Your Name   Your Signature

Student ID #

                                            Kristine   Katherine

Section (Tues.)   8:30   10:00   8:30   10:00

(circle one)   AA   AB   AC   AD

- Turn off all cell phones, pagers, radios, mp3 players, and other similar devices.

- This exam is closed book. You may use one $8.5'' \times 11''$ sheet of handwritten notes (both sides OK). Do not share notes. No photocopied materials are allowed.

- You can use only a Texas Instruments TI-30X IIS calculator.

- In order to receive credit, you must **show all of your work**. If you do not indicate the way in which you solved a problem, you may get little or no credit for it, even if your answer is correct.

- Place a box around your answer to each question.

- If you need more room, use the backs of the pages and indicate that you have done so.

- Raise your hand if you have a question.

- This exam has 4 pages, plus this cover sheet. Please make sure that your exam is complete.

Question	Points	Score
1	12	
2	8	
3	8	
4	10	
5	12	
Total	50	

1. Determine if the following limits exist. If they exist, compute them. Justify your answers.

   (a) (4 points) $\displaystyle \lim_{x \to 2} \frac{\sqrt{3x^2 - 8} - 2}{x - 2}$

   (b) (4 points) $\displaystyle \lim_{t \to \infty} \tan^{-1}\left(\frac{t^2 + 1}{1 + 3t - 5t^2} \right)$

   (c) (4 points) $\displaystyle \lim_{x \to 0} \frac{\cos(x)}{10x^2 - x}$

2. (8 points) Calculate the equation of the tangent line to $\quad g(x) = \left| x^2 - 4x \right| \quad$ at $x = 3$.

3. (8 points) Find all the points (a, b) on the curve $\quad y = \dfrac{e^x}{x^2 - 15} \quad$ where the tangent line is horizontal.

4. (10 points) Find the equations of all the tangent lines to the curve $y = x^2 + 3x$ that pass through the point $(2, 1)$.

5. A bug is travelling along the x-axis so that its x-coordinate is given by the formula $x = \dfrac{1-t}{t+2}$. Here x is in feet and t is in seconds. Assume $t \geq 0$.

   (a) (4 points) Calculate the bug's average velocity between $t = 3$ and $t = 3.1$ seconds.

   (b) (8 points) Find the bug's instantaneous velocity at time $t = 3$. Do not use any differentiation formulas in this problem. Use the limit definition of the derivative.