MATH 113 – 22 MARCH 2007 – EXAM 2

Answer each of the following questions. Show all work, as partial credit may be given.

1. (8 pts. each) Evaluate the derivative of each of the following functions.

(a) $f(x) = x^3 - 3(x^2 + 4)$

(b) $g(t) = (e^{-t} + 3)\tan(t)$

(c) $r(\theta) = \dfrac{1 + \sin\theta}{1 - \cos\theta}$ (Hint: Be sure to simplify your answer.)

(d) $f(x) = (5x^2 + \ln(2x))^{3/2}$

(e) $h(x) = \sin^{-1}(x^2 - 1)$

(f) $f(x) = (x + 2)^x$

2. (8 pts. each) The position s (in meters) of a body at time t (in seconds) is given by $s = \frac{1}{4}t^4 - t^3 + t^2$, $0 \le t \le 3$.

(a) Find expressions giving the velocity v and acceleration a of the body at time t.

(b) Find the times t at which the body is at rest.

(c) Find the intervals of t for which the body is moving to the right and to the left.

3. (8 pts. each) Consider the curve defined by the equation $x^3 + 4xy - 3y^{4/3} = 2x + 9$.

(a) Find dy/dx using implicit differentiation.

(b) Find the equation of the line tangent to the above curve at the point $(2, 1)$.

4. (8 pts.) Use logarithmic differentiation to find the derivative of $y = \dfrac{(t+1)^3 \sin(t)}{\sqrt{t^2 + 1}}$.

5. (8 pts.) Suppose that the volume, V, of a rectangular box with a square base of edge length x and height h is increasing at a rate of $1200\, cm^3/min$. If the edge length x is *decreasing* at a rate of $20\, cm/min$ at what rate is the height of the box changing when $x = 10$ and $h = 15$? Be sure to put your answer in correct units.