

MATH 121, Calculus I — Exam I (Spring 2014)

Name: _____

KU ID No.: _____

This exam has a total value of 100 points. There are 9 problems in total to be solved. The first seven are worth 10 points, the remaining two are worth 15 points. This is strictly a closed-book exam. **Be sure to show all work.** If you need to find a derivative, use the **limit definition of the derivative** unless otherwise directed.

Score

# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	Total

1. [10 points] Find the exact value of $\lim_{x \rightarrow 0} \frac{\sqrt{5-x} - \sqrt{5}}{x}$.

Answer:

2. [10 points] Which of the following statements are true? (Since there may be more than one correct answer, determine all correct answers.)

- (A) If $\lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$ exists, then f is differentiable at a .
- (B) If f is continuous at a , then f is differentiable at a .
- (C) If $\lim_{x \rightarrow a} f(x)$ exists, then f is differentiable at a .
- (D) If f is differentiable at a , then $\lim_{x \rightarrow a} f(x) = f(a)$.

Answer:

3. [10 points] Evaluate $\lim_{x \rightarrow 0} x^2 \cos(x)$.

Answer:

4. [10 points] For what value of the constants a and b is the function f continuous on $(-\infty, \infty)$?

$$f(x) = \begin{cases} \frac{x^2-4}{x-2} & \text{if } x < 2 \\ ax^2 - bx + 3 & \text{if } 2 < x < 3 \\ 2x - a + b & \text{if } x \geq 3 \end{cases}$$

Answer:

5. **[10 points]** For what values of x does the graph of $f(x) = x^2 - 2$ have a horizontal tangent? You may use derivative rules from chapter 3 if applicable.

Answer:

6. **[10 points]** Find an equation of the tangent line to the curve $y = 1/x$ at the point $(1, 1)$.

Answer:

7. [10 points] Find the value of $\lim_{x \rightarrow \infty} \frac{3x^2 - x + 2}{x^3 + 3x + 1}$.

Answer:

8. [15 points] Let $f(t) = 5t - 9t^2$. Use the *limit definition of the derivative* to find $f'(t)$.

Answer:

9. **[15 points]** The position function of a particle is given by $s(t) = t/2 + 3$, $t \geq 0$.
- (a) When does the particle reach a velocity of 5 m/s? Explain the significance of this.
 - (b) When does the particle have acceleration 0 m/s²? Explain the significance of this.

Bonus. **[5 points]** On what interval(s) is the function $f(x) = (x^3 + 3x^2)e^x$ decreasing? You may use derivative rules from chapter 3 if applicable.