Name(s) and table number _____

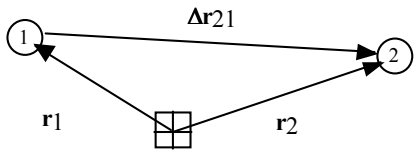
Measuring 2DVectors

In this activity you will construct real position vectors to various points on your work table and then determine the displacement vectors between these points. Each table will split as evenly as possible into two teams, "A", and "B". Each team will measure the components of three position vectors and determine corresponding displacement vectors.

Set up

On your table, are 3 colored dots labeled 1, 2, 3. These represent the points for which you will find position vectors. In addition there are two post-it notes with Coordinate System Origins marked A (for Team A) and B (for Team B.)

Procedure and measurements



Using a meter stick, your team will measure the *x*- and *y*-components of the position vectors for each of the three points using the coordinate system origin for your team. Measure as accurately as you can and estimate the uncertainties.

Next use your position vector measurements, $\vec{r}_1,\ \vec{r}_2,\ \vec{r}_3$ to determine the components of the three displacement vectors $\Delta\vec{r}_{21} = \vec{r}_2 - \vec{r}_1,\ \Delta\vec{r}_{32} = \vec{r}_3 - \vec{r}_2,\ \Delta\vec{r}_{13} = \vec{r}_1 - \vec{r}_3$. For each component of each displacement, calculate the measurement uncertainty, using the error propagation rules.

Note: Calculations called for on the following results page should be shown on separate pieces of paper and not squeezed onto the results page.

Team _____

Position	x (cm)			y (cm)		
$\vec{r}_1$		±			±	
$\vec{r}_2$		±			±	
$\vec{r}_3$		±			±	

Displacements for Team _____

Displacement	Δx			Δy		
$\Delta\vec{r}_{21}$		±			±	
$\Delta\vec{r}_{32}$		±			±	
$\Delta\vec{r}_{13}$		±			±	

Now calculate the magnitude of the displacement vector and *its* uncertainty, using the information recorded above, and enter into a table. Then measure the length of a piece of string stretched between the points and its uncertainty.

Displacement	Magnitude			Measured with string		
$\Delta\vec{r}_{21}$		±			±	
$\Delta\vec{r}_{32}$		±			±	
$\Delta\vec{r}_{13}$		±			±	

Questions:

1. Compare the positions you measured with those of the other team. Are they the same or different, within uncertainty? Explain the result.

2. Compare the displacements you measured with those of the other team. Are they the same or different within uncertainty? Explain the result.

3. Are the calculated magnitudes of the displacements equal to the measured distance to within the uncertainty?

4. Suppose we now add your three displacement vectors. What *should* be the result of this vector sum, if we have done it right? Do your results agree with your expectation, within uncertainty?