Problem List

8.1 Review a Textbook problem

Given: Pollock – Spring 2011, Spring 2012

Exam review! (The rest of this homework is required, and you should turn it in. But, for obvious reasons, the grader will not look over what you write in *detail*, each part will be graded simply "credit/no credit") Our exams are designed to take one hour (though you have 75 minutes of class time to do it) It will likely be 4 questions (each multiple parts), so we figure ∼15 min/question.

On our website, in the syllabus, after our "Introduction" paragraph, there is a link to our course goals. Go there, read that page. Then -

(a) Find in the textbook (Taylor, or one of the "recommended" texts available in the Physics library reserve), or invent a plausible exam question covering material we have covered so far this term (You might also explicitly think about what we've covered in Boas, too - can you "hook that in"?) Write it down.

(b) Solve it. (Include your solution with your homework) (If it takes $<\approx$ 5 min, how could we have made it a little more interesting/richer/challenging? If it takes $>\approx$ 20 min, how could we scaffold/hint/simplify to get at the interesting physics, without making it tedious/grungy?)

(c) Write a brief (just a few words) summary which characterizes what *content* this problem covers (e.g, "position vectors in polar-coordinates", or "Newton's law in tilted Cartesian coordinates", or etc)

(d) Which of the course scale learning goals does your problem address (list them by number) (See http://www.colorado.edu/physics/phys2210/phys2210_sp11/course_goals.html

8.2 Design and share an exam question

Given: Pollock – Spring 2011, Spring 2012

Get together with at least one other person from class, and share your made-up exam question. Do theirs, and discuss with them whether you think they got the level and coverage right. To turn in to us:

(a) Write down the name(s) of the person you worked with

(b) To show us that you really did this activity (yes, this IS a homework problem, for credit!), write down in your homework the problem of theirs that you did. (If it's really long, paraphrase)

Given: Pollock – Spring 2011, Spring 2012

Exam review! This question is similar to what we assigned you before Exam. 1. (Again you are required to turn this in. And again, for obvious reasons, the grader will not grade what you write in *detail*, each part will be graded simply "credit/no credit").

(a) Find or invent a plausible exam question covering material you expect to see on this exam. (Exams are cumulative, but focus on new material since the previous midterm) You might also think about what we have covered in Boas, too - can you hook that in? Write it down. Solve it. (Include your solution with your homework) (If it takes $<\approx$ 5 min, how could we have made it a little more interesting/richer/challenging? If it takes $>\approx$ 20 min, how could we scaffold/hint/simplify to get at the interesting physics, without making it tedious/grungy?) Write a brief (just a few words) summary which characterizes what content this problem covers (e.g, "Gauss law", or "Simple harmonic motion" or "Conservation of energy", etc) Finally, which of the course scale learning goals does your problem address (list them by number) See

http://www.colorado.edu/physics/phys2210/phys2210_sp11/course_goals.html

(b) Get together with at least one other person from class, and share your made-up exam question. Do theirs, and discuss with them whether you think they got the level and coverage right. To turn in to us: Write down the name(s) of the person you worked with. To show us that you really did this activity (yes, this IS a homework problem, for credit!), write down in your homework the problem of theirs that you did. (If it's really long, paraphrase)

8.3 Reflect on your homework

Given: Pollock – Spring 2011, Spring 2012

Homework review! *Note: If you have perfect scores on all homeworks so far, congratulations. Just let the grader know! Otherwise...* Go back over all your old homeworks, and look over what you missed. (Note: solutions are posted on CULearn) Pick at least one problem you didn't do well on, and redo it to your satisfaction. You don't need to turn in the resolved problem - instead, turn in a summary of what went wrong, and what you needed to do to fix it. Were you missing a concept? A math trick? Was it sloppiness, a lack of time, or something deeper? Try to articulate what you have learned by redoing the problem (For obvious reasons, the grader will not grade what you do here in *detail*, this question will be graded simply "credit/no credit").

8.4 Learn to check your answer

Given: Pollock – Spring 2011

On the midterm, we asked you to check an answer to a calculation, and we observed a lot of people struggled with this. Let's practice! In each case below, I will pose an abbreviated problem and a proposed answer. Your task is NOT to solve the problem (!!) but rather, to simply CHECK the given answer. Briefly, comment!

(a) In a tragic accident, a car (mass m) plunges into an icy lake. The water produces a linear drag force on the car $\vec{f_d} = -b\vec{v}$. Find the velocity of the car as a function of time. The student's response after several lines of careful calculations was:

$$v(t) = v_0 e^{bt/m} \tag{1}$$

(Remember, you are NOT being asked to solve this problem!! You only need to make two **checks** of this answer to see if it is reasonable. If your checks indicate it is not reasonable, do they suggest any possible fix, or something you might look into?)

(b) A buoy bobs in the Boulder reservoir. It is cylindrical in shape, with a circular base of radius r, and height h. Small periodic wavelets (of amplitude A meters, frequency ω) drive the buoy. (Water has density ρ) What is the resulting period of oscillation, averaged over a very long time? The student's response after several lines of careful calculations was:

$$T = 2\pi/\omega - 2\pi\sqrt{m/(\rho g(2\pi r h))} \tag{2}$$

(Again, don't solve the problem, just check the solution - and then, can you make any suggestions about what might be wrong even without having solved the problem?)

(c) A formula for potential energy U(x,y,z) was given, and the question asked for the resulting force. The student's response after several lines of careful calculations was:

$$\vec{F}(x,y,z) = cx\ \hat{j} \tag{3}$$

with the constant $c = 4.9/s^2$ (Again, don't solve the problem, just check the solution - and then, can you make any suggestions about what might have gone wrong even without having solved, or in this case even seen, the original problem?)

Given: Pollock – Spring 2012

We often ask you to *check* your answer. "Check" (in this sense) doesn't mean "redo the problem carefully", nor to invent and solve a related problem. It means think about a basic physical result you know must be true *independent* of working out the formula, and then you check that your formulaic answer agrees with that expectation. (E.g, the units are as expected, or the behavior at extreme values of some parameter does what you expect...) To be useful, you must *already know* what that behavior should be (e.g. if friction goes up, terminal velocity should go down. Or, if you get far away, a force should vanish. That sort of thing)

Let's practice! In each case below, I will pose an abbreviated problem and a proposed answer. Your task is NOT to solve the problem(!!) but rather, to simply CHECK the given answer. If you can think of more than one way, all the better. In each case, briefly comment! If the check does NOT work out, does it suggest to you what MIGHT be wrong, where you might look more carefully if you needed to get the answer right?

(a) In a tragic accident, a car (mass m) plunges into an icy lake. The water produces a linear drag force on the car $\vec{f_d} = -b\vec{v}$. Find the velocity of the car as a function of time. The student's response after several lines of careful calculations was:

$$v(t) = v_0 e^{bt/m} \tag{4}$$

(Remember, you are NOT being asked to solve this problem!! You only need to make two **checks** of this answer to see if it is reasonable. If your checks indicate it is not reasonable, do they suggest any possible fix, or something you might look into?)

(b) A formula for potential energy U(x,y,z) was given, and the question asked for the resulting force. The student's response after several lines of careful calculations was:

$$\vec{F}(x, y, z) = cx\ \hat{j} \tag{5}$$

with the constant $c = 4.9/s^2$ (Again, don't solve the problem, just check the solution - and then, can you make any suggestions about what might have gone wrong even without having solved, or in this case even seen, the original problem?)

(c) A space platform is in the shape of an annulus: a flat ring of uniform mass per unit area of σ, with different inner and outer radii given in terms of some distance R. A student on an exam works out the gravitational potential energy of a test mass m at position z above the central axis, and gets

$$U(z) = -2\pi G\sigma(\sqrt{4R^2 + z^2} + \sqrt{R^2 + z^2}) \tag{6}$$

One final time, don't redo the problem to check it - just check this given solution. (I can think of at least two obvious ways, each of which catches a different small but important mistake.)

8.5 Review your midterm

Given: Pollock – Spring 2012

Go back to midterm #2, and pick any "lettered" portion (like 7-i or whatever) where you lost more than ∼1/3 of the points. Look it over, redo the problem, and explain what pieces you were missing and why you missed them. Solutions are posted, so we're not so much interested in "the right answer" as your reflections about what you did wrong and why. (For a couple of you, there were no sub-parts where you lost this much credit - just let the grader know.)