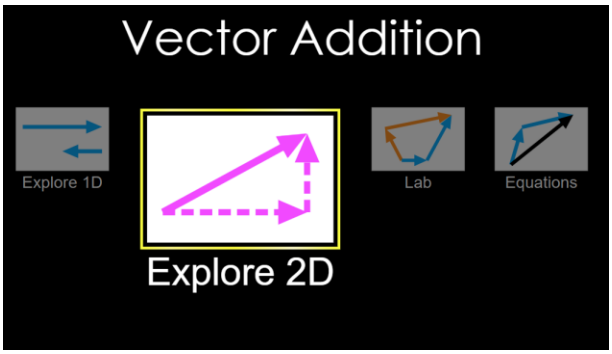
Phys 195 Lab 1 – Vectors

For this lab, you'll use a computer simulation where you can manipulate vectors. The questions that you need to answer are all on MasteringPhysics, in the "Lab 1 Questions" assignment; you'll enter your answers there and they'll be graded automatically.

Directions:

Click on this link to access the Vectors computer simulation:
https://phet.colorado.edu/sims/html/vector-addition/latest/vector-addition_en.html

Click on the Explore 2D option; you have to click on it twice (not a double-click, though) to open it.



Part 1: enter all answers here in "Lab #1 Question 1" on MasteringPhysics, in the answer box with the same letter as the question here (i.e. for question B, enter the answer in Part B of "Lab #1 Question 1")

I) Drag the vector $\vec{a}$ into the space, place its **tail at the origin**, and give it a magnitude of 18.0 and a direction of 33.7 degrees by dragging its "tip" around (get those exact values, as read in the "bar" directly above the graph); the direction is the angle measured counterclockwise from the +x-axis. (Hint: with the tail at the origin, the tip of the vector will be on one of the grid points when it has that specific magnitude and angle. So drag the tip around to the various grid points (where the horizontal and vertical lines cross each other) until the magnitude and direction are correct.)

A) Answer question Part A in MasteringPhysics (called MP from here on).

B) Answer question Part B in MP.

C) Answer question Part C in MP.

D) Answer question Part D in MP.

We are going to put in two vectors, $\vec{b}$ and $\vec{c}$, one along the x-axis and one along the y-axis, that when added together are equal to vector $\vec{a}$. Put vector $\vec{b}$ on the grid with its tail at the origin. Set the magnitude of $\vec{b}$ to be the same as the x-component of $\vec{a}$. Use 0 for the angle in order for the vector to

be on the x-axis. Put in vector $\vec{c}$ in the same way, except use the y-component of $\vec{a}$ for its magnitude and 90 degrees as the angle, so that $\vec{c}$ points in the positive y-direction.

Click on the Sum box to show the sum of all of the vectors (i.e. $\vec{a}+\vec{b}+\vec{c}$) on the grid. The vector will be placed in the middle of the grid. Move it so its tail is at the origin.

E) Answer question Part E in MP.

F) Answer question Part F in MP.

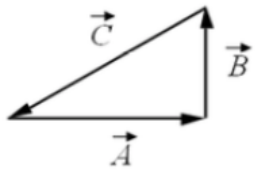
Leave $\vec{b}$ and $\vec{c}$ and the sum vector on the grid. Change the magnitude and direction of $\vec{a}$ until the sum vector is equal to zero. Since $\vec{b}+\vec{c}$ equaled the original $\vec{a}$, but $\vec{b}+\vec{c}$ plus the new vector $\vec{a}$ equals zero (vector of magnitude zero), the new vector $\vec{a}$ is the negative of the original $\vec{a}$.

G) Answer question Part G in MP.

H) Answer question Part H in MP.

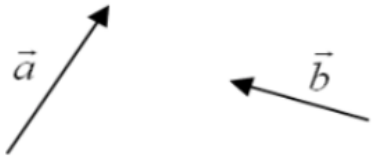
II)

The following diagram is to use in answering Part I in MP:

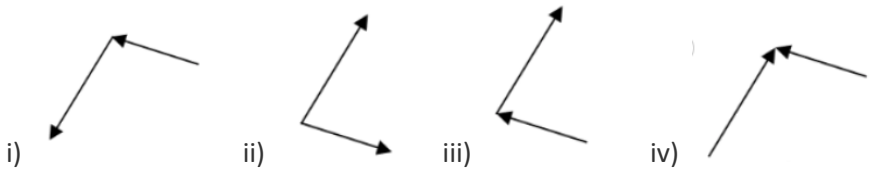


I) Answer question Part I in MP.

The following diagram is to use in answering Part J in MP:



J) Consider the two vectors $\vec{a}$ and $\vec{b}$ in the diagram above. Which of the following shows the correct way to graphically add the two vectors together? Enter your answer in Part J in MP.



K) The magnitudes and directions of 4 vectors (A, B, C and D) are given in the table below. For which vector is either the x-component or y-component given in the table *incorrect*? Enter your answer (A, B, C or D) in Part K in MP.

		x component	y component
A	1 unit at 75^0	positive	positive
B	5 units at 275^0	positive	negative
C	3 units at 175^0	negative	positive
D	4 units at 250^0	negative	positive

III)

Clear off all of the vectors on the grid using the reset button: 

Place vector $\vec{a}$ back onto the grid with magnitude 18.0 and angle 33.7 degrees. Place a second vector $\vec{b}$ onto the grid (with its tail at the origin) with a magnitude of 11.2 and an angle of 116.6 degrees.

L) Answer question Part L in MP.

M) Answer question Part M in MP.

N) Answer question Part N in MP.

O) Answer question Part O in MP.

P) Answer question Part P in MP.

Q) Answer question Part Q in MP.

R) Answer question Part R in MP.

S) Answer question Part S in MP.

Remove the sum vector and add a vector $\vec{c}$ (with its tail at the origin) whose magnitude is 15.8 and direction is -18.4 degrees (so that it points 18.4 degrees <u>below</u> the +x-axis).

T) Answer question Part T in MP.

U) Answer question Part U in MP.

V) Answer question Part V in MP.

W) Answer question Part W in MP.

Part 2: enter all answers here in "Lab #1 Question 2" on MasteringPhysics, in the answer box with the same letter as the question here (e.g. for question B, enter the answer in Part B of "Lab #1 Question 2")

Clear all the vectors from the screen. Click and drag the origin of the coordinate system so that it's near the center of the screen. Put the following 3 vectors, listed by magnitude and angle from the +x-axis, on the grid:

$\vec{a}$: 11.2 at 116.6 degrees $\vec{b}$: 13.4 at -116.6 degrees $\vec{c}$: 21.8 at -15.9 degrees

Place them with the tail of $\vec{a}$ at the origin, and then arrange the others in the correct way that would represent displacement $\vec{a}$ followed by displacement $\vec{b}$ followed by displacement $\vec{c}$ (so their tails will NOT all be at the origin).

Click on Sum, to obtain the vector sum of the three vectors. Drag the Sum vector so that its tail is at the origin. **Take a screenshot, and then upload it on Canvas, to the link (under Assignments) for Lab #1.**

If the vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ were displacements undergone by some object, sequentially, then the Sum vector here is the overall displacement vector for the whole trip, since it points from the tail of the first displacement vector ($\vec{a}$) to the tip of the last displacement vector ($\vec{c}$).

Using the known magnitudes and angles of the three vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$, calculate:

A) the x-component of the vector sum $\vec{R} = \vec{a} + \vec{b} + \vec{c}$ (i.e. calculate R_x). (When calculating, round each component a_x, b_x and c_x to **2 decimal places**, and round your answer for R_x to 2 decimal places.) Enter your answer in Part A on MP.

B) the y-component of the vector sum $\vec{R} = \vec{a} + \vec{b} + \vec{c}$ (i.e. calculate R_y). (When calculating, round each component a_y, b_y and c_y to **2 decimal places**, and round your answer for R_y to 2 decimal places.) Enter your answer in Part B on MP.

C) the magnitude of the vector sum $\vec{R} = \vec{a} + \vec{b} + \vec{c}$ (use the values of R_x and R_y you calculated to **2 decimal places**, and round the answer for the magnitude to 2 decimal places.) Enter your answer in Part C on MP.

D) the angle (in degrees) of that vector sum $\vec{R} = \vec{a} + \vec{b} + \vec{c}$ makes with the +x-axis, measured counterclockwise (so it will be a positive angle). (Use the values of R_x and R_y you calculated to **2 decimal places**, and round the answer for the magnitude to 2 decimal places.) Enter your answer in Part D on MP.