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a  b  c  d  e

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**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 2018 Exam 2 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. Let  $H(x) = (3x + 40)g(2x)$ . Find the derivative,  $H'(x)$ . **Do not simplify** your answer. Clearly **circle** your final answer.

2. The total profit (in dollars) from the sale of  $x$  bicycles is given by

$$P(x) = 50x - x^2 - 300$$

Find the **marginal average profit** at a production level of 10 bicycles. **Show all steps clearly** and **circle** your final answer.

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**Multiple Choice Questions***Show all your work on the page where the question appears.**Clearly mark your answer on the cover page on this exam.*

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3. For the function  $f(x) = 9x^3 + 7x^2 + 2x + 5$ , find the equation of the tangent line to the graph of  $f$  at  $x = 2$ .

**Possibilities:**

- (a)  $y = x^3 + 17$
  - (b)  $y = 138x - 167$
  - (c)  $y = 109$
  - (d)  $y = 138x + 109$
  - (e)  $y = 109x - 80$
- 

4. Find the derivative,  $f'(x)$ , if  $f(x) = \sqrt[5]{6x^3 + x^2 + 9x + 4}$ .

**Possibilities:**

- (a)  $(1/5)(6x^3 + x^2 + 9x + 4)^{-1/5}$
  - (b)  $(1/5)(6x^3 + x^2 + 9x + 4)(18x^2 + 2x + 9)$
  - (c)  $(1/5)(18x^2 + 2x + 9)^{-4/5}$
  - (d)  $(1/5)(6x^3 + x^2 + 9x + 4)^{-4/5}(18x^2 + 2x + 9)$
  - (e)  $\sqrt[5]{18x^2 + 2x + 9}$
- 

5. Find the derivative,  $f'(x)$ , if  $f(x) = \ln(5x + 2) + 50x + 90$ .

**Possibilities:**

- (a)  $\frac{5}{5x + 2} + 50$
  - (b)  $5e^{5x+2} + 50$
  - (c)  $\frac{1}{\ln(5x + 2)} \cdot \frac{5}{5x + 2} + 50$
  - (d)  $(5x + 2)e^{5x+1} + 50$
  - (e)  $\ln(5x + 2) + 140$
-

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6. Suppose  $F(x) = g(x)e^{6x}$ . If  $g(0) = 8$  and  $g'(0) = 7$ , find  $F'(0)$ .

**Possibilities:**

- (a) 15
- (b) 55
- (c) 7
- (d) 42
- (e) 21

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7. Suppose  $g(-3) = -10$  and  $g'(-3) = 7$ . Find  $F'(-3)$  if

$$F(x) = \frac{g(x)}{x^2}$$

**Possibilities:**

- (a)  $-\frac{1}{27}$
- (b)  $-\frac{1}{9}$
- (c)  $\frac{1}{27}$
- (d)  $\frac{1}{3}$
- (e)  $-\frac{7}{3}$

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8. Suppose  $H(x) = f(x^2 + g(x))$ . If  $g(2) = 10$ ,  $g'(2) = 7$ ,  $f'(11) = 15$ , and  $f'(14) = 17$ , then find  $H'(2)$ .

**Possibilities:**

- (a)  $15(14)(4 + 17)$
  - (b) 17
  - (c) 15
  - (d)  $(17)(11) + (14)(15)$
  - (e)  $17(4 + 7)$
-

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9. Suppose  $F(x) = f(\ln(x))$ . If  $f(1) = 7$ ,  $f'(1) = 11$ , and  $f'(0) = 2$ , then find  $F'(1)$ .

**Possibilities:**

- (a)  $\ln(2)$
- (b)  $\ln(7)/11$
- (c)  $11/7$
- (d)  $2$
- (e)  $7/11$

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10. For the function  $f(x) = \begin{cases} x^2 - 4 & x < 10 \\ x^3 - 5 & 10 \leq x < 20 \\ \sqrt{x+9} & 20 \leq x \end{cases}$ , find the slope of the tangent line to the graph of  $f$  at  $x = 6$ .

**Possibilities:**

- (a) 211
- (b) 12
- (c) 32
- (d)  $\frac{1}{30}\sqrt{15}$
- (e) 108

---

11. Find the derivative,  $f'(x)$ , if  $f(x) = \ln(\ln(4 + 9x))$ .

**Possibilities:**

- (a)  $\frac{9}{e^{4+9x}}$
- (b)  $\left(\frac{9}{4+9x}\right) e^{\ln(4+9x)}$
- (c)  $\frac{1}{\ln(4+9x)} \cdot \frac{9}{4+9x}$
- (d)  $\frac{1}{\frac{4+9x}{9}}$
- (e)  $\frac{1}{\ln(\ln(4+9x))} \cdot \frac{1}{\ln(4+9x)} \cdot \frac{9}{4+9x}$

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12. If  $f(x) = 7x^8 + 3x^5 + 9x$  then find the third derivative  $f'''(x)$ :

**Possibilities:**

(a)  $2352x^5 + 180x^2$

(b)  $3584x^8 + 375x^5$

(c)  $2352x^5 + 180x^2 + 19x$

(d)  $392x^6 + 60x^3$

(e)  $\frac{56x^7 + 15x^4 + 9}{x^2}$

---

13. If  $f(x) = e^{14x+38}$  then  $f''(x) =$

**Possibilities:**

(a)  $(14x + 38)(14x + 37)e^{14x+36} + 14e^{14x+37}$

(b)  $(14x + 38)(14x + 37)e^{14x+36}$

(c)  $28^2 (14)^{28} (14x + 38)$

(d)  $14^2 e^{14x+38}$

(e) 0

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14. Find the derivative,  $f'(x)$ , of  $f(x) = \frac{6}{x^{30}}$

**Possibilities:**

(a)  $-180x^{-31}$

(b)  $-30x^{-29}$

(c)  $-30x^{-31}$

(d)  $180x^{29}$

(e)  $6/(30x^{29})$

- 
15. The graph of  $f(x)$  passes through the point  $(0, 29)$ . The slope of  $f$  at any point  $P$  is 2 times the  $y$ -coordinate of  $P$ . Find the value of  $f(1)$ .

**Possibilities:**

- (a)  $29 \ln(2)$
- (b)  $2 \ln(29)$
- (c)  $29e^2$
- (d)  $2e^{29}$
- (e) 58

- 
16. If \$1000 dollars is invested at 6% interest compounded continuously, what is the value of the investment at the end of 4 years?

**Possibilities:**

- (a) \$110023.18
- (b) \$786.63
- (c) \$4247.35
- (d) \$240.00
- (e) \$1271.25

- 
17. If a tank holds 6000 gallons of water, which drains from the bottom of the tank in 30 minutes, then Torricelli's Law give the volume  $V$  of water remaining in the tank after  $t$  minutes as

$$V = 6000 \left(1 - \frac{t}{30}\right)^2.$$

Find the rate at which water is draining out of the tank after 10 minutes.

**Possibilities:**

- (a)  $\frac{800}{3}$  gallons per minute
- (b)  $\frac{400}{3}$  gallons per minute
- (c) 400 gallons per minute
- (d)  $\frac{8000}{3}$  gallons per minute
- (e) 8000 gallons per minute

- 
18. The total cost (in dollars) of producing  $x$  machines is

$$C(x) = 1800 + 30x - .1x^2.$$

Use the **marginal cost** to approximate the cost of producing the 31st machine.

**Possibilities:**

- (a) \$2633.90
- (b) \$23.80
- (c) \$2610.00
- (d) \$24.00
- (e) \$23.90

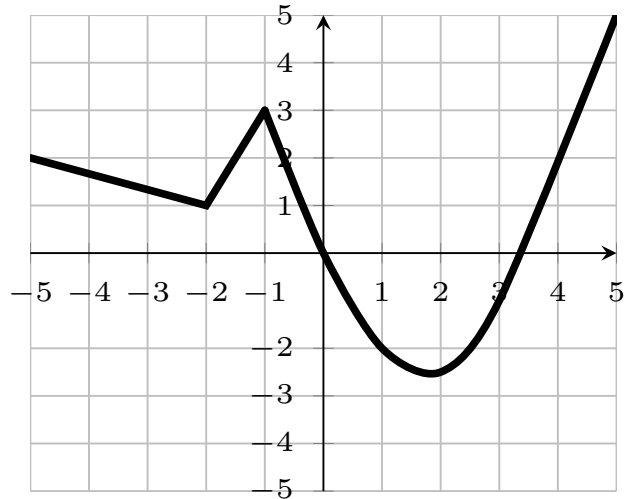


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19. The graph of  $y = f(x)$  is shown below. The maximum value of  $f(x)$  on the interval  $[-3, 3]$  occurs at which  $x$ ?

**Possibilities:**

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



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20. Find the minimum value of  $f(x) = \begin{cases} x^2 + 2x + 5 & \text{if } x \leq 1 \\ 7x + 1 & \text{if } x > 1 \end{cases}$

on the interval  $[0, 10]$ .

**Possibilities:**

- (a) 8
- (b) 71
- (c)  $\frac{7}{2}$
- (d) 1
- (e) 5

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