Assignment 3 Due: Friday, Sept. 18

33.331

1) Problem 5.2 of the text.

2) Problem 5.3 of the text.
Two spacecraft have the same mass. One has just been launched at escape velocity, the other has just been put into (very) low altitude orbit. Find the ratio of their kinetic energies.
Another spaceship has velocity v_0 when it is *very* far away from the Earth. Find the total work done on the ship by gravity as it approaches the Earth and lands on the surface. Is the work positive or negative?

3) Problem 5.5 of the text.
Is it a good approximation to treat the destination as being the center of the Earth rather than its surface? Why or why not?
You should get an answer involving constants. It is sufficient to show numerically that your answer is about the same as $\frac{9}{11}$.

4) Problem 5.7 of the text.
Express your answer in terms of the ratio R/l (where possible).
If the mass per unit length, λ, is constant, what happens when $l \to \infty$? Explain.
Hint: The integral you need is in appendix E.

5) Problem 5.15 of the text.
Before you plug in numbers, express your answer in terms of the earth's radius, R, and the gravitational field strength at the surface of the earth, g_0.
Also find the period of a satellite in *very* low orbit. How do the two periods compare?

6) The stability problem in example 5.3 in Thornton and Marion can be addressed from an alternative point of view as follows. Find the potential $\Phi(z)$ along the z axis and make a sketch of it. What is it doing near $z = 0$? Explain how by simply looking at this sketch you can draw a conclusion about the stability of a particle moving away from the origin in the x, y plane, which is the focus of the Thornton and Marion calculation. Next show that this is an easy method for finding the coefficient on the right side of their (5.31). [Hint: Poisson.]