Name: _____

1. Class notes for this week: This week we have covered Sections 1.8, 2.1, and 2.2. Next week we will cover Sections 2.3, 2.4, and part of 2.5.

2. A laboratory is growing bacteria for an experiment. The number of bacteria after t hours of the experiment is $f(t)$.
   (a) (1 point) What are the units on $f'(t)$? Explain in a sentence what this number means.
   (b) (1 point) Suppose there is an unlimited amount of space and nutrients for the bacteria. Would you expect $f'(5)$ or $f'(10)$ to be larger?

(a) The units on $F'(t)$ are bacteria/hour. The derivative is the rate at which the population is increasing, in new bacteria per hour, at any given time.

(b) We expect $F'(10)$ to be larger: After 10 hours, there are more individuals in the population than there were after 5, and they are all reproducing without bound, so probably the rate of increase is faster at $t=10$.

Question 3 is on the back

3. Consider the function $f(x) = x^3 - 15x^2 + 71x - 103$.

   (a) (1 point) What is the largest number of roots this function could have? (This is a question from algebra, not calculus.)

   (b) (2 points) Compute $f(2)$, $f(3)$, $f(5)$, $f(6)$, and $f(7)$, and use this information to identify intervals in which the roots of the $f(x)$ are contained. Explain your reasoning. Be sure you check that the hypotheses of any theorems you use are satisfied!

(a) This is a third-degree polynomial; it can have at most three roots.

(b)

x	F(x)
2	-13
3	2
5	2
6	-1
7	2

Notice that F(x), being a polynomial, is continuous everywhere. Therefore the Intermediate Value Theorem implies that for any [a,b], if $f(a) < 0 < f(b)$ or $f(b) < 0 < f(a)$. (that is, if one of f(a) and f(b) is negative and the other positive), there is a root in (a,b). This implies there are three roots, and they lie in (2,3), (5,6), and (6,7).