Math 124 - Winter 2013
Exam 2
February 26, 2013

Name: _____

Section: _____

Student ID Number: _____

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- There are 5 pages of questions. Make sure your exam contains all these questions.
- You are allowed to use a scientific calculator (**no graphing calculators and no calculators that have calculus capabilities**) and one **hand-written** 8.5 by 11 inch page of notes.
- You must show your work on all problems. The correct answer with no supporting work may result in no credit. **Put a box around your FINAL ANSWER for each problem and cross out any work that you don't want to be graded.** Give exact answers wherever possible.
- If you need more room, use the backs of the pages and indicate to the grader that you have done so.
- Raise your hand if you have a question.
- Any student found engaging in academic misconduct will receive a score of 0 on this exam.
- You have 80 minutes to complete the exam. Budget your time wisely.
  SPEND NO MORE THAN 15 MINUTES PER PAGE!

GOOD LUCK!

1. (12 pts) Compute the derivatives of the following functions. You do not have to simplify your final answer.

   (a) $y = \sin\left(\sec\left(\frac{1}{x^2} + 1\right)\right)$

   (b) $y = x^3 \ln\left(e^{5x} + \sin^4(x)\right)$

   (c) $f(x) = \tan^{-1}\left(\sqrt{3x + 5^x}\right)$

2. (16 pts) The two parts below are independent of each other.

   (a) (8 pts) Find the equation for the tangent line to $y = (3x + 1)^{\sqrt{x}}$ at $x = 1$.

   (b) (8 pts) Find all values of t at which the parametric curve $x = 3t^2$, $y = 15t - 3\ln(t)$ has a tangent line with slope 2.

3. (9 pts) Consider the curve implicitly defined by $4y^3 + x^2 \sin(\pi y) - x^2 = 0$. There is one point on the curve that has a y-coordinate of $y = 1$ **and** a negative x-coordinate. Find the equation for the tangent line to the curve at this point.
(Give your numbers simplified in exact form).

4. (12 pts) Larry Bernandez throws a baseball whose location (viewed from the side) is given by the equations:

$$x(t) = 80t \ , \ y(t) = -16t^2 + 8t + 6,$$

where t is in seconds since it was thrown and distances are in feet.

(a) (5 pts) Find the **coordinates** of the ball at the instance when its vertical velocity is zero.

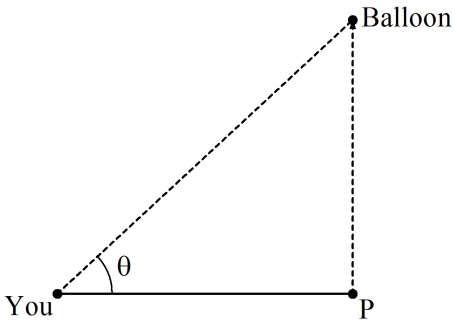
(b) (7 pts) Recall, the speed is given by $\sqrt{(x'(t))^2 + (y'(t))^2}$ ft/sec. Find the speed of the ball **and** the equation of the tangent line at the instant when the ball reaches the point $(x, y) = (60, 3)$.

SPEED _____ ft/sec

TANGENT LINE EQUATION: _____

5. (11 pts)

At time $t = 0$ seconds, a balloon is released from the ground from a point P which is 332 feet away from you. You are walking toward the point P at the constant rate of 4 feet per second and the balloon is rises vertically at the constant rate of 50 feet per second.



(a) (6 pts) At what rate is the straight line distance between you and the balloon changing when the balloon is exactly 400 feet high? (Hint: Note it takes $t = 8$ seconds for the balloon to get to 400 feet high.)

(b) (5 pts) Let θ be the angle of inclination between your line of sight to the balloon and the ground (see picture). At what rate is θ changing when the balloon is exactly 400 feet high? (Give in units of rad/sec).