Name _____   Section time & instructor _____

Student ID_____

Math 1A—Calculus, Spring 2014—Haiman
Midterm Exam 2

Instructions:

• Write your name, ID number and discussion section time and instructor's name at the top of this page. Do not look at the other pages until the signal to start is given.

• You may use one sheet (written on both sides) of prepared notes. No other notes, books, calculators, or other electronic devices are allowed.

• Use scratch paper for preliminary work, then write your solutions on the exam paper. Hand in **only the exam paper** itself.

• Show enough steps to indicate how you got your answer. An answer that is just a number or formula without explanation will receive no credit if wrong, and might not receive full credit even if correct.

• There are 7 questions, for a total of 100 points.

1. (8 pts each part) (a) Express
$$\lim_{x \to 3} \frac{2^x - 8}{x - 3}$$
as the derivative $f'(a)$ of some function $f(x)$ at some number a.

(b) Evaluate it.

2. (14 pts) Differentiate $\tan^{-1}(\sqrt{4x + 1})$.

3. (14 pts) Differentiate $(x + 1)^{x/2}$.

4. (14 pts) Find the point (x, y) where the graph of

$$y = xe^{-x}$$

has a horizontal tangent line.

5. (14 pts) If $e^{xy} = y$, find an expression for dy/dx in terms of x and y.

6. (14 pts) The pressure P, volume V and temperature T of a gas are related by

$$PV = KT,$$

where K is a constant. If the pressure, volume and temperature are functions of time t, find dT/dt when $P = 50$ N/cm^2, $V = 1000$ cm^3, $T = 300$ K, $dP/dt = 10$ N/cm^2 s and $dV/dt = -50$ cm^3/s.

7. (14 pts) Use a linear approximation or differentials to approximate $\sqrt[4]{80}$. Hint: $3^4 = 81$.