Information for the Teacher

The PocketLab centripetal acceleration was obtained from the *y* component of the accelerometer data. The PocketLab angular velocity was obtained from the z component of the gyroscope data. Data should be collected near the horizontal plateau for each of the three fan speeds

Data Table for PocketLab Centripetal Acceleration Experiment with Ceiling Fan

	A	B	C	D	E	F	G
FAN SPEED	*PocketLab Centripetal Acceleration (g)*	*PocketLab Angular Velocity (°/s)*	*Period (s)*	*Tangential Velocity (m/s)*	*Centripetal Acceleration from v^2/r (m/s^2)*	*Centripetal Acceleration from column E (g)*	*Percent Difference |A-F|/F x 100%*
LOW	*7.7*	*1050*	*0.34*	*3.70*	*68.45*	*7.0*	*10*
MEDIUM	*3.7*	*730*	*0.49*	*2.56*	*32.8*	*3.4*	*9*
HIGH	*1.2*	*407*	*0.88*	*1.43*	*10.2*	*1.0*	*20*

Sample calculations for FAST speed fan:

Column A - Obtained directly from either the movie or the y component of the accelerometer csv file.

Column B - Obtained directly from either the movie or the z component of the gyroscope csv file.

Column C - Frequency = 1050 deg/s x 1 revolution/360 deg = 2.92 revolutions/s.

Therefore, period = 1 / 2.92 revolutions/s = 0.34 s.

Column D - Tangential velocity = $2\pi r/T = 2\pi(0.2 \text{ m})/0.34 \text{ s} = 3.70$ m/s. (Note that *r* is obtained from the close-up photo of the fan.)

Column E - Centripetal acceleration = $v^2/r = (3.70 \text{ m/s})^2 / 0.2 \text{ m} = 68.45 \text{ m/s}^2$.

Column F - Centripetal acceleration (in g's) = $68.45 \text{ m/s}^2 / 9.80 \text{ m/s}^2 = 7.0$ g.

Column G – Percent Difference = $|7.7 – 7.0| / 7.0 \times 100\% = 10\%$.

Centripetal acceleration from the accelerometer and from data obtained from the gyroscope agree to within about 10% for the high speed setting of the ceiling fan.