Math 141 A **Spring 2008**
Professor Landweber **26–28 February 2008**

Take Home Midterm

Your solutions, which must be stapled, will be due at the start of class on Thursday, February 28, 2008. You must work on your own, consulting only the textbook, your course notes, and your homeworks as references. If you have any questions, you can come to my office hours or ask me via e-mail. You must do all eight problems, which are equally weighted. You may use a calculator.

1. If $\sin x = 3/5$ and $\cos x > 0$, what is $\sin 2x$?

2. Five years ago, your grandparents gave you \$1000, which you deposited in an account at the local bank. You have not touched it, and with compound interest the current value of your account is \$1600. You want to use this money to buy a \$2000 used car. Assuming that the bank is still paying you the same interest rate, how long must you wait before you can afford the car?

3. Find x such that $\log_x 4 = 10$.

4. Compute the following limit by plugging in several values for x:

$$\lim_{x \to 0} \frac{e^x - 1}{x}.$$

5. Determine the following limit by algebraic means:

$$\lim_{x \to 1} \frac{x^3 - x^2}{x^4 - 1}.$$

6. Neglecting air resistance, a ball dropped from the top of a tall building falls $4.9\,t^2$ meters in t seconds. Suppose the building is 490 meters tall.

   (a) Compute the average velocity of the ball from the time it is dropped to the time it hits the ground.

   (b) Estimate the ball's instantaneous velocity when it hits the ground.

7. Using the definition of the derivative and algebraic techniques, compute the derivative $f'(x)$ of the function $f(x) = \dfrac{1}{x}$.

8. Give the equation of the line tangent to the graph of $f(x) = x^3$ at the point $(2, 8)$.