11. Measure the various angles with a protractor. Record the results next to the symbols on your diagram.

12. Measure arrow R_{12} with a ruler and apply your scale factor to determine the magnitude of this resultant force vector. For instance, if you measure 4.5 cm and if your scale factor is 1 cm ~ 2 N; then, R_{12} = 4.5 cm x 2 N /cm = 9 N. Record your value of R_{12} next to that symbol on your diagram.

13. Ideally, R_{12} should be equal and opposite to F_3. Calculate the percent difference in magnitude. (Sample calculation for Trial I)

$$\text{Percent difference in magnitude} = \left|\frac{F_3 - R_{12}}{F_3 + R_{12}}\right| \times 200$$

$$= \left|\frac{15 - 17.2}{15 + 17.2}\right| \times 200. \qquad \text{(Substitute)}$$

$$= \underline{\quad 13.6 \quad}\ \% \qquad \text{(Final Answer)}$$

14. The total angle between R_{12} and F_3 is equal to $\theta_{1R} + \theta_{13}$. Ideally, this angle should be equal to 180°. Calculate the percent error in this angle. (Sample calculation for Trial I)

$$\text{Percent error in angle} = \frac{\theta_{1R} + \theta_{13} - 180^\circ}{180^\circ} \times 100$$

$$= \frac{35 + 125 - 180}{180} \times 100 \qquad \text{(Substitute)}$$

$$= \underline{\quad -11.1 \quad}\ \% \qquad \text{(Final answer)}$$

15. Copy the values of the various angles and force magnitudes from your diagram onto the Data Table at the end of this section. Also copy the results of steps 13 and 14 onto the data table.

16. Alter the positions of the balances and repeat steps 2 through 15 for a Trial II. Be sure that each drawing is marked with the trial number. Do any calculations for Trials II and III on scratch paper. Record the measured data and calculated results in the appropriate place in the Data Table. Be sure that the magnitudes and angles of the forces are distinctly different in your three trials. The angle θ_{12} should be greater than 90° in at least one trial and less than 90° in at least one trial.

Note: Each student must turn in a data table that is complete for all three trials. Each student must turn in a diagram, as previously described, for at least one of the trials. If there should be more than three students in a group, it will be necessary to recopy one of the diagrams (by hand or by a photocopy machine), so that each student can turn in a diagram with his report. If there are only two students in a group, one student should turn in two diagrams and the other student should turn in the other diagram. Staple the diagram to the back of this report.