**Math 2200** (Lieman), Fall 2002, Third Exam

**Directions**: This exam is worth 100 points. You will have seventy-five minutes to complete this exam. You may **not** use calculators, but they will not be necessary. In order to receive full credit for an answer, you must show all of your work. If you need scratch paper, please use the extra page at the end of this exam. You do **not** have to completely simplify your answer once you've done what the problem has asked you to do (e.g. compute a derivative). This exam should have 8 pages. *Good luck!*

Name:

| Problem | Possible | Score |
|---|---|---|
| 1 | 20 | |
| 2 | 20 | |
| 3 | 20 | |
| 4 | 20 | |
| 5 | 20 | |
| **Total** | 100 | |

1. (20 points) A rocket that is launched vertically is tracked by a radar station located on the ground 3 miles from the launch site. What is the vertical speed of the rocket at the instant that its distance from the radar station is 5 miles and that distance is increasing at the rate of 5000 miles/hour?

2. (20 points) This problem has four parts, each worth five points.

Compute the derivatives of

$$a) e^x \sin(x) \qquad b) \ln(x) x^2 \qquad c) e^{(x^2)} \qquad d) \ln(\cos(x))$$

3. (20 points) This problem has two parts, each worth ten points.

(a) Use linear approximation to approximate $(124)^{2/3}$. Note that

$$(125)^{2/3} = \left[(125)^{1/3}\right]^2 = 5^2 = 25.$$

(b) Use linear approximation to approximate $(28)^{1/3}$.

4. (20 points) This problem has two parts, each worth ten points.

(a) Compute the derivative $\frac{dy}{dx}$ where $y$ is a function of $x$ that satisfies $y^3x^2+y^2 = e^x + x^8$.

(b) Compute the derivative $\frac{dy}{dx}$ where $y$ is a function of $x$ that satisfies $y^2e^y = \ln(x)$.

5. (20 points) This problem has two parts, each worth ten points.

(a) An airplane flying horizontally at an altitude of 3 miles at a speed of 480 miles per hour flies directly over an observer on the ground. How fast is the distance from the observer to the airplane increasing 30 seconds later?

5. (continued)

(b) Find the equation of the tangent line to $x^3 + y^3 = 3xy$ at the point $\left(\frac{3}{2}, \frac{3}{2}\right)$.

(scratch page)