Math 20A **Midterm Exam 2 v. A** **Name:** _____
November 20, 2017 **(Total Points: *25*)** **PID:** _____

Instructions

1. **Write your Name and PID in the spaces provided above.**
2. **Make sure your Name is on every page.**
3. **No calculators, tablets, phones, or other electronic devices are allowed during this exam.**
4. **Put away ANY devices that can be used for communication or can access the Internet.**
5. **You may use one handwritten page of notes, but no books or other assistance during this exam.**
6. **Read each question carefully and answer each question completely.**
7. **Write your solutions clearly in the spaces provided.**
8. **Show all of your work. No credit will be given for unsupported answers, even if correct.**

(1 point) 0. Carefully read and complete the instructions at the top of this exam sheet and any additional instructions given before the exam or written on the chalkboard during the exam.

(4 points) 1. Evaluate each of the following limits. Be sure to show your work in order to earn full credit.

(a) $\lim_{x \to 1} \dfrac{e^x - e}{\ln(x)}$

(b) $\lim_{x \to 0} \dfrac{\cos(3x) - 1}{x^2}$

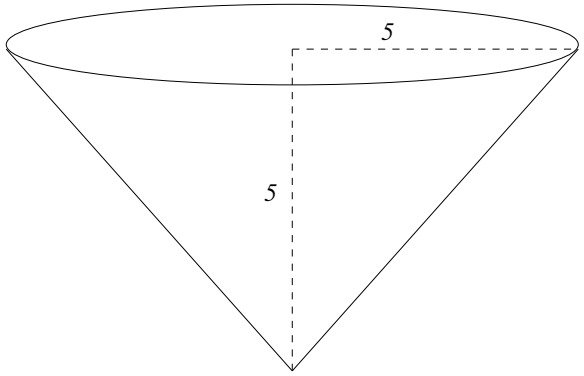
(6 points) 2. Let $f(x) = x + \dfrac{1}{x-3}$. The derivative of f is given by $f'(x) = 1 - \dfrac{1}{(x-3)^2}$.

(a) Find the interval(s) on which f is increasing and the interval(s) on which f is decreasing.

(b) Find the local maximum and local minimum values of f.

(c) Find the interval(s) on which the graph of f is concave up and the interval(s) on which the graph of f is concave down.

(5 points) 3. Randall Cohn has a pool with the shape of an inverted cone which is 5 meters deep with a radius of 5 meters at the top (base). Randall fills the pool with his garden hose at a rate of 0.1 cubic meters per minute. At what rate is the water depth increasing when the depth is 3 meters? (Note: The volume of a cone of height h and radius r is given by $V = \frac{1}{3}\pi r^2 h$.)



(4 points) 4. Find the linear approximation to $f(x) = xe^{-x^2} + e^{3x}$ at $x = 0$, and use it to estimate $f(0.1)$.

(5 points) 5. Find the point(s) on the ellipse $x^2 + xy + y^2 = 12$ at which the corresponding tangent line is horizontal.