Math 141 Test #2 Fall 2004

1. (10 pts) Use the limit process to find the derivative of $f(x) = 2x^2 + 3x$. p. 101: 17

2. (10 pts) Find the equation of the tangent line to the graph of $f(x) = x^3$ at the point $(2, 8)$. p. 101: 25

3. (42 pts) Use the rules of differentiation to find the derivatives of the following functions. You do not need to simplify your answers.

   (a) $f(x) = 5x^4 + 8x^2 - 10x + 99$ p. 113: 15

   (b) $f(x) = \sqrt{x}$ p. 113: 10

   (c) $f(x) = \frac{5}{x^2}$ p. 113: 27

   (d) $f(x) = x^2 \sin x$ p. 124: 5

   (e) $f(x) = \frac{x^2+1}{3x+2}$ p. 124: 8

   (f) $f(x) = \cot 2x$ p. 133: 55, 92

   (g) $f(x) = (3x^5 + 1)^{10}$ p. 133: 7

4. (8 pts) Let $y = 8x^4 + 6x^3 - 2x$. Find d^2y/dx^2. p. 124: 89

5. (10 pts) Let y be a function of x defined implicitly by the equation $x + y = xy$. Find the first and second derivatives of y with respect to x, each expressed as a function of x and y. p. 142: 5, 35

6. (10 pts) A machine is pouring sand into a pile. As more sand is poured, the pile gets larger. Suppose that the pile is in the shape of a right circular cone and that the radius of its base is always equal to its height. If the sand is being poured at a rate of 5 ft^3/sec, then how fast is the height of the pile growing when the height is 3 ft? Include the proper units in your answer. The formula for the volume of right circular cone is p. 149: 24

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

7. (10 pts) A 15-ft ladder is leaning against a wall. If the base of the ladder is moving away from the wall at 3 ft/sec, then how fast is the top of the ladder falling when the base is 9 ft from the wall? p. 149: 27