Name: _____

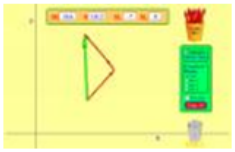
PhET Vectors Simulations Lab

Introduction:

A **vector** quantity is one that has both a **magnitude** and a **direction**. For instance, your car's velocity vector will have a magnitude (24 m/s) and a direction (northeast or 45 degrees). These simulations will illustrate how vectors are made of X and Y components, how two vectors can be added to produce a resulting vector, and how the acceleration vector affects the velocity vector in **two-dimensional** motion.

Vector Addition Simulation: *Play With Sims → Math → Vector Addition* Run Now!

Place two vectors in the work area. Change their direction and magnitude be dragging the heads of the arrows representing each vector. Click Show Sum to view the resultant (sum) of the two vectors. You may click the *Styles* to show the *X* and *Y components*.



Click on one vector and fill in the boxes: |R| θ R_x R_y

Click on another vector and fill in the boxes: |R| θ R_x R_y

Click the **resultant** vector and fill in: |R| θ R_x R_y

|R| = Magnitude of the vector θ = angle of the vector R_x = X component R_y = Y component

Repeat with two different vectors: Vectors 1 and 2

|R| θ R_x R_y

|R| θ R_x R_y

The Resultant Vector

|R| θ R_x R_y

Calculating Resultant Vectors: ***GRADED***

Find the mathematical sum of each set of vectors below **(with a calculator).**

After you have calculated, recreate (as closely as possible) the vectors in the simulation to **check your work**.

Vector Components and Vector Addition Review:

- To add vectors, break each vector into its X an Y **components** by calculating $X = R\cos\theta$ and $Y = R\sin\theta$. The components CAN BE NEGATIVE (-x , -y)
- The resultant vector's X and Y components are the sum of the X and Y components of each vector: $X_r = X_1 + X_2$
- The resultant vector's ***magnitude*** **|R|** is found using the Pythagorean Theorem using X_{total} and Y_{total} as the legs of a right triangle, where the hypotenuse is the magnitude (R).
- The **angle θ** of the resultant vector is found with the **inverse tangent** (**$\tan^{-1}$**) of the X_{total} and Y_{total} components.

Fill in all available boxes - exact, graded answers will come from calculations, use the sim to check your work

#1

Vector 1

R	angle, θ	X_1	Y_1
6.0	35		

Vector 2

R	angle, θ	X_2	Y_2
2.5	20.		

Resultant of adding vector 1 and vector 2 components

R	Θ	X_{total}	Y_{total}

#2

Vector 1 ***negative angles - be careful***

R	angle, θ	X_1	Y_1
1.8	15.		

Vector 2

R	angle, θ	X_2	Y_2
7.0	-25		

Resultant

R	θ	X_{total}	Y_{total}

#3

Vector 1

R	angle, θ	X_1	Y_1
		3.5	2.5

Vector 2

R	angle, θ	X_2	Y_2
		4.0	6.0

Resultant

R	θ	X_{total}	Y_{total}

#4

Vector 1

R	angle, θ	X_1	Y_1
	70	4.7	

Vector 2

R	angle, θ	X_2	Y_2
	-15		-2.0

Resultant

R	θ	X_{total}	Y_{total}
		12.1	10.8