

## Force Table Lab 3

In this lab we will investigate how forces add together vectorially. By treating forces as vectors and finding the resultant of three and even more forces, the forces should balance, or  $F = 0$ . If two or more forces pass through the same point in a system of forces, they may be replaced by one force which is called the **resultant**. If this force turns out to be zero, we can conclude that the individual forces all balance out and the vectors used to describe them add up (vectorially) to zero.

When making your measurements, you may encounter some error. In any experiment there is error and it must be addressed. Error in experiments is quantified, usually with a +/- amount of error. You can imagine (and will need to list) where you are encountering error. You will also figure out how much you are erring and will be able to quantify that error. You should also comment about the amount of error that can propagate throughout an experiment.

### ***Procedure:***

**Part 1:** Set the force table so one vector is on  $0^\circ$  and the other is on the  $180^\circ$  line. Remember the weight holder is 5 grams.

- a) Draw a particle model with the vector forces
- b) Write down the magnitudes and errors of the two vectors below.
- c) Break the vectors into components then add together below.
- d) Do your results add to zero? What does this suggest about vectors that are equal in magnitude and opposite in direction?

**Part 2:** Set the force table up with three vectors, one on the  $0^\circ$  line, one on the  $120^\circ$  line and one on the  $240^\circ$  line. Use the round masses to balance your vectors. Record the amount of mass necessary to balance the forces on each vector.

- a) Draw a particle model picture of your scenario
- b) Write down the magnitudes and errors of the three vectors
- c) Break the vectors into components and then add together
- d) How close do your results come to the null vector?

**Part 3:** Set up the force table using two 5 g masses and one 7.5 g mass. Locate each force so they balance. Record the angle of each vector.

- a) Draw a particle model of the scenario
- b) Write down the magnitudes and errors of the three vectors below.
- c) Break the vectors into components and then add together.
- d) How close do your results come to the null vector?

**Part 4:** Set up the force table using three different weights and angles of your choice. Balance the forces then:

- a) Draw a particle model of your scenario.
- b) Break them into components (including the error measurement).
- c) Add them together. Do they add vectorially to zero?