MATH 141

Midterm 2

April 1, 2005

NAME (please print legibly): _____

Your University ID Number: _____

- **No calculators are allowed on this exam.**
- **Please show all your work. You may use back pages if necessary. You may not receive full credit for a correct answer if there is no work shown.**
- **Present you work using proper mathematical notation.**

QUESTION	VALUE	SCORE
1	18	
2	20	
3	32	
4	15	
5	15	
TOTAL	100	

1. (18 pts) Use the definition of the derivative function to show that for $f(x) = 3x - x^2$, $f'(x) = 3 - 2x$.

[Hint: remember the **definition** of the derivative function involves taking a limit. You will earn no points for using derivative rules, such as the power rule, on this problem.]

2. (20 pts) The position of an object is moving along a line at time t (in minutes) is given by the function

$$s(t) = t^3 - 12t^2 + 45t + 3$$

where $s(t)$ is in measured in feet.

(a) Find the position of the object at time $t = 0$.

(b) Find the average velocity of the object over the time interval $0 \leq t \leq 2$.

(c) Find the function which describes the velocity of the object at time t.

(d) When is the object at rest?

(d) Find the total distance traveled by the object over the time interval from $t = 0$ to $t = 5$ minutes.

3. (32 pts) Find $\dfrac{dy}{dx}$. In this problem you are welcome to use derivative formulas. You don't need to (and shouldn't) use the definition of the derivative here.

(a) $y = \dfrac{3x^{12}}{x^2} - \dfrac{2}{\sqrt{x^3}} + x(x+2)$

(b) $y = e^{3x} \arctan(x)$

(c) $y = \ln(5x - \sin(x))$

(d) $y = \dfrac{(3x+1)^7}{(6x+x^3)^8(7-x^2)^3}$ [Hint: Use logarithmic differentiation.]

4. (15 pts) The graph of $f(x)$ is given below. In the space provided sketch the graph of $f'(x)$.

At which x-values is $f(x)$ not differentiable?

5. (15 pts) Find the **equation** of the line tangent to the curve

$$3x^2y + y^3 = 10$$

at the point $(1, 2)$.