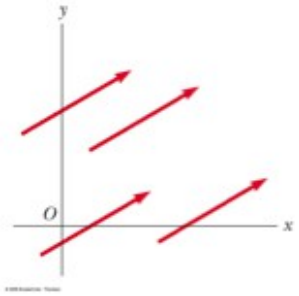
PHYS 141
In Class Assignment #2

Name:

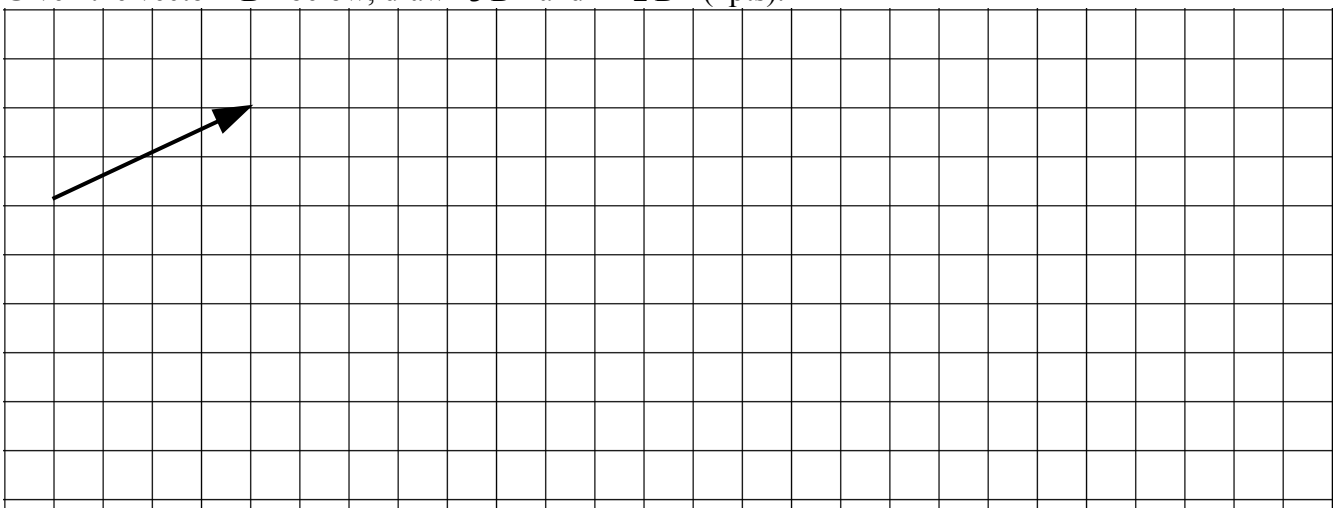
Box #:



Vector Properties

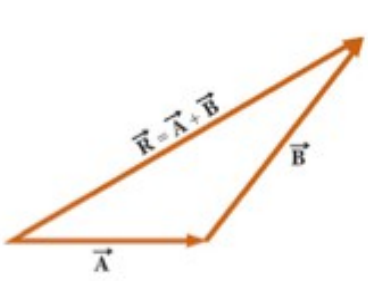
1. Two vectors are equal if they have the same magnitude and direction.
2. Multiplying a vector by a scalar changes its length. $2\vec{A}$ is twice the length of $\vec{A}$ and the same direction. $\frac{1}{2}\vec{A}$ is half the length of $\vec{A}$.
3. The negative of a vector has the same length and points in the opposite direction.

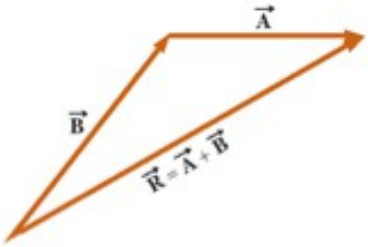
Given the vector $\vec{D}$ below, draw $3\vec{D}$ and $-2\vec{D}$ (4pts).

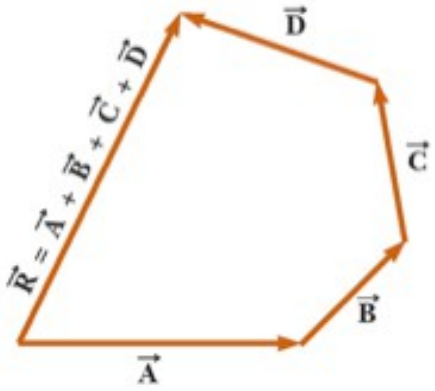


Vector Addition – Tip to Tail

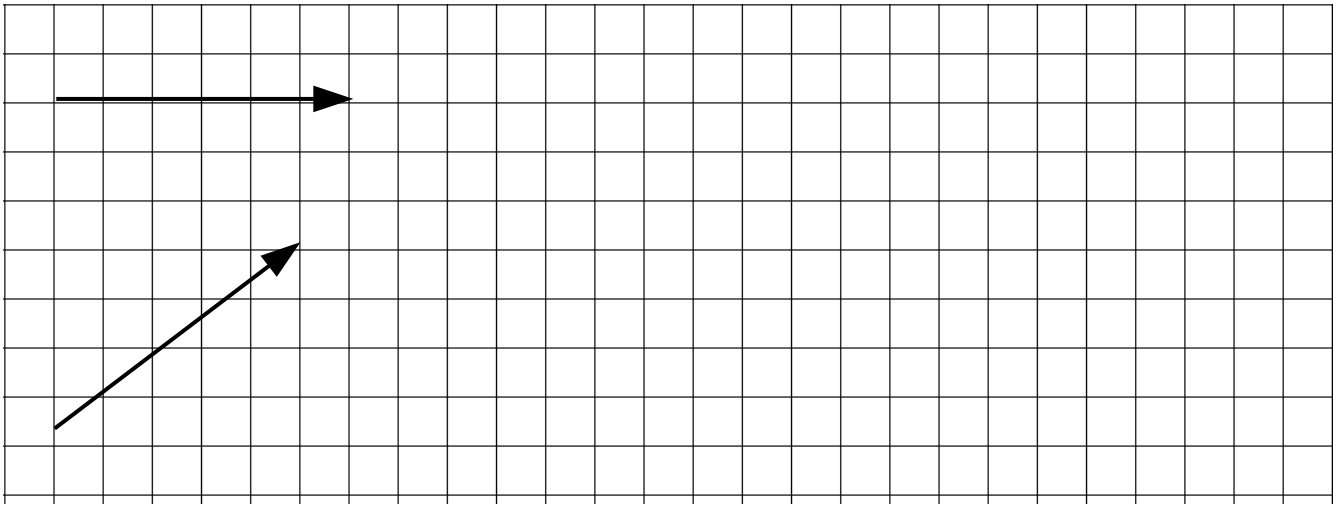
Vectors are added by drawing the first vector, then the second with its tail at the first vector's tip. This process can be repeated to add several vectors. The resultant vector is then one that starts at the tail of the first vector and its tip at the tip of the last vector added. The order in which vectors are added doesn't matter.







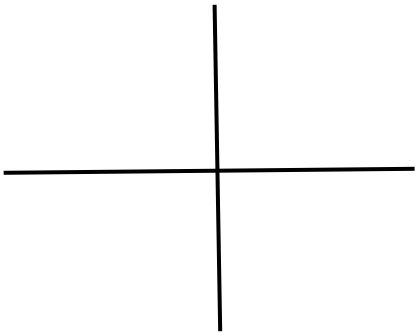
Add the two vectors shown below. Label the resultant vector $\vec{R}$ (3pts).



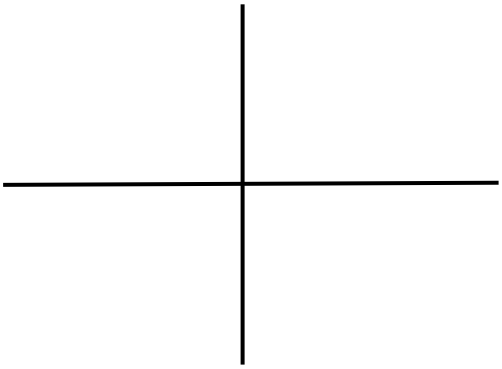
Vector Directions

Vectors are often specified by giving a length (magnitude) and direction (angle). Draw the following vectors.

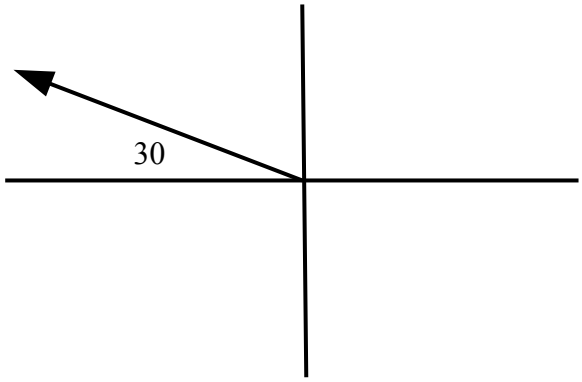
1. 5 units long, 120 degrees counter-clockwise from the positive x axis (2pts)



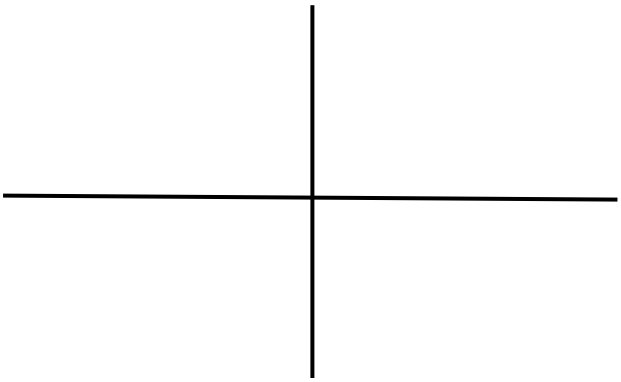
2. 3 units long, 40 degrees below the positive x axis. (2pts)



Vectors angles are sometimes specified using cardinal directions. This looks like: 30 degrees north of west. What this means is start with a vector pointing west, then drag the tip 30 degrees towards the north.

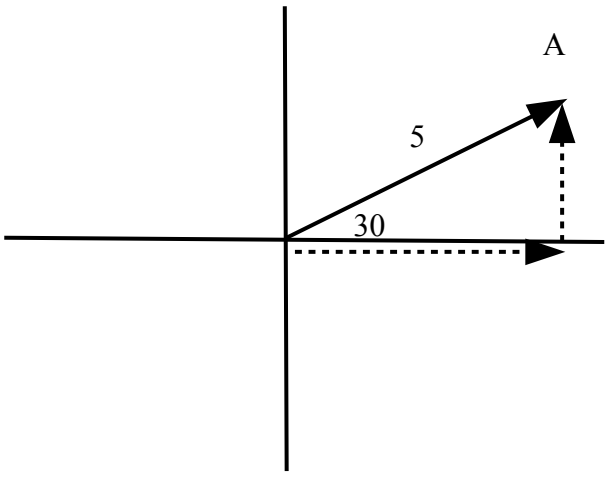


Draw a vector pointing 20 degrees east of south. (2pts)



Vector Components

Vectors can be broken into components which are vectors that point along the x and y axis that can be added together to form the original vector. Vector components can be found using trigonometry. Fill in the blanks below to find the vector components. (4pts)



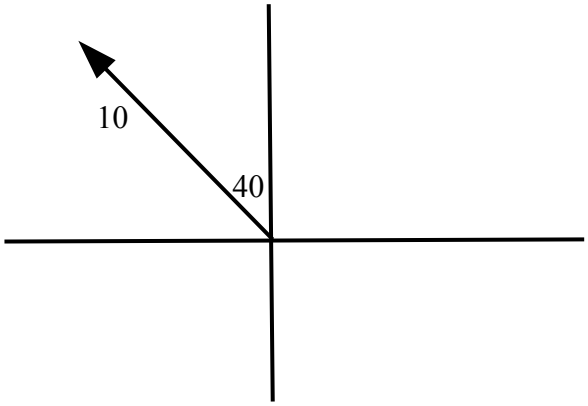
X-Component

$\cos 30 = \frac{A_x}{5}$ $A_x =$ _____

Y-Component

$\sin 30 = \frac{A_y}{5}$ $A_y =$ _____

Calculate the components of the vector B below which is 10 units long. Warning! If a component points in the negative x or negative y direction, then that component is given a negative sign. (3pts)



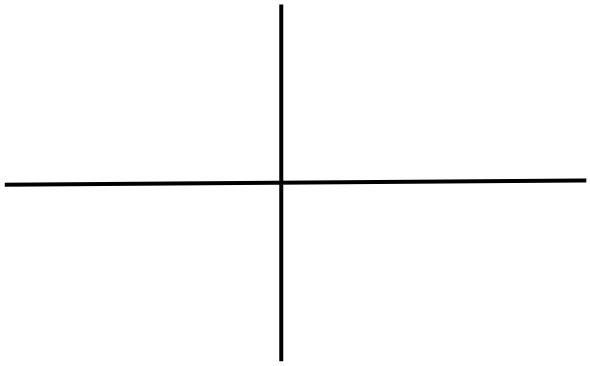
Vector Addition – Component Method

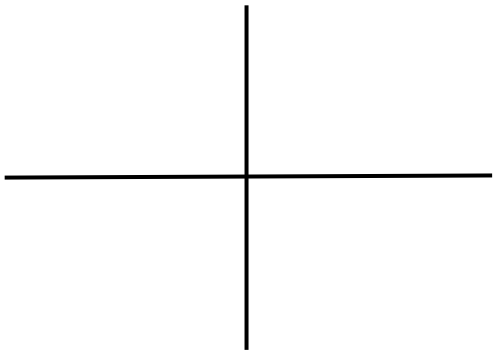
Since the x components of vectors all point along the x direction, it is legal to add the component magnitudes. Likewise with the y components. The component sums will be equal to the components of the resultant vector. This suggests the following method for vector addition.

1. Take each vector to be added and find its x and y components.
2. Add all the x components together.
3. Add all the y components together
4. Draw a resultant vector with the x component equal to your answer to step (2) and a y component equal to your answer to step (3).
5. Use the Pathagorean Theorem to find the length of the resultant vector and the inverse tan to find its direction (angle).

The steps below will be used to solve the following problem: An ant walks from its hole 20 cm at an angle 50 degrees south of east. It then turns and walks due south for 10 cm. How far is the ant from its hole at the end of its journey.

Draw diagrams of the two vectors, one vector per diagram, representing the two stages of the ant's journey. Label any angles and vector lengths. (4pts)



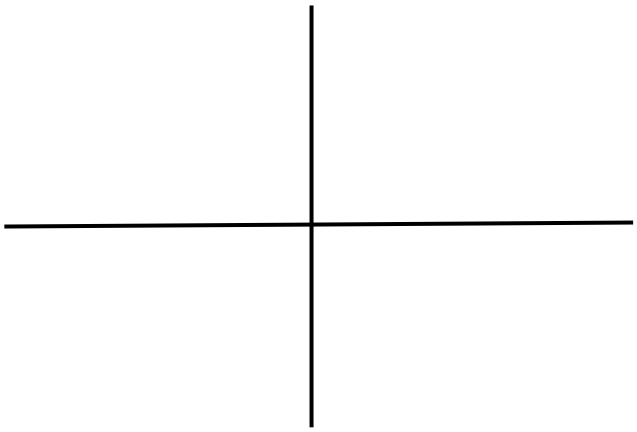


Calculate each vector's x and y components, filling in the table below. Don't forget to include appropriate negative signs! (4pts)

	x - component	y - component
Vector 1		
Vector 2		
Resultant		

Add together the two x components to get the resultant x component. Add together the two y components to get the resultant y components and fill in these values in the table above. (2pts)

Draw the resultant vector using the x and y components you just calculated. Label the lengths of the x and y components. (2pts)



Use your picture to calculate the magnitude (length) of the resultant net displacement vector. (2pts)

Calculate the angle of the net displacement with respect to one of the north south east or west directions. (2pts)

Write down something you have learned about vectors or motion (2pts).

Write down a question you have about vectors, displacement, velocity or acceleration. (2pts)