Spring '05/MAT 250/Exam 2 **Name:** *Show all your work.*

Differentiate and simplify where appropriate:

1. (4pts) $\dfrac{d}{dx}\left(7x^3 - 4^x + \sqrt[3]{x^2} + c^4\right) =$

2. (4pts) $\dfrac{d}{dx}\left(x \ln x - x\right) =$

3. (5pts) $\dfrac{d}{dx} \cos\sqrt{x^2 - 5x + 10} =$

4. (5pts) $\dfrac{d}{dx} \dfrac{x}{\sqrt{x^2+5}} =$

5. (5pts) Use logarithmic differentiation to find $\dfrac{d}{dx}\, x^{\tan x}$.

6. (4pts) Find the first three derivatives of $f(x)$ and use them to find the formula for $f^{(n)}(x)$ if $f(x) = e^x(x+5)$.

7. (6pts) Use implicit differentiation to find y'.

$e^{xy} = x^2 + y^4$

8. (4pts) The side x of a cube is increasing.
a) At what rate with respect to the length of the side is the volume of the cube increasing when $x = 4$cm? What are the units?
b) Approximate by how much the volume changes if x changes from 4 to 4.1 centimeters.

9. (6pts) An old shoe is thrown vertically upward with initial velocity 40m/s. Its position is given by $s(t) = 40t - 5t^2$, where s is in meters, t in seconds.
a) What is the maximum height that it reaches?
b) What is its velocity when, on its way down, it is at height 60m?

10. (7pts) A plane flying horizontally at an altitude of 1mi and a speed of 500mi/hr passes directly over a radar station. Find the rate at which the straight-line distance from the plane to the radar station is increasing when this distance is 2mi.

Bonus. (5pts) Verify that $\dfrac{d}{dx}\left(\dfrac{2x^2-1}{4}\arcsin x + \dfrac{x\sqrt{1-x^2}}{4}\right) = x\arcsin x.$