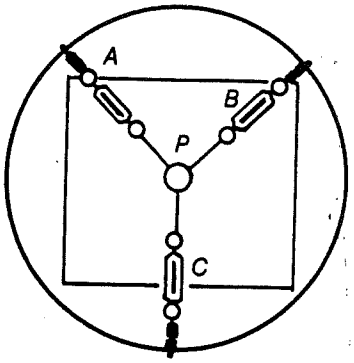
ADDITION OF VECTORS LAB

Purpose: In this lab, we will show that forces can be added as vectors both graphically and mathematically to confirm Newton's 2nd and 3rd Laws.

Reference: Textbook, Chapter 4 and Appendix A



Procedure:

1. Set up equipment as shown. Be sure to zero scales. Avoid 90°, 180°, and small angles. Use forces > 3 N.
2. On a clean sheet of plain paper, each group member is to make a sketch, labeling all magnitudes and string directions. Use pencil!
3. Choose a scale that results in a large drawing. Use a ruler to neatly make sketch to scale.

Data: Each group member is to accomplish the following on his/her drawing:

1. Name and scale used to draw the vectors.
2. Neat drawing, to scale, of the 3 force vectors with magnitude (Newtons) and angles labeled.
3. Show addition of any 2 vectors by graphical and mathematical methods (Law of Cosines). Draw and label the resultant vector.
4. Error calculation between each of the 2 methods and the 3rd unused vector.
5. Collate all group members' results in a data table:

Name	Force a	Force b	Force c	Graphical a + b	% error	Math a + b	% error

Questions: Answer as a group in complete sentences:

1. How do your graphical and mathematical methods compare? Which is more accurate?
2. Compare the magnitude and direction of the resultant vector to the 3rd (unused) vector. How does this confirm Newton's 3rd Law?
3. Suppose you add all 3 vectors head to tail; what geometric shape do you have? Does this make sense? What does this say about the motion of the center washer? About Newton's 2nd Law?
4. Does it matter in what order you add vectors, i.e., does the commutative property of addition apply to vectors?

Conclusion and summary: Write individual conclusions and summaries (ID yourself) based on individual results of what each of you found while doing the graphical and mathematical vector addition. How much error did you have? How were Newton's 2nd and 3rd Laws demonstrated?

Grading: Full group lab report required, worth 25 points.