

# Physics Grade 11

## Experiment 2

### *Addition of Vectors by their Components*

Time for activity 40-60 minutes

#### Resources

The Virtual Lab [https://phet.colorado.edu/sims/html/vector-addition/latest/vector-addition\\_en.html](https://phet.colorado.edu/sims/html/vector-addition/latest/vector-addition_en.html)

Paper. Pencil, Calculator

#### Software Requirements

The new HTML5 sims can run on iPads and Chromebooks, as well as PC, Mac, and Linux systems.

##### **iPad:**

iOS 11+ Safari

[iPad compatible sims](#)

##### **Android:**

Not officially supported. If you are using the HTML5 sims on Android, we recommend using the latest version of Google Chrome.

##### **Chromebook:**

Latest version of Google Chrome

The HTML5 and Flash PhET sims are supported on all Chromebooks.

[Chromebook compatible sims](#)

##### **Windows Systems:**

Microsoft Edge and Internet Explorer 11, latest version of Firefox, latest version of Google Chrome.

##### **Macintosh Systems:**

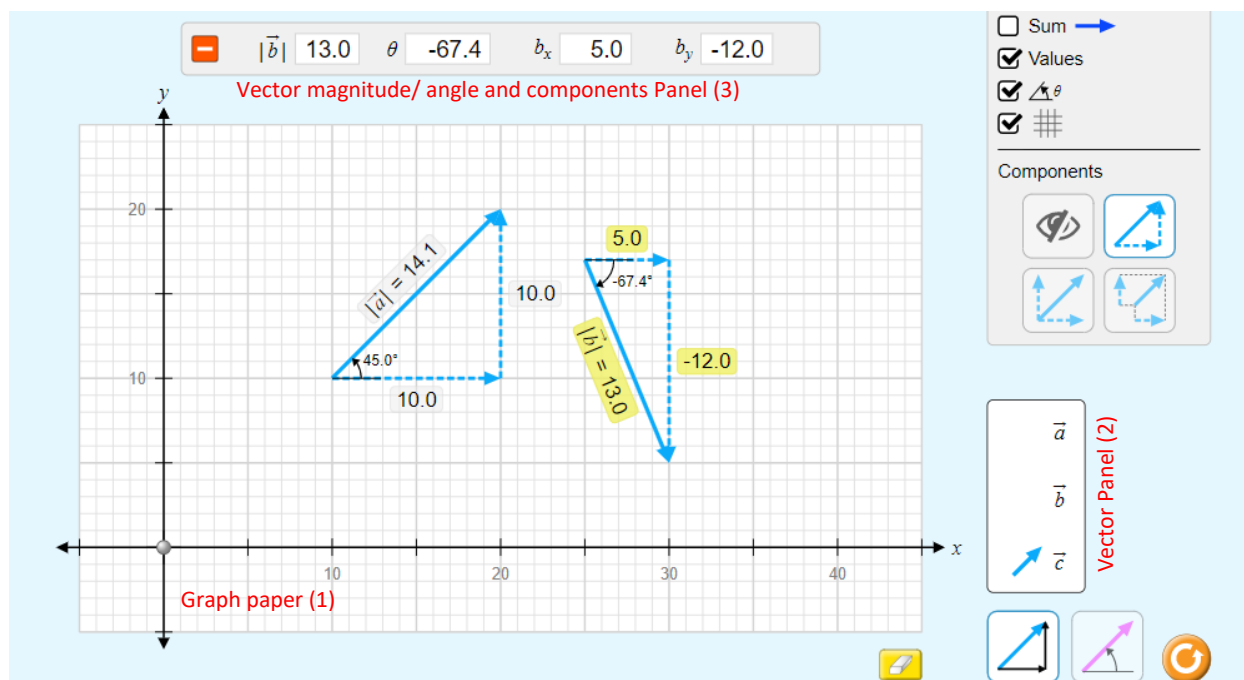
macOS 10.9.5+, Safari 9+, latest version of Chrome.

##### **Linux Systems:**

Not officially supported. Please contact [phethelp@colorado.edu](mailto:phethelp@colorado.edu) with troubleshooting issues.

## The Lab Environment

Spend a few minutes to understand/ explore the functionalities of the different tabs/panels.



### Finding the Resultant – Algebraic Method

1. Drag two vectors  $\vec{a}$  and  $\vec{b}$  from the vector panel (2) to graph paper (1). And adjust their length and orientations.
2. Note down their magnitudes and the angles and record in the respective cells in the Table 2.
3. Calculate the x and y-components of the two vectors  $\vec{a}$  and  $\vec{b}$ , using  $a_x = a \cos \theta$ ,  $b_x = b \cos \theta$ ,  $a_y = a \sin \theta$ ,  $b_y = b \sin \theta$  and record the calculations in the respective cells.
4. Find the x-component of the resultant  $\vec{s}$  by
 
$$s_x = a_x + b_x$$
5. Find the y-component of the resultant  $\vec{s}$  by
 
$$s_y = a_y + b_y$$
6. Find the magnitude of the resultant using the formula
 
$$|s| = \sqrt{s_x^2 + s_y^2}$$
7. Find the angle that the resultant makes with the positive x-axis by using the formula
 
$$\theta = \tan^{-1} \left( \frac{s_y}{s_x} \right)$$

### Verification

The calculated magnitude (from step 7) of the resultant vector  $\vec{s}$  must match with the observed value obtained from the graph paper (1).

The calculated angle (from step 8) of the resultant vector  $\vec{s}$  must match with the observed value obtained from the graph paper (1).

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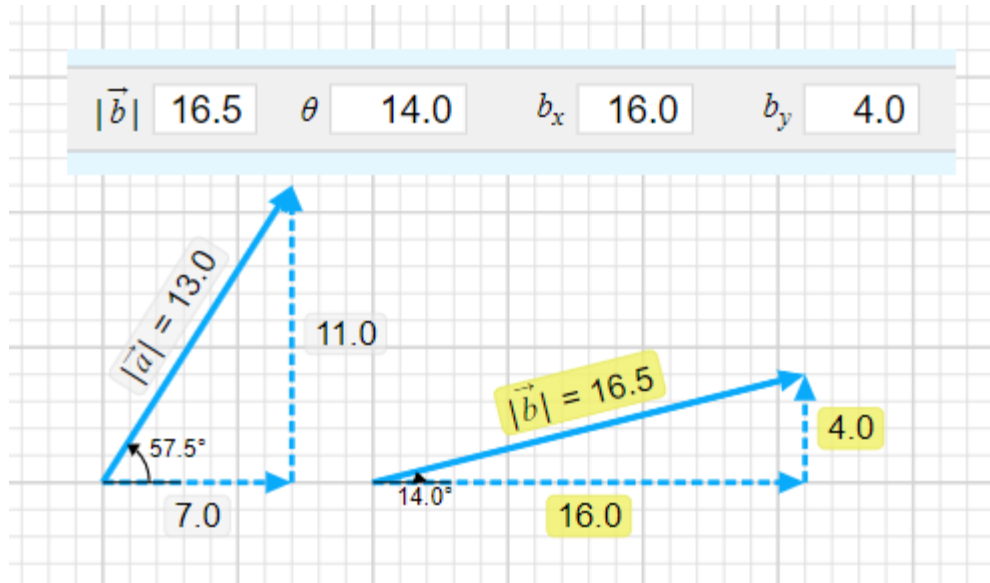
## Experiment 2

### Addition of Vectors by their Components

Student's Name \_\_\_\_\_

Grade \_\_\_\_

#### Observations and calculations



**Table 2:** Addition of two vectors by Algebraic Method.

No of Obs	First Vector $\vec{a}$		Second Vector $\vec{b}$		Resultant $\vec{s}$		
					Calculations	Observed	
	Magnitude	$ \vec{a}  =$	Magnitude	$ \vec{b}  =$	x-component	$s_x = a_x + b_x$	
	Angle	$\theta^\circ =$	Angle	$\theta^\circ =$	y-component	$s_y = a_y + b_y$	
	x-component	$a_x = a \cos \theta$	x-component	$b_x = b \cos \theta$	Magnitude	$ s  = \sqrt{s_x^2 + s_y^2}$	
	Y-component	$a_y = a \sin \theta$	Y-component	$b_y = b \sin \theta$	Angle	$\theta = \tan^{-1} \left( \frac{s_y}{s_x} \right)$	