

Name: _____ Section and/or TA: _____

Do not remove this answer page. You will return the whole exam. You will be allowed two hours to complete this test. No books or notes may be used. You may use a graphing calculator during the exam, but NO calculator with a Computer Algebra System (CAS) or communication capabilities is permitted. You may not use a phone or other communication device during the exam.

The exam consists of 12 multiple choice questions that are worth 5 points each and 4 free response questions that are worth 10 points each. You should work the multiple choice questions on the question page. After you have checked your work carefully, record your answers by completely filling in the circle below that corresponds to your answer. If you must change your answer, make a note on the front of the exam. Be sure to check carefully when you transfer your answers to the cover sheet.

Show all work to receive full credit on the free response problems. You do not need to compute a decimal approximation to your answer. For example, the answer 4π is preferred to 12.57.

Multiple Choice Questions

- | | | | | | | | | | | | |
|----------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-----------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 1 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E | 7 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E |
| 2 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E | 8 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E |
| 3 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E | 9 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E |
| 4 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E | 10 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E |
| 5 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E | 11 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E |
| 6 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E | 12 | ☐ A | ☐ B | ☐ C | ☐ D | ☐ E |
-

SCORE

Multiple Choice	13	14	15	16	Total Score
60	10	10	10	10	100

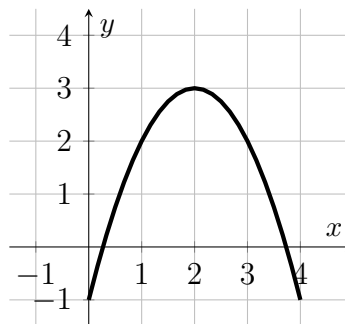
This page is left blank.

Multiple Choice Questions

1. (5 points) Give the domain of the function $f(x) = \frac{x^2 - 64}{x^2 + 4x}$.
- A. $(-\infty, -4) \cup (-4, \infty)$
 - B. $(-\infty, -4) \cup (-4, 0) \cup (0, \infty)$
 - C. $(-\infty, 0) \cup (0, \infty)$
 - D. $(-\infty, -8) \cup (-8, 4) \cup (4, \infty)$
 - E. $(-\infty, -8) \cup (-8, 0) \cup (0, \infty)$
2. (5 points) Let $f(x) = \frac{1}{x^2}$ with the domain $(-\infty, -1]$. Find the inverse function $f^{-1}(x)$.
- A. $f^{-1}(x) = \frac{1}{\sqrt{x}}$ with the domain $[1, \infty)$
 - B. $f^{-1}(x) = \sqrt{x}$ with the domain $[1, \infty)$
 - C. $f^{-1}(x) = \frac{-1}{\sqrt{x}}$ with the domain $(0, 1]$
 - D. $f^{-1}(x) = x^2$ with the domain $[1, \infty)$
 - E. $f^{-1}(x) = \frac{1}{\sqrt{x}}$ with the domain $(-\infty, -1]$

3. (5 points) The graph below gives the position of an object at time x . Find the average velocity over $[0, 4]$.

- A. 2 meters/second
- B. 0 meters/second
- C. -4 meters/second
- D. -2 meters/second
- E. 4 meters/second



4. (5 points) Consider the function f defined by

$$f(x) = \begin{cases} x + 1, & x \leq 1 \\ -x^2 + 2x - 1, & 1 < x \end{cases}.$$

Find the one-sided limit $\lim_{x \rightarrow 1^-} f(x)$.

- A. 0
- B. 1
- C. -1
- D. 2
- E. The limit does not exist

5. (5 points) Suppose $\lim_{x \rightarrow 3} f(x) = 8$ and $\lim_{x \rightarrow 3} g(x) = 9$. Find

$$\lim_{x \rightarrow 3} \left(\frac{(x-1)^3}{f(x)} + (x-2)^2 g(x) \right).$$

- A. $39/4$
- B. -8
- C. $19/2$
- D. 0
- E. 10

6. (5 points) Use the Squeeze Theorem to compute the limit $\lim_{x \rightarrow 0} x \cos \left(\frac{9}{x} \right).$

- A. 0
- B. 9
- C. $1/9$
- D. 1
- E. The limit does not exist

7. (5 points) Consider the function f defined by

$$f(x) = \begin{cases} \sqrt{x}, & \text{if } 0 \leq x \leq 4 \\ -x + a & \text{if } 4 < x \end{cases}.$$

For which value of a is the function f continuous on $[0, \infty)$?

- A. $a = -2$
 - B. $a = 6$
 - C. $a = 4$
 - D. $a = 2$
 - E. This function is not continuous for any value of a .
8. (5 points) Select the statement that best describes the behavior of $f(x) = \frac{113}{x}$ near $x = 0$.

- A. $\lim_{x \rightarrow 0^+} f(x) = -\infty$ and $\lim_{x \rightarrow 0^-} f(x) = -\infty$
- B. $\lim_{x \rightarrow 0^+} f(x) = -\infty$ and $\lim_{x \rightarrow 0^-} f(x) = +\infty$
- C. $\lim_{x \rightarrow 0^+} f(x) = +\infty$ and $\lim_{x \rightarrow 0^-} f(x) = +\infty$
- D. $\lim_{x \rightarrow 0^+} f(x) = +\infty$ and $\lim_{x \rightarrow 0^-} f(x) = -\infty$
- E. $\lim_{x \rightarrow 0} f(x) = 113$

9. (5 points) Find the limit $\lim_{x \rightarrow \infty} \frac{2x + 11}{4x - 3}$.

- A. 0
- B. $+\infty$
- C. $-\infty$
- D. $-11/3$
- E. $1/2$

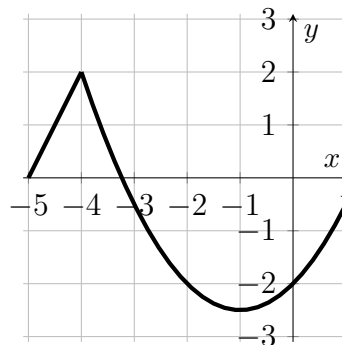
10. (5 points) Find the equation of the tangent line to the curve $y = x^2$ at the point $(-1, 1)$.

- A. $y = -\frac{x}{2} + \frac{1}{2}$
- B. $y = -\frac{x}{2} - 1$
- C. $y = 2x - 1$
- D. $y = -2x - 1$
- E. $y = -x$

11. (5 points) Consider the function $f(x) = 5x + 113$. If you evaluate and simplify the expression

$$\frac{f(1+h) - f(1)}{h} \quad \text{you obtain}$$

- A. 5
B. 113
C. 0
D. $5/h$
E. 1
12. (5 points) The graph of f is shown below. For which of the following values of x is the derivative $f'(x) = 0$?



- A. $x = -1$
B. $x = -2$
C. $x = 0$
D. $x = -4$
E. $x = -3$

Free response questions: Show all work clearly using proper notation.

13. (10 points) Let $f(x) = \frac{x}{6x-4}$.

- (a) Find the formula for the inverse function f^{-1} .
- (b) Give the domain of f and domain of f^{-1} .
- (c) Use the relation between the domain of f and the range of f^{-1} to give the range of f and range of f^{-1} .

Free response questions, show all work, and clearly label your answers

14. (10 points) For each limit, find the limit or state that it does not exist. Show steps clearly using proper notation.

(a) $\lim_{x \rightarrow 3} \frac{3x^2 - 10x + 3}{x^2 - 9}$

(b) $\lim_{x \rightarrow -3} \frac{8}{x + 3}$

(c) $\lim_{x \rightarrow \infty} \frac{3x^2 - 10x + 3}{x^2 - 9}$

Free response questions, show all work, and clearly label your answers

15. (10 points) (a) State the intermediate value theorem.
- (b) Use the intermediate value theorem to show $\frac{1}{x} - 2x = 0$ has a solution. Be sure to give the interval on which you are applying the intermediate value theorem.

Free response questions, show all work, and clearly label your answers

16. (10 points) Let $f(x) = \sqrt{x}$. Use the **limit definition** of the derivative to find the derivative $f'(64)$.