# Mathematics 121-A                                    Spring 2000

<div align="right">**Exam 5**</div>

**Date:**

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_____

*Name*
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**Technology used:** _____

**Textbook/Notes used:** _____

**Directions:**      Be sure to include in-line citations, including page numbers if appropriate, every time you use a text or notes or technology. Include a careful sketch of any graph obtained by technology in solving a problem. **Only write on one side of each page.**

## The Problems

1. (15 points) Do **one** of the following.

   (a) Find the slope of the tangent line to the curve $x = \sin^2(y)$, at the point $(x, y) = (1/2, \pi/4)$ .

   (b) The equation $x^2 - xy + y^2 = 3$ represents a "rotated" ellipse. Find an equation of the tangent line at one of the two points where the ellipse crosses the $x$ - axis.

2. (15 points each) Do **two** of the following.

   (a) Model a water tank by a cone 40 feet high with a circular base of radius 20 feet at the top. Water is flowing into the tank at a constant rate of 80 ft$^3$/min. How fast is the water level rising when the water is 12 feet deep?

   (b) A ship with a long anchor chain is anchored in 22 meters of water. The anchor chain is being wound in at the rate of 20 meters per minute, causing the ship to move toward the spot directly above the anchor resting on the seabed. The hawshole—the point of contact between ship and chain—is located 2 meters above the waterline. At what speed is the ship moving when there are exactly 26 meters of chain still out?

   (c) A particle moves along the parabola $y = 12x^2$. At what point(s) of the parabola do the $x$- and $y$- coordinates of the particle increase at the same rate?

3. (15 points each) Do **two** of the following.

   (a) Use differentials to estimate the values of $x$ for which $\sqrt{x+1} - \sqrt{x} < 0.01$.

   (b) Estimate $\sqrt[4]{82}$ by using differentials. [Hint: $\sqrt[4]{81} = 3$.]

   (c) Estimate $f(3.8)$ given that $f(4) = 2$ and $f'(x) = (x^3 + 61)^{1/3}$.

4. (15 points) Use Newton's method to find the first three approximations $x_1$, $x_2$, $x_3$ to a root of $f(x) = x + x^5 - 7$ using $x_0 = 1$ as your initial seed.