(TO) graph how the length of a pendulum varies with the square of its period. To observe that the ratio of these variables yields a constant number.

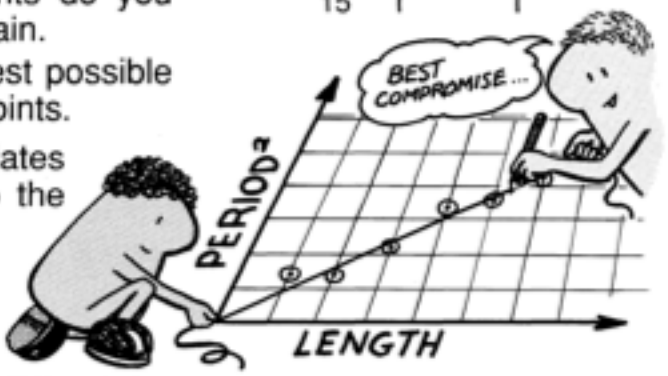
SQUARE IT ○ Pendulums ( )

1. Copy the period data from activity 5 into this new table:

Activity 5 last column

LENGTH L=cm	PERIOD T=s/c	PERIOD² T²=(s/c)²
0		
2		
3		
⋮		
15		

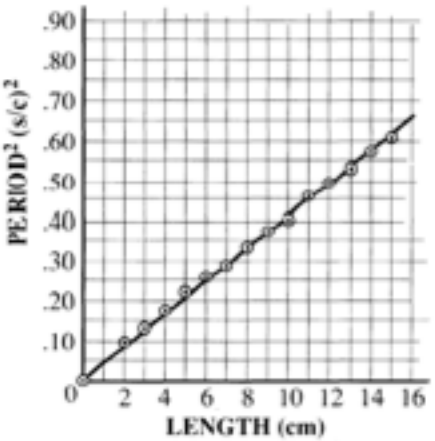
2. Find the square of each period: use a calculator to multiply the period by itself, then enter each result (to three figures) in column 3.
3. Graph your data from columns 1 and 3.
   a. Your points will distribute into a fairly straight line, with some scattering due to experimental error. Which points do you trust the most? The least? Explain.
   b. Use a thread to draw the best possible straight line among your data points.
4. Each point on your graph line relates a unique pendulum length (L) to the square of its particular period (T^2).
   a. Compute the ratio L/T^2 for T^2 = .20, .40, and .60.
   b. What always seems true?



Answers / Notes

1-3.

LENGTH L=cm	PERIOD T=s/c	PERIOD² T²=(s/c)²
0	0	0
2	.313	.098
3	.369	.136
4	.423	.179
5	.468	.219
6	.508	.258
7	.538	.289
8	.574	.329
9	.609	.371
10	.637	.406
11	.676	.457
12	.702	.493
13	.730	.533
14	.757	.573
15	.783	.613



3a. Data points for longer lengths are more reliable than data points for shorter lengths, because the pendulum swings over a longer time interval and at a slower pace that is more easily tracked. *(The point at [0,0], however, is a given with no margin of error at all. A pendulum with no length has an infinitely short period.)*

3b. *Students should position one end of the thread at (0,0) then align the other end so that as many points as possible (especially those of longer lengths) remain near or under the straightened thread.*

4a. $\frac{L}{T^2} = \frac{4.8}{.20} = 24.0$ $\frac{L}{T^2} = \frac{9.7}{.40} = 24.3$ $\frac{L}{T^2} = \frac{14.5}{.60} = 24.2$

4b. The ratio is always close to 24. *(The most ideal result is 25, a constant that will be important in the next activity.)*

This constant does have units: 25 cm/sec². While units are an extremely important part of any measurement, we have not included them when substituted into mathematical formulas, for the sake of simplicity.

Materials

- ☐ The data table from activity 5.
- ☐ A calculator.
- ☐ Graph paper.
- ☐ Thread.
- ☐ An index card or straightedge.