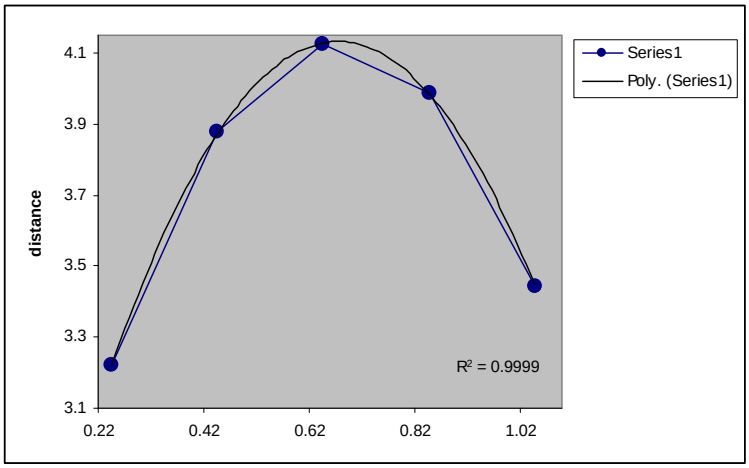
Stages of Discovery - Physics Exam Study Questions

0. Review your physics lecture notes, readings, and various homework and workshop sets with the "Physics Learning Goals relevant for Week 10 Exam" document as your guide. The questions below provide some more practice/review.

1. You are helping some students with their physics homework. They show you a graph they have made for the motion of a ball.
a) What are you able to tell from this graph?
b) What questions would you need to ask them in order to better understand this graph?
c) What advice would you give them about improving this graphical presentation of data?



2. You demonstrated that the lenses you used in physics workshop could be modeled using ray diagrams and the thin-lens equation: $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$.

a) You have a lens of known focal length 10 cm. You place an object 50 cm from the lens. Show that in order to obtain a clearly focused image on a screen, you would need to put the screen 12.5 cm from the lens.
b) You have a lens of known focal length 20 cm. You find that when you place a screen 60 cm from the lens, you obtain a clearly focused image. Show that the object is 30 cm from the lens.
c) You have a lens with unknown focal length. Describe carefully the measurements and calculations you would do in order to determine the focal length of the lens.

3. You saw in lab that the period of a 100 cm long pendulum swinging through small angles was almost exactly 2 s.

a) Show that the period of a 200 cm long pendulum is $2\sqrt{2}\ \text{s} = 2.83\,\text{s}$.

b) Show that a pendulum that has period 4 seconds is 400 cm long.
c) Describe some essential features of the experiments you did to determine the dependence of the period of a pendulum on swing angle, mass, and length.

4. Draw a motion diagram and a position vs. time graph for the following:
a) Two objects moving at constant speed (uniform motion), with one moving twice as fast as the other.
b) An object moving with uniformly accelerated motion in a straight line.
b) Projectile motion (show position vs. time graphs for vertical and horizontal motion).
c) An object moving with neither uniform motion nor uniformly accelerated motion.

5. Go to the Week 4 Calendar page. Go to Videos for Analysis (under Wednesday October 19). Open the file "different mass drop" (you may need to save the file to your computer before opening it). This is a video version of a demonstration we did in class. Describe the demonstration in your own words (describe what you observe). What claim of Galileo does this demonstration support? Briefly explain the claim and how the demonstration supports it.

6. Go to the Week 5 Calendar page. Go to Videos (under Wednesday October 26). Open the file "Video 4" (you may need to save the file to your computer before opening it). This is a video version of a demonstration we did in class. Describe the demonstration in your own words (describe what you observe). What physics principles does this demonstration show? What conclusions can you draw from these observations?

7. Use $c = 3 \times 10^8$ m/s as the speed light travels in vacuum. In one hour, light travels a distance of 1 lt-hr.

a) Show that 1 lt-hr = 1 080 000 000 000 m = 1.08×10^{12} m.

b) The distance between the earth and the sun is approximately 1.5×10^{11} m. Show that this distance is approximately 8 light minutes (lt-min).

8) The Week 9 Workshop (Relativity III: Spacetime) has two problems which serve as reviews of the major concepts of special relativity we have studied: problem 8) and the last page of problem 9.