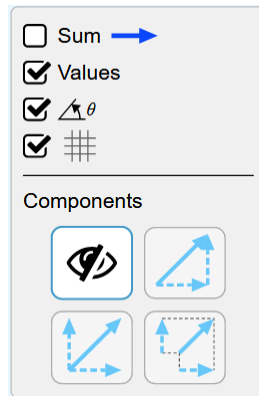
Simulation: https://phet.colorado.edu/sims/html/vector-addition/latest/vector-addition_en.html
(or link through libbyteach.net)

Introduction

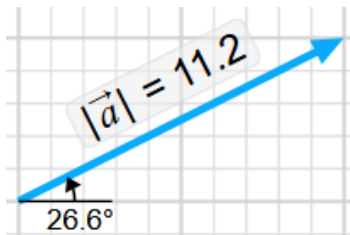
1. Choose “Explore 2D” from the options given.



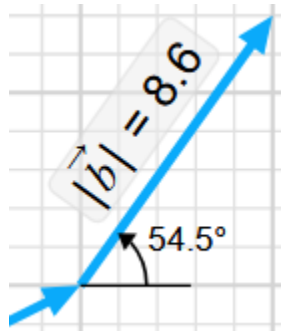
2. Set the controls on the right-hand side of the simulation as shown to show the values, angles, and a grid.



3. Drag vector \vec{a} onto the grid (anywhere) and adjust until it has a length of 11.2 and an angle of 26.6° .



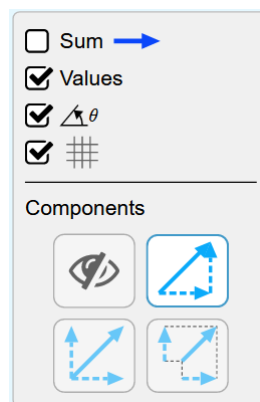
4. Drag vector \vec{b} onto the grid such that the tail of \vec{b} starts at the tip of \vec{a} . Adjust \vec{b} to have a length of 8.6 and an angle of 54.5° .



5. The components of each vector need to be calculated. This is done using the trigonometric ratios sin and cos.

	x-component	y-component
\vec{a}	$11.2 \cos 26.6 = 10.0$	$11.2 \sin 26.6 = 5.0$
\vec{b}	$8.6 \cos 54.5 = 5.0$	$8.6 \sin 54.5 = 7.0$

6. Change the controls as shown to show the components.



The values on the simulation should match the calculated values.

7. The vectors are added together by adding the components of the vectors together and then calculating the hypotenuse and angle.

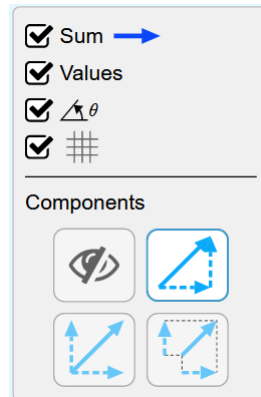
Adding the components gives the following:

	x	y
\vec{a}	10.0	5.0
\vec{b}	5.0	7.0
\vec{c}	15.0	12.0

Now the vector must be “built” from its components.

$$|\vec{c}| = \sqrt{(15.0)^2 + (12.0)^2} = 19.2 \text{ m}$$
$$\theta = \tan^{-1}\left(\frac{12}{15}\right) = 38.7^\circ$$

8. Check this value by setting the controls as shown so that the sum of the vectors is shown. You may have to move the vector so that you are able to see the values.



Name: _____

Activity

Answer the following questions in the space provided.

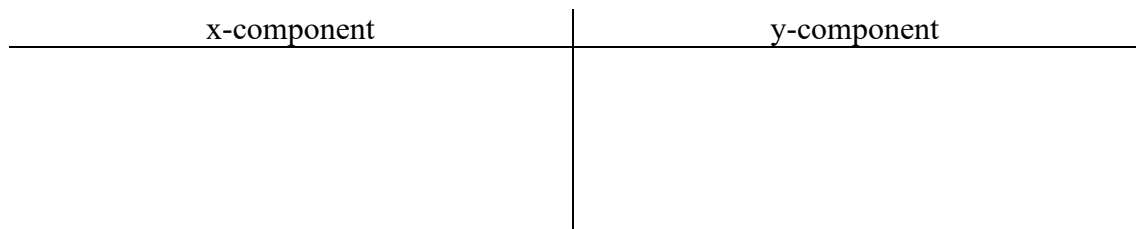
1. A car is traveling 10.6 km/h with a compass reading of 48.8° north of east.

(a) Represent the vector using the simulation. How fast is your car traveling in the

(i) north direction? _____

(ii) east direction? _____

(b) Show how the components are calculated mathematically.



2. To get to the sandwich shop, you leave home and drive 6 km south and then 10 km west.

(a) A bird flies from your house to the sandwich shop in a straight line. Using the simulation, determine

(i) how far the bird flies. _____

(ii) the direction the bird flies from your house. _____

(b) Show the calculations required to answer these questions.

3. A paper airplane is given a push so that it could fly 5.0 m/s 36.9° North of East, but there is wind that also pushes it 7.2 m/s 33.7° North of West.

(a) Calculate the speed and direction of the paper airplane? Show your work.

(b) Check your work by using the simulation.