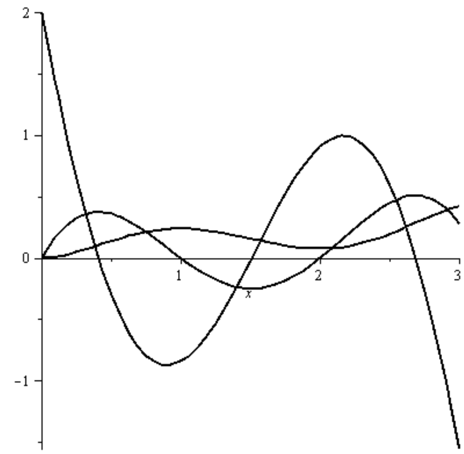
Math 11 Practice Problems for Final Exam Farris
Not due as graded homework

This is not a practice test. It is a set of problems to help you practice. The exam will also include some more routine problems, which you can practice using your textbook.

1. Three levels: The figure shows graphs of three functions on the same axes. These functions are $f(x)$, $f'(x)$, and the function $y(x)$ that solves the ordinary differential equation $\frac{dy}{dx} = f(x)$, with $y(0) = 0$. Write a short essay to explain how you can tell which is which.



2. A person who is 6 feet tall stands 3 feet away from a pole. If a lantern is hoisted up the pole at a constant rate of 2 feet per second, how fast is the person's shadow (on the ground) shrinking when the lantern is 9 feet above the ground?

3. Consider the same set-up as in Problem 2, but now suppose that the height of the lantern above the ground is given by $y(t) = 9 + 2\sin(t)$. Show that this is consistent with the previous information when $t = 0$. Then determine the longest and shortest possible lengths of the shadow. [Note: You *could* solve this problem without calculus, but use calculus anyway, to help practice for a different situation.]

4. Here are three integrals. One can be evaluated easily, one is tricky, and one cannot be evaluated at all. Which is which and how do you know? Evaluate two of them and explain why you cannot evaluate the other.

   A. $\int \frac{3x^3}{\sqrt{x^4+9}}\,dx$ *B.* $\int \frac{3x^2}{\sqrt{x^4+9}}\,dx$ *C.* $\int \frac{3x^7}{\sqrt{x^4+9}}\,dx$

5. At a football game, a video camera on a tripod is set up 5 yards from edge of the field and even with the goal line. The player with the ball runs toward the goal line along the edge of the playing field. The camera rotates to track the runner. At the instant when the player is 10 yards from the goal, a sensor in the camera records that the camera is turning at a rate of 2/5 radians per second. How fast was the player running?

6. A swimmer in a calm ocean is $\sqrt{6}$ miles directly offshore from the point A on a straight coastline. At sea, she can swim 1 mile per hour, but along the beach, she can run 5 miles per hour. She wants to reach point B, 3 miles down the coast from A, as quickly as possible. Where should she meet the coast to get to B in the shortest time?