

Do not remove this answer page — you will turn in the entire 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.

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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	
	(maximum 110 points)

Fall 2018 Exam 4 Short Answer Questions

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

1. Find the equation of the tangent line to the graph of $f(x) = \ln(3x + 10)$ at $x = 0$.

Equation: $y =$ _____

2. Evaluate $\int_0^T (x^{10} + \sqrt[3]{x} + 40) dx$. Show steps clearly and **circle** your final answer. You do **NOT** need to simplify your final answer.

Name: _____

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. Suppose you are given the following data points for a function $f(x)$.

x	0	2	4	6	8	10
$f(x)$	7	11	15	18	27	31

Use this data and a **left-endpoint** Riemann sum with five equal subdivisions to estimate the integral, $\int_0^{10} f(x) dx$.

Possibilities:

- (a) 109
- (b) 156
- (c) 218
- (d) 204
- (e) 180

4. Suppose that $\int_7^{16} f(x) dx = 117$. Find the average value of $f(x)$ on $[7, 16]$.

Possibilities:

- (a) 117
- (b) 14
- (c) 9
- (d) $\frac{117}{2}$
- (e) 13

5. Assuming $x > 0$, evaluate the definite integral

$$\int_9^x \frac{13}{t^8} dt$$

Possibilities:

(a) $26\sqrt{x} - 26\sqrt{9}$

(b) $-\frac{13}{9}(x^{-9}) + \frac{13}{9}(9^{-9})$

(c) $13 \ln(|x^8|) - 13 \ln(9^8)$

(d) $-\frac{13}{7}(x^{-7}) + \frac{13}{7}(9^{-7})$

(e) $\frac{13}{\frac{1}{7}x^7} - \frac{91}{4782969}$

6. Given the function $f(x) = \begin{cases} \frac{1}{x} & \text{if } x < 68 \\ 14x & \text{if } x \geq 68 \end{cases}$

evaluate the definite integral

$$\int_1^{78} f(x) dx$$

Possibilities:

(a) 10658

(b) $\ln(68) + 10220$

(c) $\ln(68) + 140$

(d) $\frac{694893}{68}$

(e) 730

7. Let

$$F(x) = \int_0^x (t^2 + t - 42) dt$$

For which positive value of x does $F'(x) = 0$?

Possibilities:

(a) 42

(b) $\frac{1}{2}$

(c) 6

(d) $-\frac{1}{2}$

(e) 48

8. Use the Fundamental Theorem of Calculus to compute the derivative, $F'(x)$, of $F(x)$, if

$$F(x) = \int_1^{8x+9} (\ln(t))^3 dt$$

Possibilities:

(a) $(\ln(x))^3 \cdot (8x + 9)$

(b) $\left(\frac{1}{8x+9}\right)^3 \cdot (8)$

(c) $(\ln(x))^3 \cdot (8x + 9) \cdot (8)$

(d) $\frac{1}{4} (\ln(8x + 9))^4 \cdot (8)$

(e) $(\ln(8x + 9))^3 \cdot (8)$

9. Evaluate the integral

$$\int_0^T x^2 e^{9x^3+8} dx$$

Possibilities:

- (a) $\frac{1}{9}e^T - \frac{1}{9}$
- (b) $\frac{1}{27}e^T - \frac{1}{27}$
- (c) $\frac{1}{9}e^{9T^3+8}$
- (d) $\frac{1}{27}e^{9T^3+8} - \frac{1}{27}e^8$
- (e) $9T^2 e^{9T^3+8}$

10. A car is traveling due east. Its velocity (in miles per hour) at time t hours is given by

$$v(t) = -2.7t^2 + 16t + 60.$$

How far did the car travel during the first 7 hours of the trip?

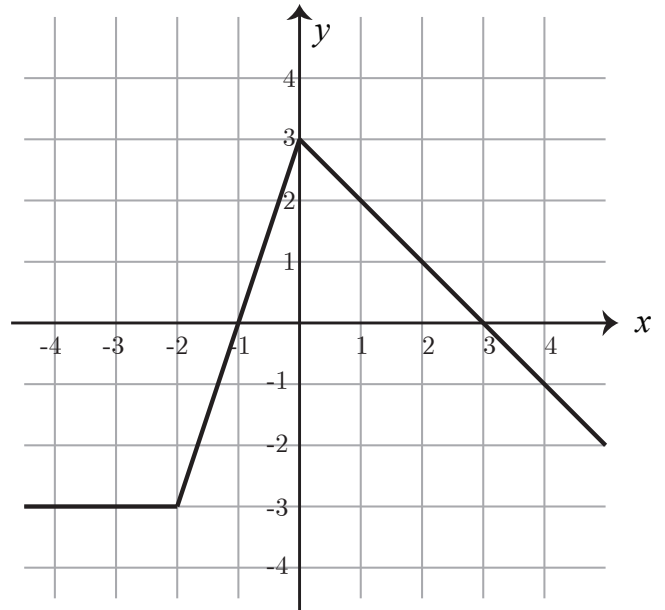
Possibilities:

- (a) 503.3 miles
 - (b) 488.6 miles
 - (c) 69.8 miles
 - (d) 40.4 miles
 - (e) 19.6 miles
-

-
11. The graph of $y = f(x)$ shown below consists of straight lines. Evaluate the definite integral $\int_{-3}^3 f(x) dx$.

Possibilities:

- (a) 6
- (b) 2.5
- (c) 7.5
- (d) 21.5
- (e) 1.5



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12. Suppose that $\int_5^{19} f(x) dx = 14$ and $\int_{13}^{19} f(x) dx = 27$. Find the value of $\int_5^{13} f(x) dx$.

Possibilities:

- (a) 41
- (b) $-\frac{13}{8}$
- (c) -13
- (d) 13
- (e) -41

-
13. Let $f(x) = x^4$. Find a value c between $x = 0$ and $x = 9$, so that the average rate of change of $f(x)$ from $x = 0$ to $x = 9$ is equal to the instantaneous rate of change of $f(x)$ at $x = c$.

Possibilities:

(a) $\frac{9}{\sqrt[3]{4}}$

(b) 729

(c) $\frac{9}{4}$

(d) 2916

(e) $\frac{\sqrt[3]{4}}{9}$

-
14. Compute $\lim_{t \rightarrow 3} \frac{t^2 - 10t + 21}{t^2 + 3t - 18}$

Possibilities:

(a) $-\frac{5}{9}$

(b) $-\frac{4}{9}$

(c) $-\frac{1}{3}$

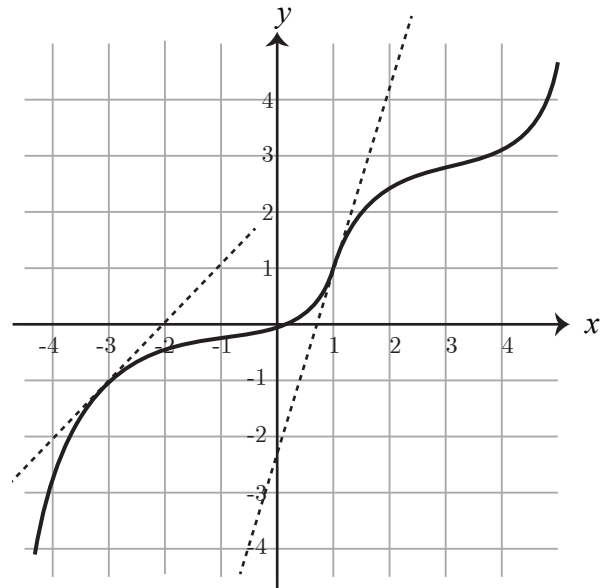
(d) $-\frac{2}{9}$

(e) The limit does not exist.

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

Possibilities:

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



16. Find the derivative, $f'(x)$, if $f(x) = (60x + 80) \ln(9x + 8)$.

Possibilities:

- (a) $9e^{9x+8} + 60$
- (b) $60 \ln(9x + 8)$
- (c) $(60x + 80) \cdot \frac{9}{9x+8} + 60 \ln(9x + 8)$
- (d) $60 \cdot \frac{9}{9x+8}$
- (e) $(60x + 80) \cdot \frac{1}{9x+8} + 60 \ln(9x + 8)$

-
17. The total cost (in dollars) of producing x machines is $C(x) = 7000 + 60x$. The total revenue from selling x machines is $R(x) = 200x - \frac{x^2}{91}$. Find the **marginal profit** function.

Possibilities:

- (a) $140 - \frac{2}{91}x$
- (b) $-7000 + 140x - \frac{x^2}{91}$
- (c) $260 + 7000x - \frac{2}{91}x$
- (d) $\frac{-7000}{x} + 140 - \frac{x}{91}$
- (e) $\frac{7000}{x^2} - \frac{1}{91}$

-
18. Suppose $H(x) = \sqrt{f(x) + g(x)}$. If $f(7) = 8$, $f'(7) = 5$, $g(7) = 28$, and $g'(7) = 9$, find $H'(7)$.

Possibilities:

- (a) $\sqrt{14}$
- (b) $\frac{7}{6}$
- (c) $\frac{1}{12}$
- (d) $\frac{1}{28}\sqrt{14}$
- (e) 252

19. Let $g(x) = xe^{9x}$. For x in which interval(s) is g concave up?

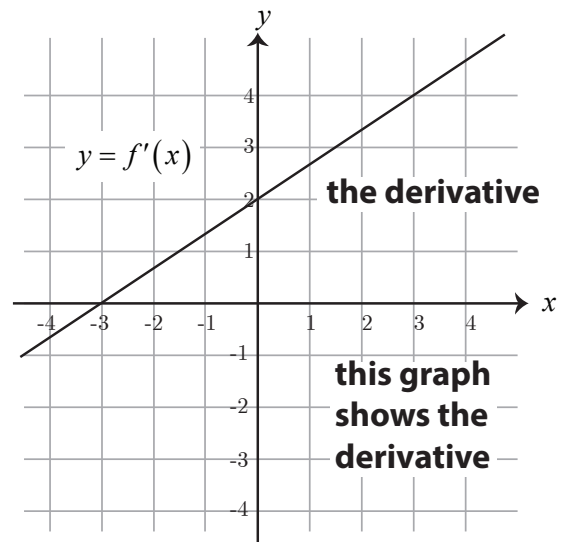
Possibilities:

- (a) $(-\frac{1}{9}, \infty)$
- (b) $(-\infty, -\frac{1}{9})$
- (c) $(-\frac{2}{9}, \infty)$
- (d) $(-\infty, -\frac{2}{9})$
- (e) $(-\infty, \infty)$

20. The following is the graph of the derivative, $f'(x)$, of the function $f(x)$.
Where is the original function $f(x)$ increasing?

Possibilities:

- (a) everywhere
- (b) $(2, \infty)$
- (c) nowhere
- (d) $(-\infty, -3)$
- (e) $(-3, \infty)$



-
21. A drug is injected into the bloodstream of a patient. The concentration of the drug in the bloodstream (in milligrams per cubic centimeter) t hours after the injection is given by

$$C(t) = \frac{.17t}{t^2 + 6}$$

Find the instantaneous rate of change after 1 hour.

Possibilities:

- (a) 0.024 units per hour
- (b) 0.017 units per hour
- (c) 0.085 units per hour
- (d) 6.000 units per hour
- (e) 35.294 units per hour

-
22. An open box is to be made out of a 12-inch by 18-inch piece of cardboard by cutting out squares of equal size from the four corners and bending up the sides. If we find the dimensions of the resulting box that has the largest volume, what is its **height**?

Possibilities:

- (a) 2.35 inches
 - (b) 2.45 inches
 - (c) 2.55 inches
 - (d) 2.65 inches
 - (e) 2.75 inches
-

Some Formulas

1. Areas:

(a) Triangle $A = \frac{bh}{2}$

(b) Circle $A = \pi r^2$

(c) Rectangle $A = lw$

(d) Trapezoid $A = \frac{h_1 + h_2}{2} b$

2. Volumes:

(a) Rectangular Solid $V = lwh$

(b) Sphere $V = \frac{4}{3}\pi r^3$

(c) Cylinder $V = \pi r^2 h$

(d) Cone $V = \frac{1}{3}\pi r^2 h$

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