

Do not remove this answer page — you will turn in the entire exam. You have two hours to do this exam. No books or notes may be used. You may use an ACT-approved calculator during the exam, but NO calculator with a Computer Algebra System (CAS), networking, or camera is permitted. Absolutely no cell phone use during the exam is allowed.

The exam consists of two short answer questions and eighteen multiple choice questions. Answer the short answer questions on the back of this page, and record your answers to the multiple choice questions on this page. For each multiple choice question, you will need to fill in the circle corresponding to the correct answer. For example, if (a) is correct, you must write

a b c d e

Do not circle answers on this page, but please circle the letter of each correct response in the body of the exam. It is your responsibility to make it CLEAR which response has been chosen. You will not get credit unless the correct answer has been marked on both this page and in the body of the exam.

GOOD LUCK!

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For grading use:

Multiple Choice	Short Answer
_____	_____
(number right) (5 points each)	(out of 10 points)

Total	_____
_____	(out of 100 points)

Fall 2015 Exam 1 Short Answer Questions

Write answers on this page. You must show appropriate legible work to be sure you will get full credit.

- 3 pts 1. Find the **average rate of change** of $f(x) = \sqrt{3x+8}$ from $x = 1$ to $x = 3$.
You do **NOT** need to simplify your answer.

- 7 pts 2. Use the **limit definition of the derivative** to find $f'(x)$ for $f(x) = 11x^2 + 2$.
You must use the limit definition to get credit. Show work clearly.

Multiple Choice Questions

*Show all your work on the page where the question appears.
Clearly mark your answer both on the cover page on this exam
and in the corresponding questions that follow.*

3. Solve the equation $6x^2 + 102xy + 4y = 5$ for y in terms of x

Possibilities:

(a) $y = \frac{-102 \pm \sqrt{10308}}{12}$

(b) $y = \frac{5 - 6x^2 - 102x}{4}$

(c) $y = \frac{102x + 4}{6x^2 - 5}$

(d) $y = \frac{6x^2 - 5}{102x + 4}$

(e) $y = \frac{5 - 6x^2}{102x + 4}$

4. Evaluate $f(10)$ when $f(x)$ is given by the piecewise definition

$$f(x) = \begin{cases} x^2 - 6 & \text{if } x \leq 4 \\ x - 9 & \text{if } 4 < x \leq 8 \\ x^2 - 3x & \text{if } 8 < x \end{cases}$$

Possibilities:

(a) -1

(b) 1

(c) DNE

(d) 94

(e) 70

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5. A train travels from city A to city B, and then travels from city B to city C. The train leaves city A at time 9:00 am and arrives at city B at 11:00 am. The train leaves city B at 11:00 am and arrives at city C at 2:00 pm. The average velocity of the train while traveling from A to B, was 39 miles per hour. What was the average velocity of the train from city B to city C, given that the average velocity of the train while traveling from A to C, was 58 miles per hour?

Possibilities:

- (a) 97 miles per hour
- (b) $(63/2)$ miles per hour
- (c) $(97/3)$ miles per hour
- (d) $(212/3)$ miles per hour
- (e) $(19/2)$ miles per hour

-
6. If $f(x) = \frac{4}{x+7}$ then choose the simplified form of $\frac{f(x+h)-f(x)}{h}$:

Possibilities:

- (a) $\frac{8x + 56 + 4h}{(x+h+7)(x+7)(2x+h)}$
 - (b) $-\frac{4}{(x+h+7)(x+7)}$
 - (c) $\frac{4}{(x+h+7)(x+7)}$
 - (d) $-\frac{4}{(x+h+7)^2}$
 - (e) $\frac{hx^2 + 14hx + 49h - 4}{(x+7)^2}$
-

7. Find a value of x so that the instantaneous rate of change of $f(x) = 4x^2 + 8$ at x is equal to 56.

Possibilities:

- (a) $x = 6$
- (b) $x = 7$
- (c) $x = 8$
- (d) $x = 9$
- (e) $x = 10$

8. For the function $f(x) = 6x^2 + 7x + 3$, find the equation of the tangent line to graph of f at $x = 5$.

Possibilities:

- (a) $y = 67x - 147$
- (b) $y = x^3 + 17$
- (c) $y = 67x + 188$
- (d) $y = 188x - 1017$
- (e) $y = 188$

9. If $\lim_{x \rightarrow 3} f(x) = 11$ and $\lim_{x \rightarrow 3} g(x) = 17$, then what is the value of $\lim_{x \rightarrow 3} \frac{(x+5)(f(x)+1)}{g(x)}$?

Possibilities:

(a) $\frac{11}{17}$

(b) 0

(c) the limit is infinity or does not exist

(d) $\frac{(3+5)(11+1)}{17}$

(e) $\frac{(3)(11)}{17}$

10. Find the limit

$$\lim_{t \rightarrow 0^+} \frac{36t^2}{t}$$

Possibilities:

(a) 18

(b) 0

(c) 36

(d) $\frac{18}{\sqrt{t}}$

(e) This limit either tends to infinity or this limit fails to exist

11. Find the limit

$$\lim_{x \rightarrow 0} \left(\frac{15}{x} + \frac{6x - 15}{x} \right)$$

Possibilities:

- (a) 1
- (b) 0
- (c) 6
- (d) 15
- (e) This limit does not exist.

12. Find the limit

$$\lim_{n \rightarrow \infty} \frac{(n + 3)^2}{13n + 11}$$

Possibilities:

- (a) $\frac{1}{11}$
- (b) $\frac{1}{24}$
- (c) The limit does not exist or approaches infinity
- (d) $\frac{1}{13}$
- (e) $\frac{9}{13}$

13. For the function

$$f(x) = \begin{cases} |4 + 8x| & \text{if } x < -2 \\ \sqrt{x^2 + 6} & \text{if } -2 \leq x < 3 \\ 3x^2 + x + 5 & \text{if } 3 \leq x \end{cases}$$

find $\lim_{x \rightarrow 5^+} f(x)$

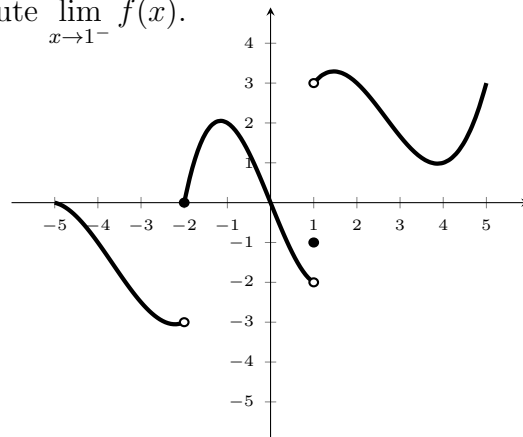
Possibilities:

- (a) 85
- (b) $\sqrt{15}$
- (c) $\sqrt{31}$
- (d) 35
- (e) 44

14. The graph of $y = f(x)$ is shown below. Compute $\lim_{x \rightarrow 1^-} f(x)$.

Possibilities:

- (a) 3
- (b) 0
- (c) -1
- (d) -3
- (e) -2



15. Consider the function $f(x) = \begin{cases} x^2 - 4 & \text{if } x < 8 \\ 2x + B & \text{if } x \geq 8 \end{cases}$

Find a value of B so that the function is continuous at $x = 8$.

Possibilities:

- (a) 40
- (b) 41
- (c) 42
- (d) 43
- (e) 44

16. Find the value of m which makes $f(x)$ differentiable everywhere, where

$$f(x) = \begin{cases} x^2, & \text{if } x \leq 4; \\ m(-4 + x) + 16, & \text{if } x > 4 \end{cases}$$

Possibilities:

- (a) 6
- (b) 7
- (c) 8
- (d) 9
- (e) 10

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17. Find the equation of the tangent line to the graph of the function $f(x) = \frac{1}{x^2 + 1} + 4$ at $x = 3$. You may use $f'(x) = -\frac{2x}{(x^2 + 1)^2}$

Possibilities:

(a) $y = -\frac{3}{50}x + \frac{107}{25}$

(b) $y = x^3 + 17$

(c) $y = \frac{41}{10}x - \frac{309}{25}$

(d) $y = -\frac{3}{50}x + \frac{41}{10}$

(e) $y = \frac{41}{10}$

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18. Consider the function $f(x) = 7x^2 + 8x + 4$. Its tangent line at $x = 5$ goes through the point $(9, y_1)$ where y_1 is:

Possibilities:

(a) 219

(b) -171

(c) 78

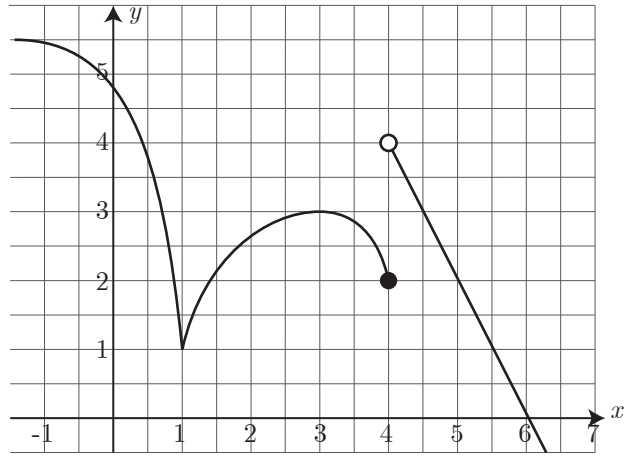
(d) 531

(e) 134

19. The graph of $y = f(x)$ is shown below. $f'(\frac{11}{2})$ is approximately :

Possibilities:

- (a) The limit does not exist or tends to infinity
- (b) -2
- (c) 2
- (d) $-\frac{1}{2}$
- (e) $\frac{1}{2}$



20. The graph of $y = f(x)$ is shown below. The function is continuous, except at $x =$

Possibilities:

- (a) $x=1$, $x=3$, and $x=4$
- (b) $x=1$ only
- (c) $x=4$ only
- (d) $x=1$ and $x=4$
- (e) $x=1$, $x=3$, $x=4$, and $x=6$

