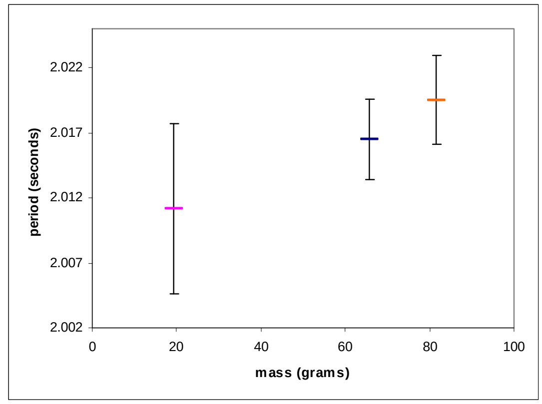
1a) Galileo claims that the period of a pendulum is independent of the mass of the bob.

1b) Galileo has argued that the time it takes a body to fall a certain distance (starting from rest) is independent of the mass of the body. He has connected this argument to his claim about how the time it takes the bob to swing back and forth through a fixed angle, and thus distance, is also independent of the mass of the bob.

1c) (As shown in class)

1d) According to the data, the period does increase as the mass increases. However, the uncertainty range in the measurements clearly overlaps, so the best we can conclude from this data is that it is consistent with Galileo's claim.



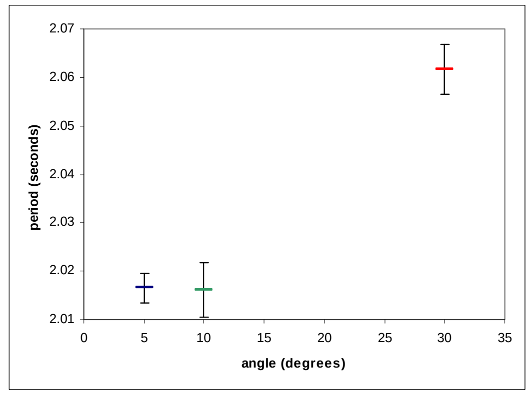
2a) Galileo claims that the period of a pendulum is independent of the initial angle of the swing.

2b) Answers will vary.

2c) (As shown in class)

2d) From the graph, we can see that the 5 degree and 10 degree swing results are consistent, given uncertainty, with Galileo's claim. However, this data clearly shows that the 30 degree swing results are, even considering uncertainty, inconsistent with the claim that the period of the swing is independent of its initial angle.

2e) Answers will vary.



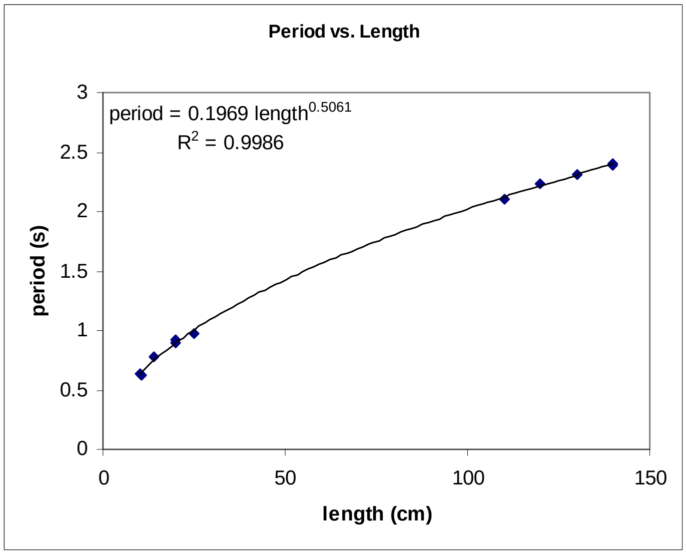
3a) According to Galileo and consistent with our experimental results, the period of a pendulum is proportional to the square root of its length, or alternatively, the period squared is proportional to the length. This means that the ratios of period squared are equal to the ratios of the lengths: $\frac{(\text{Period 1})^2}{(\text{Period 2})^2} = \frac{\text{Length 1}}{\text{Length 2}}$

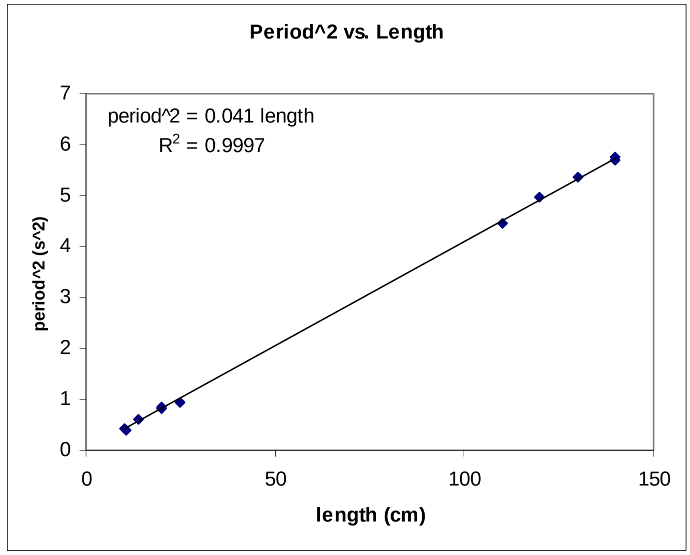
Using the given information, we see that: $\frac{(2\text{ s})^2}{(\text{Period 2})^2} = \frac{100\text{ cm}}{25\text{ cm}} = 4$

Rearranging this, we get that $(\text{Period 2})^2 = \frac{(2\text{ s})^2}{4} = \frac{4\text{ s}^2}{4} = 1\text{ s}^2 \Rightarrow \text{Period 2} = 1\text{ s}$.

This is consistent with the graph obtained from experimental results (see back).

3b) We'll use similar reasoning as above: $\frac{(2\text{ s})^2}{(3\text{ s})^2} = \frac{100\text{ cm}}{\text{Length 2}} \Rightarrow \text{Length 2} = \frac{(3\text{ s})^2}{(2\text{ s})^2}100\text{ cm} = 225\text{ cm}$.





Corresponding Learning Goals for Week 3 Physicists Workshop:

- Construct a simple pendulum and observe its motion.
- Investigate the factors that affect the period of a pendulum.
- Explore Galileo's claims that the period of a pendulum is independent of the angle of the swing and of the mass of the pendulum bob, and is dependent on the length of the pendulum; more specifically, the period of a pendulum is proportional to the square root of the length of the pendulum (or that the period squared is proportional to the length).
- Given the length and period of a particular pendulum, determine the length of a second pendulum given its period, or predict the period of a second pendulum given its length.