LAST NAME:
GIVEN NAME:
Student no.:

Math 184 - Test 2 - Friday October 25, 2013 seven pages

Please show your work. I expect some arguments and, typically, correct final answers will not receive full credit if no arguments are given. If you use a logarithm function other than $\ln(x)$ then indicate the base. No aids allowed e.g. no calculators, no cellphones etc.

1. [36 marks] Short answer questions. Simplify as appropriate but if you are pressed for time there will be part marks for a 'calculator ready' correct answer.

a) [6 marks] Compute $f'(x)$ where $f(x) = x^{3/2} + x^{2/3}$.

b) [6 marks] Compute $f'(x)$ where $f(x) = (\ln x)e^{x^2}$.

c) [6 marks] Compute $\frac{dy}{dx}$ where $x^2y + xy^2 = 3y$.

d) [6 marks] Compute

$$\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^{3n}$$

e) [6 marks] Compute

$$\lim_{y \to 1} \frac{y-1}{\sqrt{y}-1}$$

f) [6 marks] Find the tangent line for $x = 3$ to the curve

$$y = \ln\left(\frac{3}{x}\right).$$

2. [16 marks] When a restaurant charges \$7 for its famed appetizer, it sells 50 of these appetizers in a night. If it raises the price to \$8 for the appetizer, it only sells 40 appetizers.

a) [7 marks] Assuming that the quantity of demand q is a linear function of the price p, give q as a function of p.

b) [2 marks] What are the reasonable ranges on p, q for this problem.

c) [7 marks] For $p = 8$, is the appetizer price elastic, inelastic or unit elastic? If it helps, the formula for demand elasticity is $\epsilon = \frac{p}{q}\frac{dq}{dp}$.

3. [12 marks] You have invested \$1000 in an interest bearing account at the Bank of Calculus. The nominal yearly rate of interest is 2% and the compounding is done continuously. How fast is your bank balance growing at the instant that your bank balance reaches \$2000. (The answer is an integer.)

4. [20 marks] We are producing an amount q (in metric tons) of a chemical at a cost

$$C(q) = \sqrt{q^3 + 4}.$$

Find the amount for which the average cost is minimized (justify your conclusion) and determine that average cost.

5. [16 marks] A 5m ladder is leaning up against a vertical wall with the ladder's base 3m from the wall. The ladder's base is being pushed toward the wall at a rate of 3 m/minute.

a) [10 marks] At what speed is the top of the ladder moving up the the wall?

b) [6 marks] At what rate (in units of radians per minute) is the angle that the top of the ladder makes with the wall decreasing?