

MATH 121, Calculus I — Exam I: Practice (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.

Score

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

1. [10 points] Find the exact value of $\lim_{x \rightarrow 0} \frac{\sqrt{3+x} - \sqrt{3}}{x}$.

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] Suppose that the function g satisfies the following inequality

$$2x \leq g(x) \leq x^4 - x^2 + 2$$

for all values of x . Find the value of $\lim_{x \rightarrow 1} g(x)$.

Answer:

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

$$f(x) = \begin{cases} cx^2 + 2x & \text{if } x < 2 \\ x^3 - cx & \text{if } x \geq 2 \end{cases}$$

Answer:

5. [10 points] For what values of x does the graph of $f(x) = x^3 - 3x + 1$ have a horizontal tangent?

Answer:

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

Answer:

7. [10 points] Find the value of $\lim_{x \rightarrow \infty} \frac{x+2}{\sqrt{9x^2+1}}$.

Answer:

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

Caution: Do not use the Power Rule to solve this problem.

Answer:

9. [**15 points**] The position function of a particle is given by $s(t) = t^2 - 4.5t$, $t \geq 0$.

(a) When does the particle reach a velocity of 5 m/s?

(b) When does the particle have acceleration 0 m/s²? Explain the significance of this value of t .

Bonus. [**5 points**] On what interval(s) is the function $f(x) = x^3 e^x$ increasing?