MA123 — Elem. Calculus Fall 2017
Final Exam 2017-12-12

Name: _____ **Sec.:** _____

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.

The exam consists of two short answer questions and twenty 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. It is your responsibility to make it CLEAR which response has been chosen. For example, if (a) is correct, you must write

(a) b c d e

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

GOOD LUCK!

3.	a	b	c	d	e	**13.**	a	b	c	d	e
4.	a	b	c	d	e	**14.**	a	b	c	d	e
5.	a	b	c	d	e	**15.**	a	b	c	d	e
6.	a	b	c	d	e	**16.**	a	b	c	d	e
7.	a	b	c	d	e	**17.**	a	b	c	d	e
8.	a	b	c	d	e	**18.**	a	b	c	d	e
9.	a	b	c	d	e	**19.**	a	b	c	d	e
10.	a	b	c	d	e	**20.**	a	b	c	d	e
11.	a	b	c	d	e	**21.**	a	b	c	d	e
12.	a	b	c	d	e	**22.**	a	b	c	d	e

For grading use:

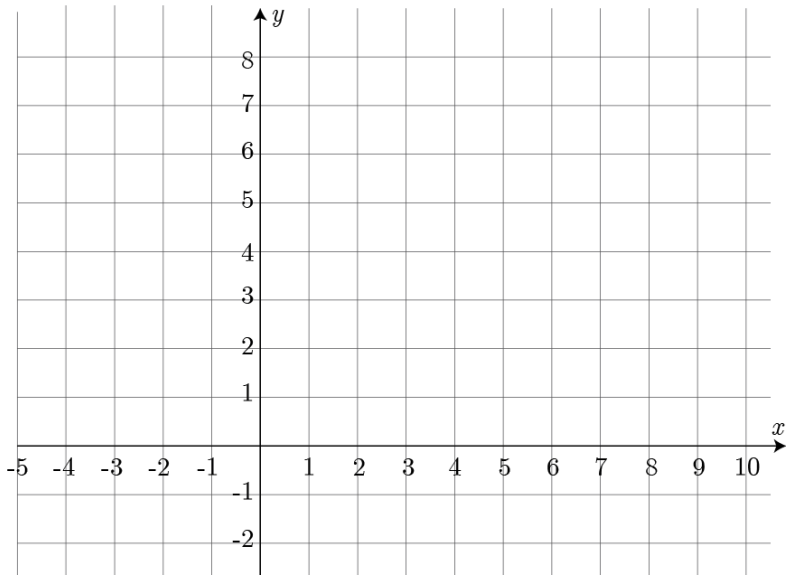
Multiple Choice		Short Answer
(number right)	(5 points each)	(out of 10 points)

Total	
	(max 110 points)

Fall 2017 Exam 4 Short Answer Questions

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

1. Sketch the graph of a **continuous** function $y = f(x)$ which satisfies $f'(x) > 0$ on $(-\infty, 1)$ and on $(6, \infty)$, $f'(x) < 0$ on $(1, 6)$; $f''(x) < 0$ on $(-\infty, 3)$ and $f''(x) > 0$ on $(3, \infty)$.



2. Find the average value of the function $f(x) = 4x^3 + 8$ on the interval $[0, 3]$. *You must **clearly show steps using calculus** to find your answer.*

Average value: _____

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
$f(x)$	4	9	16	19	26	29

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

Possibilities:

(a) 148

(b) 198

(c) 173

(d) 103

(e) 206

4. Suppose that $\int_4^{19} f(x)\,\mathrm{d}x = 195$. Find the average value of $f(x)$ on $[4, 19]$.

Possibilities:

(a) 13

(b) $\dfrac{195}{2}$

(c) 195

(d) 14

(e) 15

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

$$\int_5^x \frac{5}{t^3}\,\mathrm{d}t$$

Possibilities:

(a) $\frac{5}{\frac{1}{4}x^4} - \frac{4}{125}$

(b) $10\sqrt{x} - 10\sqrt{5}$

(c) $5\ln(|x^3|) - 5\ln(5^3)$

(d) $5\sqrt{x}$

(e) $-\frac{5}{2}(x^{-2}) + \frac{5}{2}(5^{-2})$

---

6. Given the function $f(x) = \begin{cases} \frac{1}{x} & \text{if } x < 88 \\ 8x & \text{if } x \geq 88 \end{cases}$

evaluate the definite integral

$$\int_1^{98} f(x)\,\mathrm{d}x$$

Possibilities:

(a) $\frac{654633}{88}$

(b) $\ln(88) + 7440$

(c) 17298

(d) $\ln(88) + 80$

(e) 930

---

7. Let

$$F(x) = \int_0^x \left(t^2 - 9t\right)\ \mathrm{d}t$$

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

Possibilities:

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

(b) $\frac{27}{2}$

(c) 9

(d) $\frac{477}{2}$

(e) 18

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

$$F(x) = \int_1^{7x+8} \left(t^2 + 3t + 4\right)\ \mathrm{d}t$$

Possibilities:

(a) $((7x+8)^2 + 3(7x+8) + 4) \cdot (7)$

(b) $\frac{1}{3}(7x+8)^3 + \frac{3}{2}(7x+8)^2 + 4(7x+8) - \left(\frac{1}{3}(1)^3 + \frac{3}{2}(1)^2 + 4(1)\right)$

(c) $x^2 + 3x + 4$

(d) $2x + 3$

(e) $(7x+8)^2 + 3(7x+8) + 4$

9. Evaluate the integral

$$\int_0^x (3t+8)^{20}\ \mathrm{d}t$$

Possibilities:

(a) $\dfrac{1}{21}(3x+8)^{21} - \dfrac{8^{21}}{21}$

(b) $\dfrac{1}{20}(3x+8)^{20} - \dfrac{8^{20}}{20}$

(c) $\dfrac{1}{21}x^{21} - \dfrac{8^{21}}{21}$

(d) $\dfrac{1}{3(21)}(3x+8)^{21} - \dfrac{8^{21}}{3(21)}$

(e) $21(3x+8)^{21} - 20 \cdot 8^{21}$

10. A car is traveling due east. Its velocity (in miles per hour) at time t hours is given by $v(t) = -2.7t^2 + 16t + 50$. How far did the car travel during the first 4 hours of the trip?

Possibilities:

(a) 270.4 miles

(b) 5.2 miles

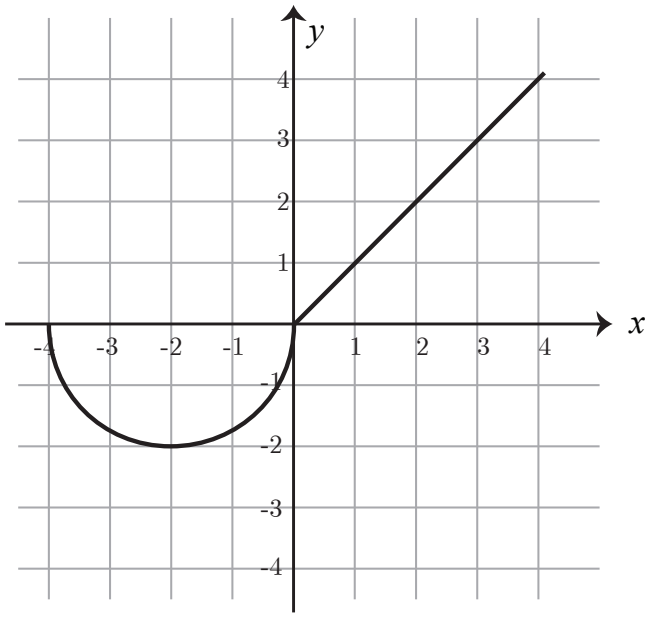
(c) 310.4 miles

(d) 77.6 miles

(e) 75.2 miles

(f) 300.8 miles

11. The graph of $y = f(x)$ shown below includes a semicircle and a straight line. Evaluate the definite integral $\int_{-4}^{4} f(x)\,\mathrm{d}x$.



Possibilities:

(a) $2\pi + 8$

(b) $-4\pi + 8$

(c) $-2\pi - 8$

(d) $-2\pi + 6$

(e) $-2\pi + 8$

12. Suppose that $\int_{3}^{18} f(x)\,\mathrm{d}x = 9$. Find the value of $\int_{3}^{18} (3f(x) + 30)\,\mathrm{d}x$.

Possibilities:

(a) 57

(b) 567

(c) 477

(d) 117

(e) 42

13. Let $f(x) = x^4$. Find a value c between $x = 0$ and $x = 6$, so that the average rate of change of $f(x)$ from $x = 0$ to $x = 6$ is equal to the instantaneous rate of change of $f(x)$ at $x = c$.

Possibilities:

(a) $\dfrac{6}{\sqrt[3]{4}}$

(b) 864

(c) $\dfrac{6}{4}$

(d) 216

(e) $\dfrac{\sqrt[3]{4}}{6}$

14. Compute $\lim\limits_{t \to 3} \dfrac{t^2 - 9}{t^2 + 5t - 24}$

Possibilities:

(a) 0

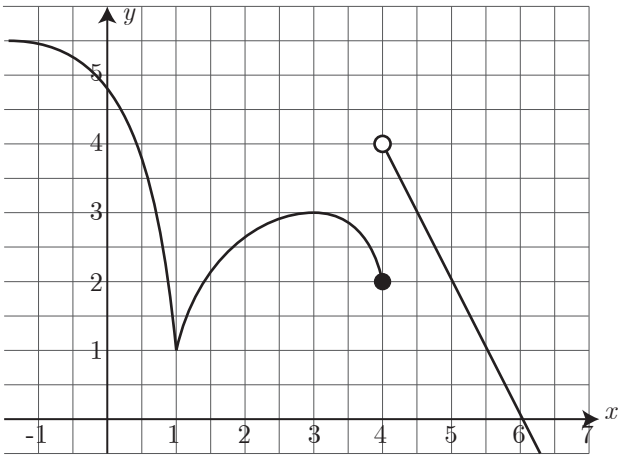
(b) The limit does not exist.

(c) 1

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

(e) $\frac{6}{11}$

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



Possibilities:

(a) x=1, x=3, and x=4

(b) x=1, x=3, x=4, and x=6

(c) x=1 only

(d) x=1 and x=4

(e) x=4 only

16. Find the derivative, $f'(x)$, if $f(x) = (17x + 3)\, e^{5x+13}$.

Possibilities:

(a) $17\,(5x + 13)\, e^{5x+12}$

(b) $5\,(17x + 3)\, e^{5x+13} + 17e^{5x+13}$

(c) $17 \cdot 5e^{5x+13}$

(d) $17e^5$

(e) $(17x + 3)\,(5x + 13)\, e^{5x+12} + 17e^{5x+13}$

17. If $f(x) = x^7 + 8x^5 + 3x^4 + 4x^2 + 7$ then find the second derivative $f''(x)$:

Possibilities:

(a) $42x^5 + 160x^3 + 36x^2 + 8$

(b) $49x^7 + 200x^5 + 48x^4 + 16x^2$

(c) $7x^6 + 21x^5 + 75x^4 + 127x^3 + 119x^2 + 67x + 16$

(d) $42x^5 + 230x^3 + 36x^2 + 94x + 14$

(e) $7x^6 + 40x^4 + 12x^3 + 8x$

18. Suppose $g(5) = 8$ and $g'(5) = 6$. Find $F'(5)$ if

$$F(x) = \frac{g(x)}{x^2 - 3}$$

Possibilities:

(a) $\frac{53}{121}$

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

(c) $\frac{14}{5}$

(d) $\frac{13}{121}$

(e) $\frac{35}{242}$

19. Suppose the derivative of $g(t)$ is $g'(t) = 12t^2 - 144t + 324$. For t in which interval(s) is g concave up?

Possibilities:

(a) $(3, 6) \cup (9, 12)$

(b) $(6, \infty)$

(c) $(-\infty, 3) \cup (9, \infty)$

(d) $(-\infty, 6)$

(e) $(3, 9)$

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:

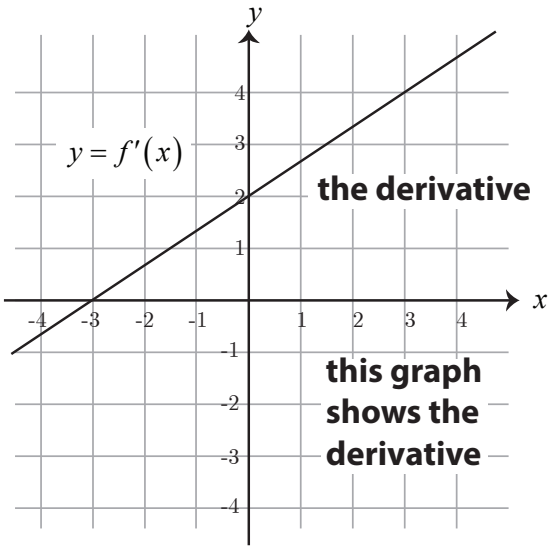
(a) $(-\infty, -3)$

(b) nowhere

(c) everywhere

(d) $(2, \infty)$

(e) $(-3, \infty)$



21. A sphere is growing so its volume is increasing at a rate of 81 cubic feet per minute. At what rate is the radius changing when its radius is 3 feet?

Possibilities:

(a) 2916π feet per minute

(b) $\frac{81}{36\pi}$ feet per minute

(c) $\frac{36\pi}{81}$ feet per minute

(d) $\frac{81}{12\pi}$ feet per minute

(e) $\frac{108\pi}{3}$ feet per minute

22. Find the area of the largest rectangle whose sides are parallel to the coordinate axes, whose bottom-left corner is at $(0, 0)$ and whose top-right corner is on the graph of $y = 21x - x^2$.

Possibilities:

(a) $\frac{21}{2}$

(b) $\frac{9261}{8}$

(c) 0

(d) 1372

(e) 420

Some Formulas

1. Areas:

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

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

(c) Rectangle $A = lw$

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

2. Volumes:

(a) Rectangular Solid $V = lwh$

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

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

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

MA123 — Elem. Calculus Fall 2017
Final Exam 2017-12-12

Name: _____ **Sec.:** _____

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.

The exam consists of two short answer questions and twenty 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. It is your responsibility to make it CLEAR which response has been chosen. For example, if (a) is correct, you must write

(a) (b) (c) (d) (e)

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

GOOD LUCK!

3.	a	**b**	c	d	e	**13.**	**a**	b	c	d	e
4.	**a**	b	c	d	e	**14.**	a	b	c	d	**e**
5.	a	b	c	d	**e**	**15.**	a	b	c	**d**	e
6.	a	**b**	c	d	e	**16.**	a	**b**	c	d	e
7.	a	b	**c**	d	e	**17.**	**a**	b	c	d	e
8.	**a**	b	c	d	e	**18.**	a	b	c	**d**	e
9.	a	b	c	**d**	e	**19.**	a	**b**	c	d	e
10.	**a**	b	c	d	e	**20.**	a	b	c	d	**e**
11.	a	b	c	d	**e**	**21.**	a	**b**	c	d	e
12.	a	b	**c**	d	e	**22.**	a	b	c	**d**	e

For grading use:

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

Total	
	(max 110 points)