Name: _____ Student ID: _____

Section: _____

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

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Multiple Choice Questions

1. (5 points) Give the domain of the function $f(x) = \sqrt{4 + 2x}$.

   A. $[-10, 10]$

   B. $(-\infty, \infty)$

   C. $(-10, \infty)$

   D. $[-2, \infty)$

   E. $(-\infty, 2]$

2. (5 points) Let $f(x) = \dfrac{2x + 4}{x - 5}$. Find the inverse function $f^{-1}(x)$ and give its domain.

   A. $f^{-1}(x) = \dfrac{2x + 4}{x - 5}$ with the domain $(-\infty, 5) \cup (5, \infty)$

   B. $f^{-1}(x) = \dfrac{x + 2}{x - 5}$ with the domain $(-\infty, 5) \cup (5, \infty)$

   C. $f^{-1}(x) = \dfrac{5x + 4}{x - 2}$ with the domain $(-\infty, 2) \cup (2, \infty)$

   D. $f^{-1}(x) = \dfrac{5x + 4}{x - 2}$ with the domain $(-\infty, -4/5) \cup (-4/5, \infty)$

   E. $f^{-1}(x) = \dfrac{x + 2}{x - 1}$ with the domain $(-\infty, 1) \cup (1, \infty)$

3. (5 points) Assume that the position (measured in meters) of an object at time t (measured in seconds) is given by $s(t) = 2t^2 + 1$. Find the average velocity of the object on the interval $[2, 4]$.

   A. 33 meters/second

   B. 24 meters/second

   C. 12 meters/second

   D. 5 meters/second

   E. -12 meters/second

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

$$f(x) = \begin{cases} x - 5, & x < 2 \\ x^2 + 5, & 2 \leq x \end{cases}.$$

   Find the **one-sided** limit $\lim_{x \to 2^-} f(x)$.

   A. -3

   B. 0

   C. 9

   D. 2

   E. The limit does not exist

5. (5 points) Find $\lim_{x \to 2} \dfrac{x^2 - 4}{x}$.

   A. $-1/2$

   B. The limit does not exist

   C. $1/2$

   D. -3

   E. 0

6. (5 points) A function f satisfies $2 - 2x^2 \leq f(x) \leq -x^2 + 2x + 3$ for all real numbers x. There is exactly one number c where we may use the Squeeze Theorem to compute the limit $\lim_{x \to c} f(x) = L$. Find c and L.

   A. $c = 0$ and $L = -1$.

   B. $c = 1$ and $L = 0$.

   C. $c = -1$ and $L = 1$.

   D. $c = 0$ and $L = 1$.

   E. $c = -1$ and $L = 0$.

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

$$f(x) = \begin{cases} 2x+4, & x < 3 \\ a, & x = 3 \\ x^2+1, & x > 3 \end{cases}$$

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

A. $a = 3$

B. $a = 0$

C. $a = 10$

D. $a = -1$

E. This function is not continuous for any value of a.

8. (5 points) Select the statement that best describes the behavior of $f(x) = \dfrac{-4}{x^2}$ near $x = 0$.

A. $\lim\limits_{x\to 0^+} f(x) = -\infty$ and $\lim\limits_{x\to 0^-} f(x) = +\infty$

B. $\lim\limits_{x\to 0^+} f(x) = -\infty$ and $\lim\limits_{x\to 0^-} f(x) = -\infty$

C. $\lim\limits_{x\to 0^+} f(x) = +\infty$ and $\lim\limits_{x\to 0^-} f(x) = -\infty$

D. $\lim\limits_{x\to 0^+} f(x) = +\infty$ and $\lim\limits_{x\to 0^-} f(x) = +\infty$

E. $\lim\limits_{x\to 0} f(x) = 0$

9. (5 points) Find the limit $\lim_{x\to\infty} \dfrac{-x^3+x^2+72}{5x^3+32x^2+1}$.

   A. $-1/5$

   B. $+\infty$

   C. $-\infty$

   D. 0

   E. 72

10. (5 points) Find the equation of the tangent line to the curve $y = x^2 + 4x$ at the point $(1, 5)$.

    A. $y = -2x + 3$

    B. $y = -6x + 11$

    C. $y = 2x + 3$

    D. $y = 2x - 2$

    E. $y = 6x - 1$

11. (5 points) Consider the function $f(x) = x^2 + 3$. If you evaluate and simplify the expression

$$\frac{f(1+h) - f(1)}{h}$$

you obtain

A. $2h + h^2$

B. $2 + h$

C. $2h + h^2 + 3$

D. 0

E. $1/h$

12. (5 points) The graph of f is shown below. Find all the values of x for which the derivative $f'(x)$ does not exist.

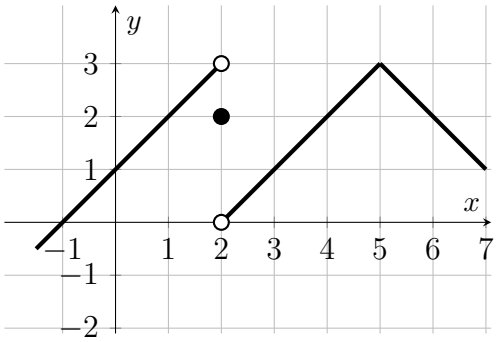
A. $x = 0$ and $x = 5$

B. $x = -1$ and $x = 0$

C. $x = 2$ and $x = 3$

D. $x = 2$ and $x = 5$

E. $x = 3$ and $x = 5$



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

13. (10 points) Let $f(x) = x^2 + 4$ with the domain $[2, \infty)$.
    (a) Find the formula for the inverse function f^{-1}.
    (b) Give the range of f.
    (c) Use the relation between the domain of f^{-1} and the range of f to give the domain and range of f^{-1}.

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

(a) $\lim_{x\to 0} \dfrac{2x^2-2}{x^2-2x+1}$

(b) $\lim_{x\to 1} \dfrac{2x^2-2}{x^2-2x+1}$

(c) $\lim_{x\to -\infty} \dfrac{2x^2-2}{x^2-2x+1}$

15. (10 points) (a) State the Intermediate Value Theorem.

(b) Use the Intermediate Value Theorem to show that the equation

$$x^4 - 3x^2 + 5x - 4 = 0$$

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 $f(x) = -x^2 + 5$. Use the **limit definition** of the derivative to find the derivative $f'(2)$.