M170–004
March 8, 2000

TEST #2 Name _____

This test consists of **5** pages, all different and none intentionally left blank.
Take a minute *right now* to ensure that you have all 5 of these pages.
In order to receive credit for your answers, you must show your work!!

1. (3 points each) First, show you know the basic formulae needed for differentiation by completing the following table.

$f(x)$	$f'(x)$
x^n	
$\sin(x)$	
$\cos(x)$	
$\tan(x)$	
$\cot(x)$	
$\sec(x)$	
$\csc(x)$	

2. (5 points each) Now, show you can use these basic formulae with the rules of differentiation to compute the derivative of each of the following functions:

   (a) $f(x) = x\sin(2x+1)$

Problem 2 continued.

(b) $f(x) = \dfrac{x^2 + 2x - 1}{3x - 5}$

(c) $f(x) = \sqrt{\sin(x) + \cos(x)}$

(d) $f(x) = \left(x + \left(2x + \left(3x + (4x + 5)^{1/2} \right)^{2/3} \right)^{3/4} \right)^{5/6}$

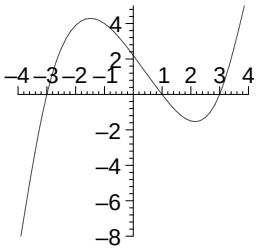
3. (5 points) What is the definition of the derivative of f evaluated at $x = a$. (This definition requires a limit!)

4. (10 points) If $f'(x) = \sqrt{x^3 + 1}$ and $f(2) = 1$, what is an equation of the tangent line to the graph of f at $(2, 1)$

5. (10 points) Let $f(x) = x^3 - x + 1$. Starting with $x_1 = -1$, do two iterations of Newton's method to find an approximation to a solution to $f(x) = 0$.

6. (10 points) Use a tangent line approximation to approximate $\sqrt[3]{8.1}$

7. The following is the complete graph of the *derivative,* f', of a function f. Using this graph, answer the following questions about the function f. (Notice that you are *not* given the graph of the function f).



(a) (3 points) Where is the slope of the tangent to f equal to zero? (Remember, you do not have a picture of f!)

(b) (3 points) On what intervals is the slope of the tangent to the graph of f positive? What does this say about the graph of f?

(c) (3 points) On what intervals is the slope of the tangent to the graph of f negative?

(d) (5 points) If $f(0) = 0$, sketch a possible graph of f.

8. (10 points) A right circular cone, volume given by

$$V = \frac{1}{3}\pi r^2 h$$

where r is the radius of the base and h is the height of the cone, is being deformed in such a way that the volume remains a constant 25π cubic centimeters. (That means, that as the height gets larger, the base gets smaller.) If the radius of the base is increasing at a rate of 3 cm/min, how fast is the height decreasing at the instant the height is 3 centimeters?