

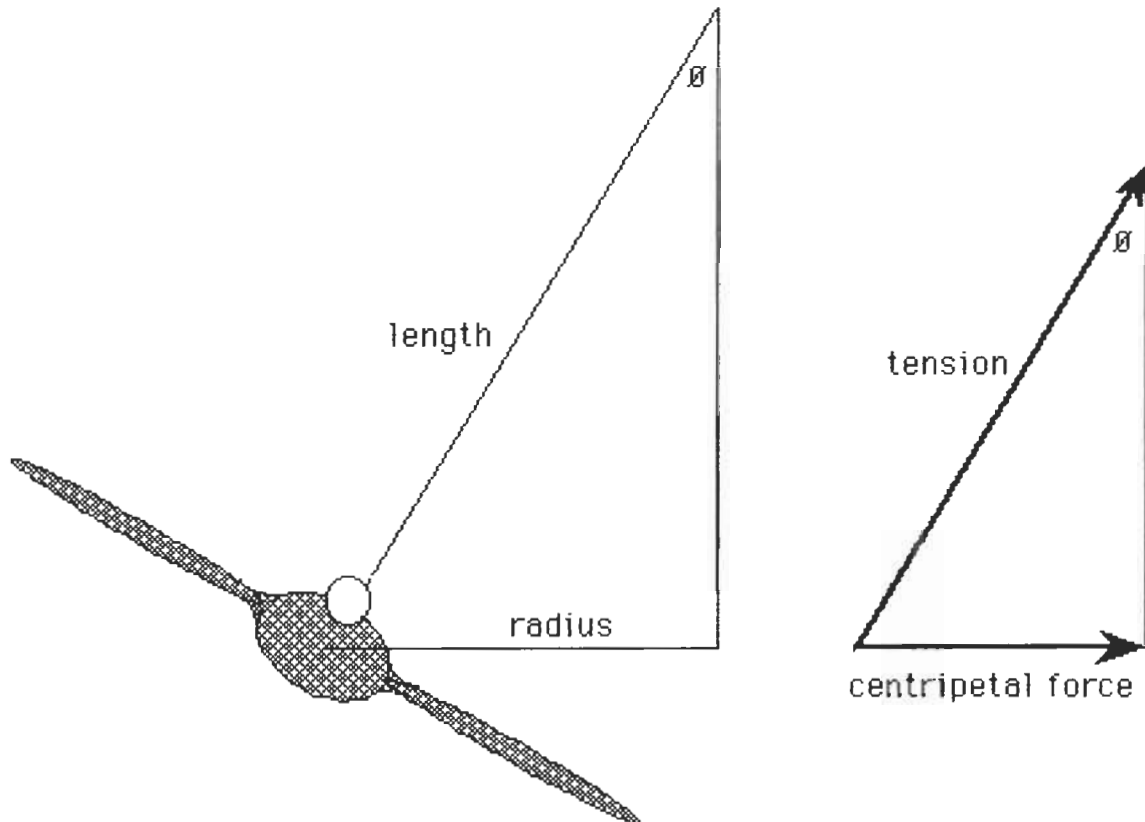
CAPE-tech Physics Laboratory Activity

Flying in Circles

by

Carl Duzen and Jane & Jim Nelson

The purpose of this laboratory activity is to compare the centripetal force acting on a toy airplane, moving with uniform circular motion, by two methods. The first method involves analysis of the forces acting on the airplane and the second method involves kinematics relationships.



[diagram #1]

MATERIALS & PROCEDURES:

1. Determine the airplane's mass and then the vertical component of the tension in the string used to tether the airplane.
2. Determine the radius of the path followed by the airplane and the length of the string used to tether the airplane. Use these to find the angle Ø (see diagram above) and the horizontal component (i.e., the magnitude of the centripetal force) of the tension in the string used to tether the airplane.
3. Measure the period of the circular motion and then the speed of the airplane.
4. Calculate the magnitude of the centripetal force using $F_c = \frac{mv^2}{r}$, and compare the result with the value obtained in step 2.

DATA TABLE:

Mass of Airplane ()	Radius of circular motion ()	Length of string used to tether airplane ()	Period of the circular motion ()

QUESTIONS & CALCULATIONS:

- Using the horizontal component of the tension in the string used to tether the airplane, determine the magnitude of the centripetal force. Show all work and calculations below:

$$F_c = \underline{\hspace{2cm}} \text{ (give your value)}$$

- Now determine the centripetal force using $F_c = \frac{mv^2}{r}$. Show all work and calculations below:

$$v = \underline{\hspace{2cm}} \text{ (give your value)}$$

$$F_c = \underline{\hspace{2cm}} \text{ (give your value)}$$

- Assume that the result found in question 1 is the accepted value, what is the percent difference between the two results? Show your work.
- Explain why the two measurements may be different.

From the article "Circular Motion Studies with a Toy Airplane" by Frank Butcher from The Physics Teacher, December 1987. Reproduced with permission of the author.

Note: For best results, fly the plane in a counter-clockwise direction, as seen from the bottom. If you have difficulty, shorten the string that is used to tether the airplane.