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You have two hours to do this exam. Please write your name and section number on this page.

**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)

### Spring 2019 Exam 1 Short Answer Questions

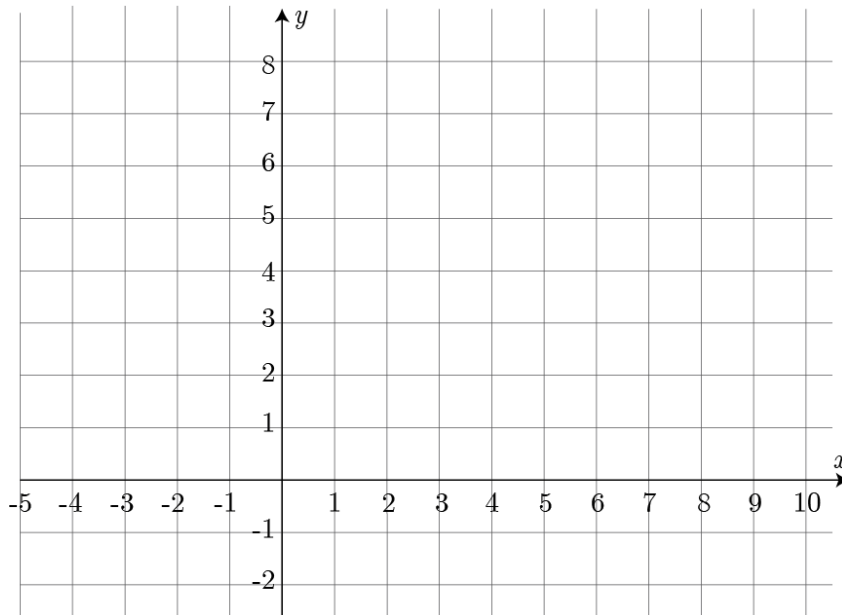
Write answers on this page. Your work must be clear and legible to be sure you will get full credit.

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1. Sketch the graph of a single function  $y = f(x)$  which satisfies the following properties:

$$\lim_{x \rightarrow 2} f(x) = 4, f(2) \text{ does not exist, } f(7) = 5, \lim_{x \rightarrow 7} f(x) \text{ does not exist, and } f(x) \text{ is}$$

continuous for all  $x$  except  $x = 2$  and  $x = 7$ .



2. Let  $f(x) = x^2 + 3x$ . Find the **average rate of change** from  $x = 5$  to  $x = 5 + h$  and simplify your answer. Clearly circle your final answer.

**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. The expression

$$\frac{x^{12} (2x)^3}{x^4}$$

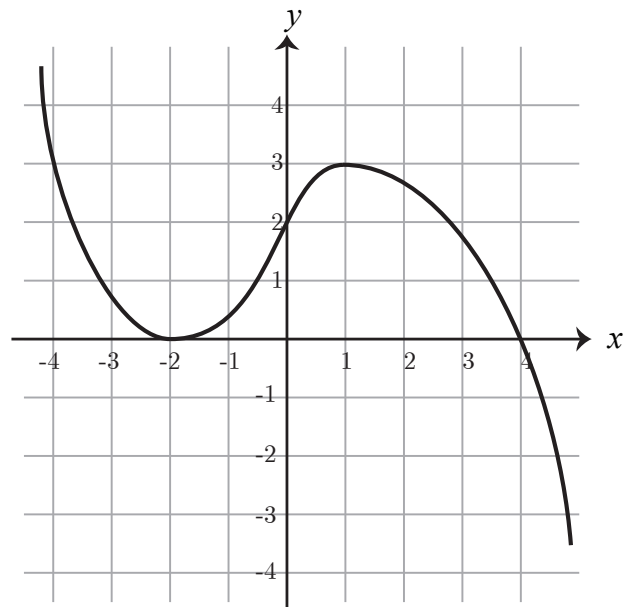
can be simplified to which of the following?

**Possibilities:**

- (a)  $8x^7$
- (b)  $2x^{11}$
- (c)  $8x^{11}$
- (d)  $2x^9$
- (e)  $2x^7$

4. The graph of  $y = f(x)$  is shown below. The expression  $f(a) = 0$  is true for which value(s) of  $a$ ?**Possibilities:**

- (a) 0
- (b)  $-2, 4$
- (c) 2
- (d)  $0, 3$
- (e)  $-2, 1$



- 
5. If  $h(t)$  represents the height of an object in feet above ground level at time  $t$  seconds and  $h(t)$  is given by  $h(t) = -16t^2 + 29t + 116$ , find the time at which the speed of the object is zero.

**Possibilities:**

- (a)  $(29/32)$  seconds
- (b) 116 seconds
- (c)  $(29/16)$  seconds
- (d)  $(61/32)$  seconds
- (e)  $(29/8)$  seconds

- 
6. If  $f(x) = \frac{8}{x+1}$  then choose the simplified form of  $\frac{f(x+h)-f(x)}{h}$ :

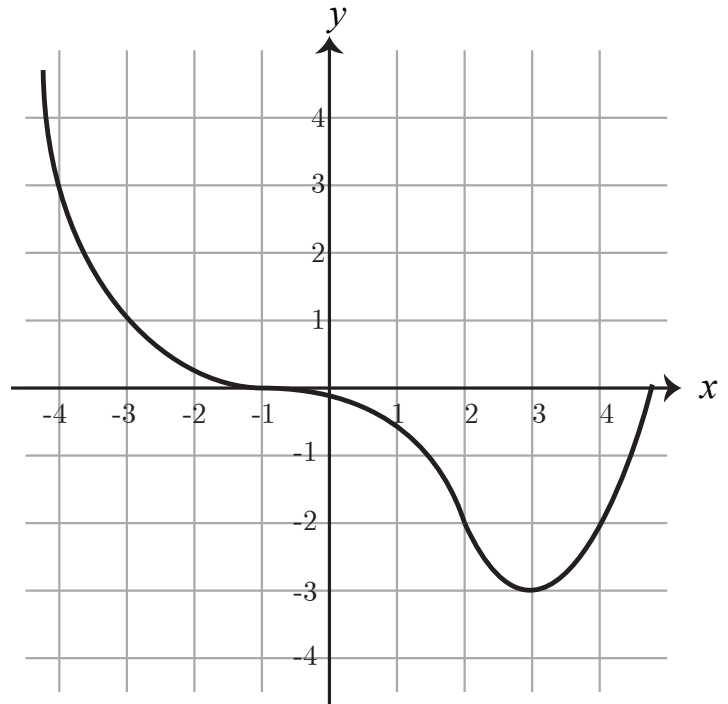
**Possibilities:**

- (a)  $-\frac{8-h(x+1)^2}{(x+1)^2}$
- (b)  $\frac{16x+16+8h}{(x+h+1)(x+1)(2x+h)}$
- (c)  $-\frac{8}{(x+h+1)(x+1)}$
- (d)  $-\frac{8}{(x+h+1)^2}$
- (e)  $\frac{8}{(x+h+1)(x+1)}$

- 
7. The graph of  $y = f(x)$  is shown below. Compute the average rate of change of  $f(x)$  from  $x = -4$  to  $x = 2$ .

**Possibilities:**

- (a)  $-\frac{7}{8}$
- (b)  $\frac{1}{6}$
- (c)  $-\frac{6}{5}$
- (d)  $-\frac{2}{5}$
- (e)  $-\frac{5}{6}$



- 
8. Let  $f(x) = x^5$ . Find a value  $c$  between  $x = 0$  and  $x = 3$ , so that the average rate of change of  $f(x)$  from  $x = 0$  to  $x = 3$  is equal to the instantaneous rate of change of  $f(x)$  at  $x = c$ . You may use the fact that  $f'(x) = 5x^4$ .

**Possibilities:**

- (a)  $\frac{3}{\sqrt[4]{5}}$
- (b) 81
- (c)  $3/2$
- (d)  $\frac{3}{\sqrt{5}}$
- (e)  $\frac{5}{\sqrt[4]{3}}$

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9. If  $\lim_{x \rightarrow 13} f(x) = 3$  and  $\lim_{x \rightarrow 13} g(x) = 5$ , then what is the value of  $\lim_{x \rightarrow 13} \frac{(x+7)(f(x)+1)}{g(x)}$ ?

**Possibilities:**

(a)  $\frac{(13)(3)}{5}$

(b)  $\frac{3}{5}$

(c) the limit is infinity or does not exist

(d)  $\frac{(13+7)(3+1)}{5}$

(e) 0

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10. Compute  $\lim_{t \rightarrow 2} \frac{t^2 + 3t - 10}{t^2 - 2t}$

**Possibilities:**

(a) 0

(b) 1

(c)  $\frac{7}{2}$

(d)  $\frac{9}{2}$

(e) The limit does not exist.

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11. Find the limit

$$\lim_{x \rightarrow 0} \left( \frac{15}{x} + \frac{3x - 15}{x} \right)$$

**Possibilities:**

- (a) This limit does not exist.
- (b) 1
- (c) 15
- (d) 0
- (e) 3

---

12. Find the limit

$$\lim_{n \rightarrow \infty} \frac{(n + 3)^2}{5n + 13}$$

**Possibilities:**

- (a) The limit does not exist or approaches infinity
- (b)  $\frac{1}{13}$
- (c)  $\frac{1}{5}$
- (d)  $\frac{1}{18}$
- (e)  $\frac{9}{5}$

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13. For the function

$$f(x) = \begin{cases} 6x^2 + 9x + 3 & \text{if } x < -1 \\ \sqrt{x^2 + 9} & \text{if } -1 \leq x < 2 \\ |8 + x| & \text{if } 2 \leq x \end{cases}$$

find  $\lim_{x \rightarrow -6^+} f(x)$

**Possibilities:**

- (a) 45
- (b)  $\sqrt{45}$
- (c) 165
- (d) 2
- (e)  $\sqrt{13}$

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14. Find all values of  $x$  where the derivative is not defined for  $f(x) = |x^2 - 11x + 18|$ .

**Possibilities:**

- (a)  $x = 0$  and  $x = 18$
- (b)  $x = 2$  and  $x = 9$
- (c)  $x = -11$  only
- (d)  $x = -11$  and  $x = 18$
- (e)  $x = 18$  only



- 
15. Consider the function  $f(x) = \begin{cases} Ax^2 & \text{if } x < 2 \\ 5 - Ax & \text{if } x \geq 2 \end{cases}$

Find a value of  $A$  so that the function is continuous at  $x = 2$ .

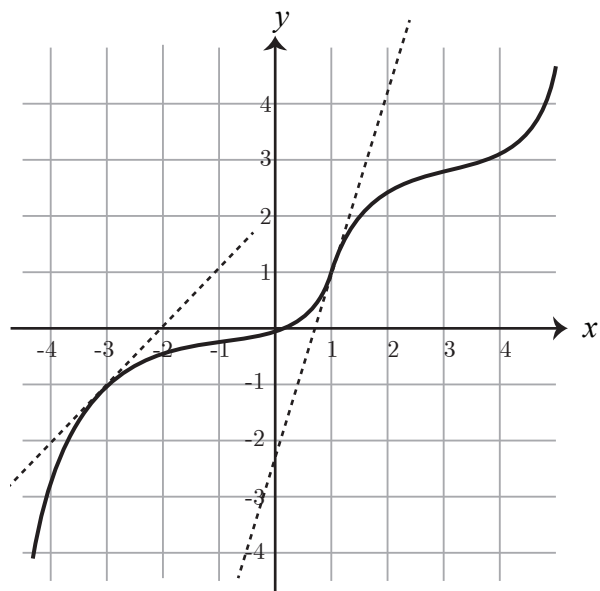
**Possibilities:**

- (a)  $\frac{1}{2}$
- (b)  $\frac{2}{3}$
- (c)  $\frac{5}{6}$
- (d) 1
- (e)  $\frac{7}{6}$

- 
16. Determine the value of  $f'(1)$  from the graph of  $f(x)$  given here:

**Possibilities:**

- (a)  $f'(1) = 0$
- (b)  $f'(1) = -1$
- (c)  $f'(1) = 1$
- (d)  $f'(1) = -3$
- (e)  $f'(1) = 3$



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17. For the function  $f(x) = (x + 4)^2$ , find the equation of the tangent line to the graph of  $f$  at  $x = 3$ .

**Possibilities:**

(a)  $y = 6x + 31$

(b)  $y = 14x + 7$

(c)  $y = 14x + 49$

(d)  $y = x + 4$

(e)  $y = 6x + 49$

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18. Consider the function  $f(x) = x^2 + 8x + 1$ . Its tangent line at  $x = 3$  goes through the point  $(9, y_1)$  where  $y_1$  is:

**Possibilities:**

(a)  $-8$

(b)  $26$

(c)  $34$

(d)  $118$

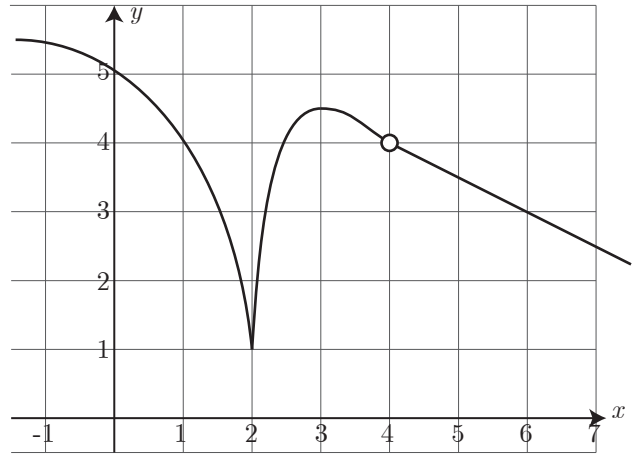
(e)  $14$

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

**Possibilities:**

- (a)  $x = 2$  only
- (b)  $x = 2$  and  $x = 4$
- (c)  $x = 4$  only
- (d)  $x = 3$  and  $x = 4$
- (e)  $x = 2, x = 3,$  and  $x = 4$

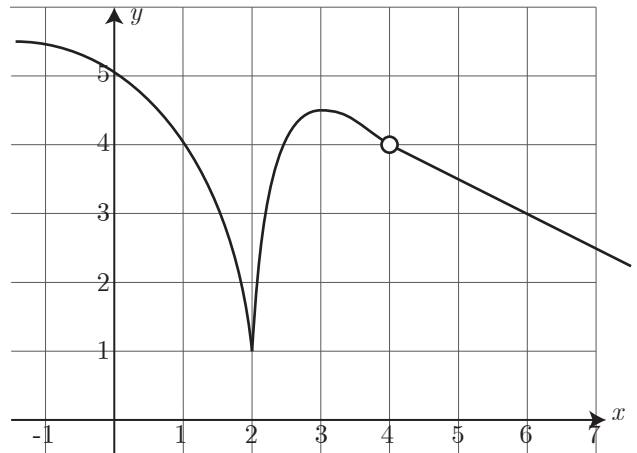


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20. The graph of  $y = f(x)$  is shown below. The function is **differentiable**, except at  $x =$

**Possibilities:**

- (a)  $x = 2$  and  $x = 4$
- (b)  $x = 2, x = 3,$  and  $x = 4$
- (c)  $x = 4$  only
- (d)  $x = 3$  and  $x = 4$
- (e)  $x = 2$  only



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