Math 170-001 Exam 3 Name _____
November 15, 2006

This test consists of **??** points and **??** pages, none of which is intentionally left blank. Take a few seconds right now to be sure you have all the pages. The point value of each question is to the left of the question number. Show all your work in the space provided. If you run out of room for an answer, continue working on the back of the page. Your answers must be justified by your work.

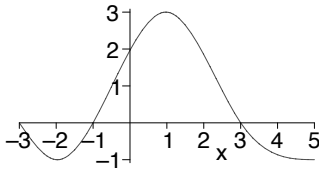
(15) 1. Find the absolute maximum and absolute minimum on the interval $[-1, 5]$ for

$$f(x) = 2\,x^3 - 15\,x^2 + 24\,x$$

(15) 2. Find and identify the local extrema of

$$f(x) = (x-3)^4(x+3)^3$$

(10) 3. The following is the graph of the derivative f' of a function f on the interval $[-3, 5]$. On what intervals is the graph of f concave up and on what intervals is the graph of f concave down? (Be Careful)



(15) 4. Sketch the graph of a function f satisfying the following:
y-intercept at $y = 4$. x intercepts at $x = -3$, $x = 1$, and $x = 4$.
$f'(x) < 0$ for $x < -3$, for $0 < x < 2$ and for $x > 3$.
$f'(x) > 0$ for $-3 < x < 0$ and for $2 < x < 3$.
$f''(x) > 0$ for $x < -1$ and for $1 < x < 2.5$.
$f''(x) < 0$ for $-1 < x < 1$ and for $2.5 < x$.

(10) 5. Suppose $f'(x) = 0 \ \forall x \in [a, b]$. Let $x, y \in (a, b)$ with $x < y$. Use the mean value theorem to prove $f(x) = f(y)$.

(15) 6. Evaluate

$$\lim_{x \to \frac{\pi}{2}^-} \sec(3x) \cos(5x)$$

7. An twelve inch long piece of wire is available to bend into the shape of a square or into an equilateral triangle, it can be cut and one piece bent into a square and the other into an equilateral triangle.

(5) (a) If we don't cut the wire and make a square, what is the area of the square?

(5) (b) If we don't cut the wire and make an equilateral triangle, what is the area of the triangle?

(5) (c) If we cut the wire into two pieces, one of length x and the other of length $12 - x$ and bend the wire of length x into a square and the other piece into an equilateral triangle, what is the total area of the two pieces (as a function of x)?

(5) (d) If we need to enclose a maximum area, should we cut the wire? Why or why not?