FORCES IN EQUILIBRIUM

OBJECTIVE: To investigate the nature of equilibrium, of balanced forces, and the manner in which forces (as vector quantities) are combined.

BACKGROUND

A *concurrent force system* is a set of forces that together act upon a single point. Forces can be added together, however since forces are vector quantities the procedure for adding vectors must be followed. With vectors, we care about directions. Using vector addition, a set of forces acting upon one point can be replaced by a single equivalent force that we call the *resultant* of the system. The resultant is the single force that would need to be applied to the object to equate to the original system of forces.

If a set of concurrent forces adds (as vectors) to zero, the system is in equilibrium. An *equilibrant* is a single force that, when added to a system that is not in equilibrium, will establish equilibrium for the system.

WRITE-UP

Although you are working in groups, EVERY STUDENT is required to submit a write-up for this lab. THIS WRITE-UP DOES NOT HAVE TO BE WORD-PROCESSED BUT IT DOES HAVE TO BE NEAT.

PROCEDURE

1. The force table before you has been leveled. DON'T MOVE IT!!. The following masses (masses are approximate, the actual mass is written on each) have been placed in the following locations: 150g @ 0^o; 220g @ 50^o; 120g @ 280^o. These three masses cause the ring in the center of the table to be out of equilibrium. The system does not move because the pin supplies the equilibrant force necessary for static equilibrium. Calculate the position and the mass attached to a fourth string so that, with the fourth mass, your ring will come into static equilibrium with your other three masses without the need for the pin. SHOW ALL CALCULATIONS. YOUR CALCULATIONS MUST BE NEAT AND YOU MUST EXPLAIN EACH OF YOUR STEPS. REMEMBER ALSO – FORCES ARE VECTORS AND CAN BE ADDED AS SUCH; MASS IS NOT A VECTOR AND SHOULD NOT BE ADDED AS VECTORS.

2. **After** you have figured out what the fourth mass should be, add your mass in the proper position and remove the central pin in the table that had been keeping the ring from falling off the table to see if the resulting system is in equilibrium. Describe what you found and discuss.