Equilibrium – Get Some

According to Newton's First Law of Motion, an object remaining at rest even when forces are acting upon it does so because there is ***no net force*** *acting on the object. This means that the* ***resultant*** *or* ***vector sum*** *of all the forces acting on the object is zero. An object in this state or condition is said to be "in* ***equilibrium****."*

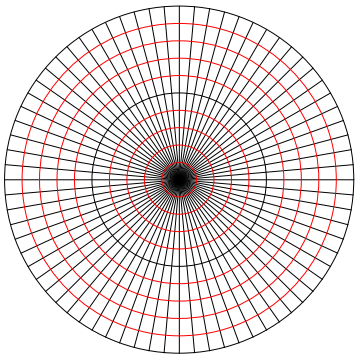
In this lab exercise, you will apply forces to an object in such a way that the object remains stationary. You will then verify that the resultant force is indeed zero.

1. Place the ring (washer) over pin with the force scales attached in the positions indicated in the data table.
2. Pull each scale in the indicated directions. Pull so that the ring remains centered over the origin. At least one of your forces should be over 10.0 N.
3. Record the reading on each scale. Record to the nearest tenth the smallest division on your scale.
4. Calculate the horizontal (x) and vertical (y) components of each force.
5. Sum the components. Record these values in the data tables.
6. Use the Pythagorean theorem and the inverse tangent function to calculate each resultant force's magnitude and direction. Your resultant magnitudes should be close to zero.

	Force (Newtons)	Angle (Degrees)	Horizontal Component	Vertical Component
F_1		**0°**		
F_2		**110°**		
F_3		**200°**		
Sum of Components =				
Resultant =				

SHOW CALCULATIONS HERE:

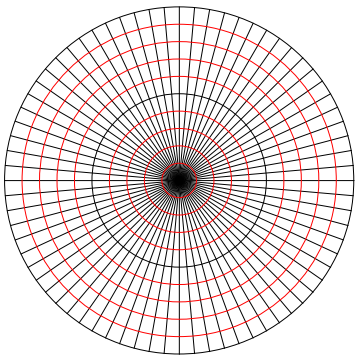
SKETCH THE VECTORS BELOW:



	Force (Newtons)	Angle (Degrees)	Horizontal Component	Vertical Component
F_1		45°		
F_2		135°		
F_3		270°		
Sum of Components =				
Resultant =				

SHOW CALCULATIONS HERE:

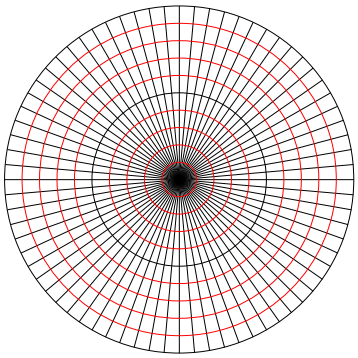
SKETCH THE VECTORS BELOW:



	Force (Newtons)	Angle (Degrees)	Horizontal Component	Vertical Component
F_1		80		
F_2		210°		
F_3		80°		
Sum of Components =				
Resultant =				

SHOW CALCULATIONS HERE:

SKETCH THE VECTORS BELOW:



Conclusion

Look at your results. If $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$ add up to be zero, how must $\vec{F}_1 + \vec{F}_2$ compare to $\vec{F}_3$? Be specific.

The following object is in equilibrium. What is the magnitude of the unknown forces, F_g and F_T, where F_g is vertical, and F_T is horizontal?