November 19, 2002 **Name (Please Print)** ____________________

Math 124 G,I—Second Midterm Exam—Autumn 2002

Your T.A. ______________ **Your Signature** ____________________

Quiz Section [ ][ ] **Student I.D.#** [ ][ ][ ][ ][ ][ ][ ]

This is a *limited open note* exam. You may use one page of notes that are *in your own handwriting*. You may *not* use books, printed matter, etc.

You may *not* use programmable calculators (like TI-89 or above). You may use a "scientific calculator" (capable of doing trig functions, exponentials, and logarithms) or a graphing scientific calculator (like TI-86 or below).

There are 5 problems. Each problem is worth 10 points, for a total of 50 points. Show all of your work. Partial credit will be given for partial solutions. Correct answers with insufficient or incorrect work will *not* get much credit.

Please note: Give all answers as EXACT answers (like $\pi/6$ or $1 + \sqrt{2}$) unless you are explicitly given directions otherwise.

Score

1.	(10)	
2.	(10)	
3.	(10)	
4.	(10)	
5.	(10)	
Total	(50)	
Exam Grade		

1. (a) (5 points) Find the derivative of the function $g(x) = x^{\ln x} \cdot \sec(e^x)$.
Do not simplify your answer.

(b) (5 points) Find the derivative of the function $h(x) = \tan^{-1}(\sqrt{2^x + 1})$.
Do not simplify your answer.

2. Let $f(x) = \dfrac{3x+10}{\sqrt{x+1}}$.

(a) (4 points) Find $f'(x)$. *Do not simplify your answer yet.*

(b) (4 points) Now simplify your answer to part (a).

(c) (2 points) For what value(s) of x is $f'(x) = 0$?

3. The point $(2, 1)$ lies on the curve $x^2 \cos(\pi y) + 2y + x = 0$.

   (a) (7 points) Find the equation of the tangent line to the curve at the point $(2, 1)$. Give your answer in the form $y = mx + b$.

   (b) (3 points) Estimate the y-coordinate of the point on the curve near $(2, 1)$ whose x-coordinate is 2.02.

4. (10 points) Sand is being dumped from a conveyor belt at a rate of 10π ft^3/min, forming a conical pile of sand. Five minutes after the pile starts, the radius of the base is 5 ft and the height is 6 ft, and at that time the height is increasing at a rate of 1 ft/min. How fast is the radius of the base changing five minutes after the pile starts?
(The volume of a cone is $V = \frac{\pi}{3}r^2h$, where r is the radius of the base and h is the height.)

5. (10 points) The Super Cheap Golf Ball Company currently makes a golf ball of radius 2 cm. Taking into account the different cost of the core material and the cover, their accounting department has figured out that it costs $r^3 + 2r^2$ cents to make a golf ball of radius r cm, so their current ball costs 16 cents to make. Hoping that noone will notice, they plan to make a smaller ball that only costs 15 cents to make. Use the tangent line approximation to estimate the radius of their new ball.