PHYSICS **Reiner, Hutchison, Vourgourakis**

Lab 2-1: Vector Addition

A force table is a physics lab apparatus that consists of a small table with a 360 degree circle printed on the top, along with 3 strings tied to a central ring. The strings go over pulleys and are attached to platforms, from which varying masses can be hung. The pulleys themselves can be moved to any angle along the outside of the circle, so that the center ring can be pulled in 3 different directions by 3 different masses.

In this exercise, you will be given two masses to be hung at two positions on the force table. Your job is to determine where to hang a third mass to balance those two masses, and what that third mass needs to be. You will do this in two different ways: by scale diagram and by vector components. The concept is that when the 3 vectors pulling on the ring all add up to zero, then the ring will be balanced. Your calculations can be tested by simply pulling the pin in the middle of the force table. If the ring does not move, then it is balanced!

Assigned values: _____ g at _____ degrees and _____ g at _____ degrees.

(note that these values do not include the platforms, which have masses of either 5 or 50 grams each)**

Step 1: Make a sketch of the ring, in which each you represent each of your assigned hanging masses (<u>including</u> the extra 5 or 50 grams from the platform) as a vector, pointing in the appropriate direction, and with an appropriate length. You may want to convert the 0-360^0 directions into N-S-E-W directions.

Step 2: Add the 2 assigned vectors by way of a scale diagram. You will need a protractor and a ruler in order to do this. Remember that vectors are always added tip to tail. You may do it in the space below or on a separate piece of paper (attach it, please!), as you wish.

Determine the resultant vector from adding your 2 assigned vectors:

Subtract 5 or 50 grams and change the direction 180^0, and you have determined the mass which needs to be added to the 3rd pulley and the angle at which the 3rd pulley should be placed in order that it balance the 2 assigned masses:

How does the value you obtained compare to those of your lab partners?

Step 3: Add your 2 assigned vectors by way of vector components (separate each vector into X and Y components, add the components to find the components of the resultant, then put these components back together to find the overall size and direction of the resultant). Consider 0 – 180 on the force table to be the X axis and 90-270 to be the Y axis. Show all work and put your results into the table shown below:

	X-component	**Y-component**
Vector 1		
Vector 2		
Resultant		

Using the Pythagorean theorem and some trignonometry, determine the overall magnitude and direction of your resultant vector.

Again, subtract 5 or 50 grams and change the direction 180^0, and you have determined the mass which needs to be added to the 3^{rd} pulley and the angle at which the 3^{rd} pulley should be placed in order that it balance the 2 assigned masses.

How does the value you obtained compare to those of your lab partners? How does it compare to the one you obtained using a scale diagram? Which one do you think is more accurate?