Name_____

University of Maryland
Department of Physics

Physics 122 **Dr. E. F. Redish**
Spring 2010 **Exam 1 (Makeup)** **11. March. 2010**

Instructions:

Do not open this examination until the proctor tells you to begin.

1. When the proctor tells you to begin, **write your full name at the top of every page.** This is essential since this exam booklet will be separated for grading.
2. Do your work for each problem on the page for that problem. You might find it convenient to either do your scratch work on the back of the page before starting to write out your answer or to continue your answer on the back. **If part of your answer is on the back, be sure to check the box on the bottom of the page so the grader knows to look on the back!**
3. On all the problems *except the multiple choice questions in problem 1 or where it says not to explain*, your answers will be evaluated at least in part on how you got them. More than half the credit of the problem may be given for the explanation. YOU MAY EARN LITTLE OR NO CREDIT FOR YOUR ANSWERS IF YOU DO NOT SHOW HOW YOU GOT THEM. Partial credit will be granted for correct steps shown, even if the final answer is wrong. Explanations don't need to be long, but they need to show what physics you are using and assumptions you are making.
4. Write clearly and logically so we can understand what you are doing and can give you as much partial credit as you deserve. We cannot give credit for what you are thinking — only for what you show on your paper.
5. If you try one approach and then decide on another, cross out the one you have decided is wrong. If your paper contains both correct and incorrect approaches the grader will not choose between the two. You will not receive any credit when contradictory statements are present, even if one is correct.
6. All calculations should be done to the appropriate number of significant figures.
7. At the end of the exam, write and sign the honor pledge in the space below ("I pledge on my honor that I have not given or received any unauthorized assistance on this exam."):

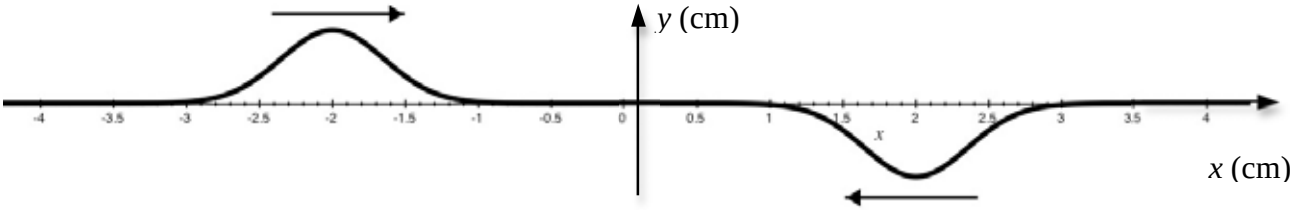
#1:	#2:	#3:	#4:	#5:	Total

****** Good Luck ******

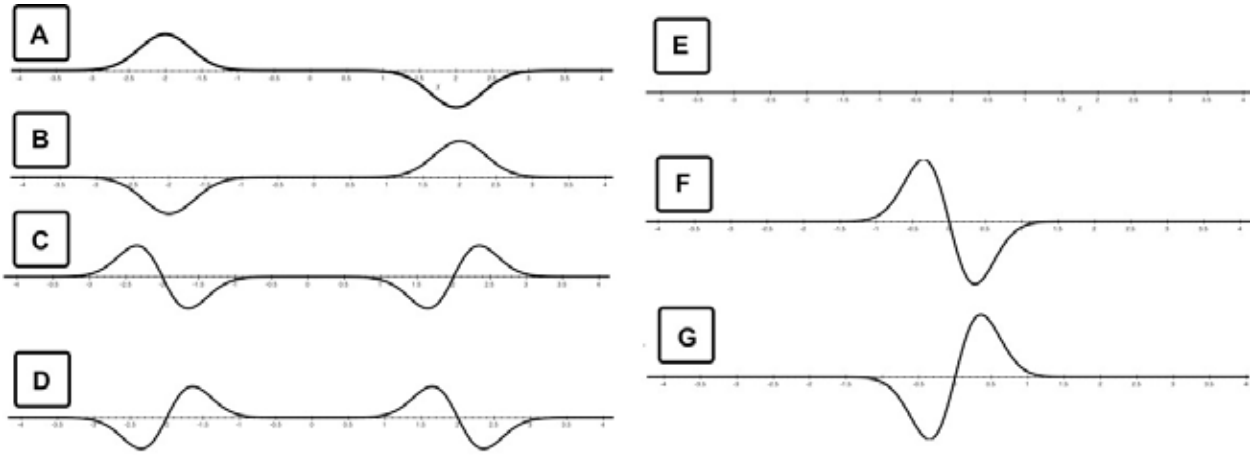
NAME_____ **POINTS**_____

Physics 122 **Dr. E. F. Redish**
Spring 2010 **Exam 1 (M.U.)**

1. (30 points) Two pulses are started on a stretched string. An upward pulse is started on the right that moves to the left. At the same instant, a downward pulse is started on the left that moves to the right. At $t = 0$ their peaks are separated by a distance of 4 cm as shown below. The pulses move on the string with a speed 200 cm/s.



In the figure below are shown graphs that could represent properties of these pulses on the string. The vertical scales in the graphs are arbitrary and not necessarily the same. The horizontal scales all represent positions on the string (x).



For the situation and the properties (a) - (f) below, select which graph provides the best representation of the given property. If none of the graphs are correct, write "N". (5 pts each)

_____ (a) Which graph best represents the appearance of the string at time $t = 0.01$ s?

_____ (b) Which graph best represents the appearance of the string at a time $t = 0.02$ s?

_____ (c) Which graph best represents the y-component of the velocity of the bits of the string at a time $t = 0$?

_____ (d) Which graph best represents the y-component of the velocity of the bits of the string at a time $t = 0.01$ s?

_____ (e) Which graph best represents the y-component of the velocity of the bits of the string at a time $t = 0.02$ s?

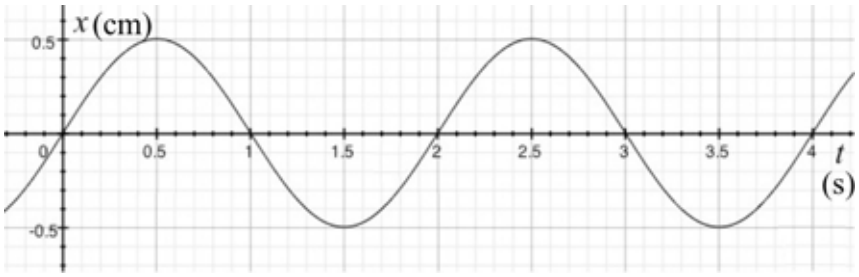
_____ (f) Which graph best represents the x-component of the velocity of the bits of the string at a time $t = 0$?

If you need more space, continue on the back and check here. ☐

NAME_____ **POINTS**_____

Physics 122 **Dr. E. F. Redish**
Spring 2010 **Exam 1 (M.U.)**

2. (20 points) Below is shown the graph of the *x* position measured by a sonic ranger but the origin is shifted so that the 0 of the coordinate occurs at the equilibrium point of the system.



A. Assume that the graph represents the position of a wooden disk hanging on a spring from a bar and that *x* is the up-down coordinate with + being up.

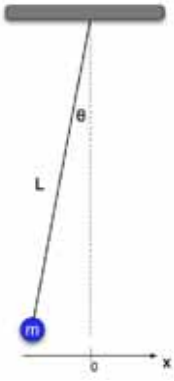
A1. The mass of the disk is 500 g. Find the spring constant, *k*. (5 pts)

$k =$

A2. How much will the spring be stretched when the mass is at the equilibrium point? (5 pts)

$\Delta L_0 =$

B. Assume that the graph represents the left-right position of a pendulum and that *x* is positive to the right as shown.



B1. The mass of the bob is 150 g. Find the length of the pendulum, *L*. (5 pts)

$L =$

B2. Could you use the information in the graph to figure out the maximum angle the bob will reach? If so, explain briefly how. If not, explain why not. (5 pts)

Yes ____ No _____

If you need more space, continue on the back and check here. ☐

NAME_____ **POINTS**_____

Physics 122 **Dr. E. F. Redish**
Spring 2010 **Exam 1 (M.U.)**

3. (15 points) It's nearly spring and the cherry trees will soon be in bloom in Washington, DC! Estimate the number of blossoms on a typical blooming cherry tree. (The tree shown in the picture is about twice as tall as a typical physics professor and an individual blossom is about 2 inches across.)

Be sure to clearly state your assumptions and how you came to the numbers you estimated, since grading on this problem will be mostly based on your reasoning, not on your answer.

If you need more space, continue on the back and check here. ☐

NAME_____ **POINTS**_____

Physics 122 **Dr. E. F. Redish**
Spring 2010 **Exam 1 (M.U.)**

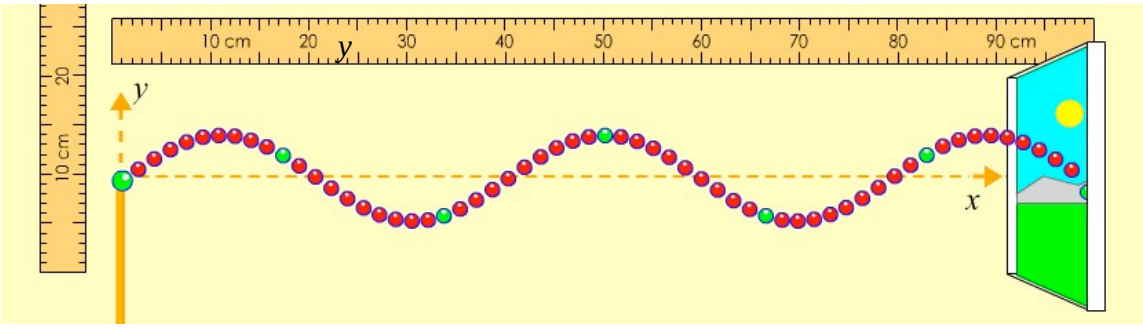
4. (10 points) In our discussion of the ray model of light, we built up a series of "foothold ideas" or principles from everyday experience. We then used these principles to predict the behavior of shadows, spots, and mirrors and we observed this behavior in tutorial. Some of the results we deduced contradicted our expectations or one-step "gut reasoning." Pick one conclusion we deduced that was surprising to you. Describe the result, explain why we claimed it to be true, and discuss whether you now accept it and why. (If nothing was surprising, pick one that you think might be surprising to a roommate and describe how you would convince them. But it would surprise me if nothing surprised you.) *Note: This is an essay question. Your answer will be judged not solely on its correctness, but for its depth, coherence, and clarity.*

If you need more space, continue on the back and check here. ☐

NAME_____ **POINTS**_____

Physics 122 **Dr. E. F. Redish**
Spring 2010 **Exam 1 (M.U.)**

5. (25 points) In the figure below is shown an elastic string that is being driven by a rotating bar to produce a sinusoidal oscillation. The string is modeled by massive beads connected by massless (and invisible) springs. The wave produced moves to the right and out through the window for a long distance. It is shown at a time $t = 0$. Use the x-y coordinate system shown by the dotted lines and the distance scale shown by the rulers.



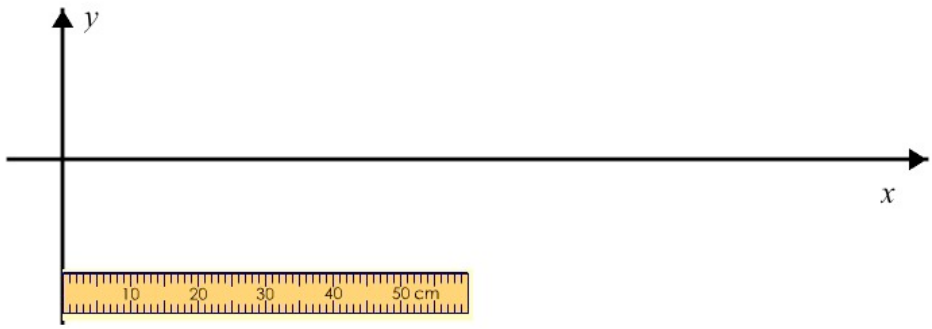
A. The rod driving the wave goes through a single up-down-up cycle in a time of 0.2 seconds. Write an equation for the displacement of the bead at position x at time t, $y(x,t)$. Explain briefly why you chose the representation you did. If you use symbols (other than y, x, and t) rather than numbers in your equation, explicitly give their numerical values. (10 pts)

$y(x,t) =$

B. With what speed will the wave travel down the string? Explain. (8 pts)

$v_0 =$

C. If the rod is slowed down so that it goes through a cycle in a time of 0.4 seconds, what will happen to the appearance of the wave? After it has been doing this for a few seconds, sketch a graph of what a snapshot of the wave will look like. (7 pts)



If you need more space, continue on the back and check here. ☐