Fall 98 **Math 125 Exam 1** Prof. Brick

Do the problems in order in your bluebook. Show your work.

1. For what value of k is the following function continuous at $x = 1$?

$$f(x) = \begin{cases} \frac{1}{2}x^2 + k, & \text{if } x \leq 1; \\ x, & \text{if } x > 1. \end{cases}$$

2. Use a linear approximation for $\sqrt{x}$ near $x = 16$ to approximate $\sqrt{16.3}$

3. Find all x where the function $y = 2x^3 - 3x^2$ is increasing at a faster and faster rate.

4. Find the equation of the line tangent to $f(x) = \sqrt{x} - \dfrac{64}{x^2}$ at $x = 4$

5. A ball is thrown up from a window. Its height after t seconds is $s(t) = 96 + 16t - 16t^2$. At what velocity does it hit the ground ?

6. Find the derivative of $h(t) = \sqrt[3]{t^2} + e^2 - e^t + \dfrac{3}{t^4} + \pi^3$ (you may use the shortcuts).

7. Find $\displaystyle\lim_{x \to +\infty} \frac{5x - 9x^6}{2x^6 - 17}$.

8. Use the definition (with limits) to find the derivative of $f(x) = \dfrac{1}{7x + 1}$

Fall 98 **Math 125 Exam 2** Prof. Brick

Do the problems in order in your bluebook. Use algebraic techniques.

1. Find the line tangent to $x^3y^2 - 9x^4 = \tan(3x^2 - y)$ at $(1, 3)$

2. Use the first derivative test to find the local min/max's of $y = x \cdot (x^2 - 1)^{\frac{2}{3}}$

3. Find the inflection points of $y = \ln(x^2 + 1)$. Also find where y is concave up or down.

4. Use the second derivative test to classify the the local min/max's of $y = e^{x^3 - x}$.

5. A kite is flown at a constant height of 210 feet. Its speed is 7π ft/sec. At what rate in degrees/sec is the angle made by the string (with the horizontal) changing when 350 ft of string has been let out ?

6. A man 6 feet tall is walking away at the constant speed of $\frac{1}{2}$ feet/sec from a streetlight that is 18 feet high. At what rate is the length of his shadow changing ?

7. Find the absolute min/max's of $y = \sin(x) + \cos(x)$ over $[3, 5]$

8. Find the limit $\lim_{x \to 0} \left(\dfrac{e^x - x - 1}{1 + x^2 - \cos(x)} \right)$

Fall 98 **Math 125 Exam 3** Prof. Brick

Do the problems in order in your bluebook. Use algebraic methods

1. A rectangular garden is to be fenced off along a long wall. The garden is to enclose 100 square feet. How should it be designed in order to use the least amount of fencing ?

2. You decide to sell calculus souvenir cups during the University's Calculus Festival. If you charge \$5 each, you will sell three hundred of them. Each quarter increase in price results in ten fewer sales. What price maximizes revenue ?

3. Find the area – not the signed area – bounded by $y = 1 - x^2$ from $x = 0$ to $x = 2$

4. Find $\displaystyle\int \frac{x^3 e^{\pi}}{x^8 + 1}\, dx$

5. Using 4 rectangles and the right-hand rule, give a sum (but don't bother adding up the sum) that approximates the area under $y = e^{-x^2}$ from $x = 0$ to $x = 2$. Sketch a graph showing the rectangles.

6. Find $\displaystyle\int_1^2 x\sqrt{x+1}\, dx$

7. Suppose you are using Newton's method to find a root of $x^3 + x - 1 = 0$. Assume you have reached $x_3 = .731$. Find x_4 and explain graphically how Newton's method works.

Fall 98 **Math 125 Final Exam** Prof. Brick

Do the problems in order in your bluebook. Use algebraic methods

1. Let cost be given by $C(x) = 1000 + 40x$ and the demand curve be given by the formula $p(x) = 80 - x$ (where p is the price and x is the number sold). Maximize the profit. [Note: there is a typo, cost should be $100 + 40x$]

2. Find the equation of the line tangent to $f(x) = x^x$ at $x = 2$

3. Approximate $\sqrt{8.9}$ using a linear approximation of $\sqrt{x}$.

4. Use the definition of the derivative to find y' where $y = \sqrt{x^2 + 1}$.

5. Use the first derivative test to find the local min/max's of $y = (x^2 - 9x)^{\frac{2}{3}}$.

6. Use the 2nd derivative test to classify the the local min/max's of $g(x) = \arctan(x^2 + 1)$.

7. A thirteen foot ladder is leaning up against a wall. The end of the wall slips and slides down at a rate of 2 ft/sec. How fast is the other end moving away from the wall, when the top of the ladder is 5 feet off the ground ?

8. Find the absolute min/max's of $y = 2x^3 + 3x^2 - 12x + 10$ over $[0, 2]$.

9. Find $\displaystyle\lim_{x \to 0} \frac{e^x - x - 1}{x^2}$.

10. A box is to be constructed by cutting out square corners from a piece of cardboard measuring $8\frac{1}{2}$ inches by 11 inches. What size corner yields maximum volume for the box ?

11. Find $\displaystyle\int \sin^4(x)\cos^3(x)\,dx$

12. Find $\displaystyle\int_e^{e^3} \frac{e}{x\ln(x)}\,dx$