

NAME: _____

Student ID #: _____

QUIZ SECTION: _____

Math 124
Midterm II
May 16, 2006

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Total:	50	

- Your exam should contain 5 pages total and 5 problems. Please check your test for completeness.
- Unless otherwise instructed, you **must show how you get your answers, using techniques developed in this class so far**. Answers with no supporting work, obtained by guess-and-check, or via methods you learned in high school or in other classes will result in partial credit at best, even if correct.
- Indicate your **final answer** by placing a box around it.
- **Leave your answers in exact form** instead of a decimal approximation. That is, $\sqrt{2}$ instead of 1.4142, and $\frac{\pi}{2}$ instead of 1.57. Simplify all you can.
- If you need more room use the backs of pages, but indicate to the reader that you have done so.
- Raise your hand if you have any questions.

GOOD LUCK!

Do you want me to post your grades so far on the class website under the last 4 digits of your student ID?

Yes, please post my grade. Sign to give permission: _____

No, please don't post my grades so far.

1. (13 points) Differentiate the following functions. **Do not simplify.**

a) $f(x) = (x^2 + 5)(\sqrt{x} + 8)$

b) $y = \frac{e^x}{\cos x + 3}$

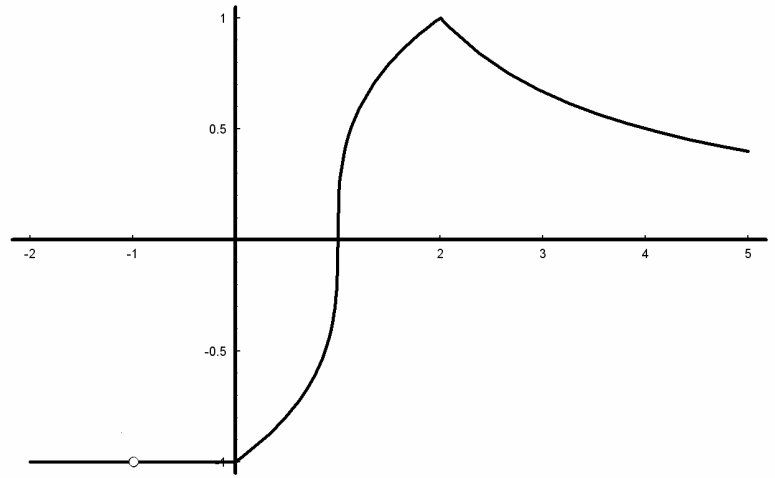
c) $h(t) = \tan^3(t) + \ln(5t + 1) + 10 \arcsin t$

2. (8 pts) Find the equation of the tangent line to the elliptic curve $y^2 + y = x^3 - x^2$ at the point (1,0).

3. (6 points)

The graph on the right is the graph of

$$g(x) = \begin{cases} -1, & x \leq 0, \quad x \neq -1 \\ \sqrt[3]{x-1}, & 0 < x < 2 \\ \frac{2}{x}, & x \geq 2 \end{cases}$$



a) List **all** the points at which $g(x)$ is **not** differentiable. No need to justify your answers.

b) What is the equation of the tangent line to the graph of $g(x)$ at $x=1$? No need to justify your answer.

4. (7 points) An oil tanker is leaking onto the ocean surface, forming a circular oil slick about 0.005 meters thick. The volume of oil spilled is given by the formula $V = \pi hr^2$, where r is the radius of the slick and h is the thickness. Suppose the tanker is leaking at a constant rate of $20 \text{ m}^3/\text{hr}$. Find the rate at which the radius of the oil slick is growing when the radius is 50 m (include units).

5. (16 points)

You are on a ferris wheel. As the wheel rotates, your coordinates (in feet, with respect to the base of the wheel) after t seconds are given by the parametrized equations:

$$x(t) = 60 \cos\left(\frac{\pi}{30}(t-15)\right)$$

$$y(t) = 60 \sin\left(\frac{\pi}{30}(t-15)\right) + 63$$

a) When will you reach the topmost point on the wheel for the first time and what are your coordinates at that point?

b) During the first revolution, at what times is your vertical velocity equal to π ft/s?

Recall, your coordinates at time t seconds are:

$$x(t) = 60 \cos\left(\frac{\pi}{30}(t-15)\right), \quad y(t) = 60 \sin\left(\frac{\pi}{30}(t-15)\right) + 63.$$

c) What is your maximal vertical acceleration? (include units)

d) You turn on a flashlight, and you point the light beam in a direction tangent to your trajectory.

Find the equation of the beam of light at $t = 25$ seconds. (Hint: $\frac{dy}{dx} = \frac{(\frac{dy}{dt})}{(\frac{dx}{dt})}$)