MA123 — Elem. Calculus Fall 2016
Exam 3 2016-11-17

Name: _____ **Sec.:** _____

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(a) b c d e

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GOOD LUCK!

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

For grading use:

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

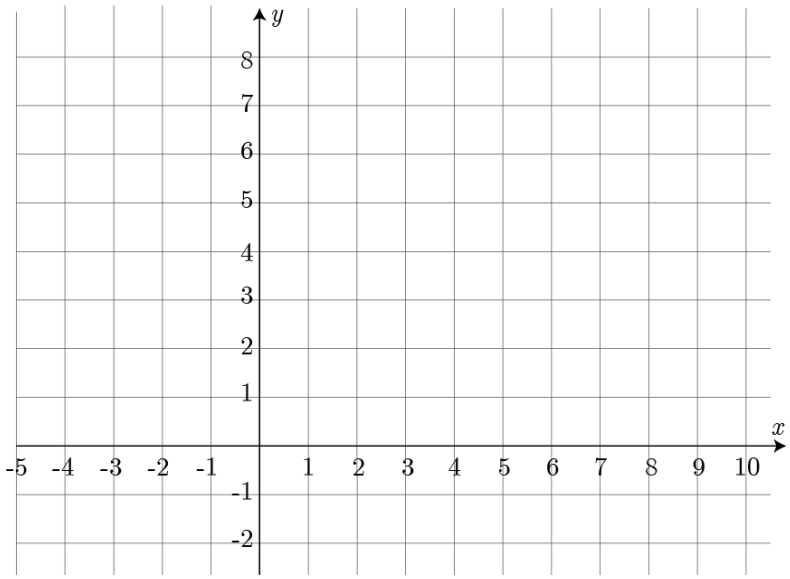
Total	
	(out of 100 points)

Name: **Last 4 digits of Student ID:**

Fall 2016 Exam 3 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 $f'(x) < 0$ for $x < -1$; $f'(x) > 0$ for $x > -1$; f is concave up for $x < 4$; concave down for $x > 4$.



2. Suppose the product of x and y is 37 and both x and y are positive. What is the minimum possible sum of x and y? *You must **clearly use calculus** to find **and justify** your answer. Your final answer does **not** need to be simplified.*

Minimum possible sum: _____

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.

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3. Where is the function $f(t) = \dfrac{1}{t-60}$ decreasing?

Possibilities:

(a) $f(t)$ is always decreasing except at t = 60

(b) $-1 < t < 60$

(c) $t > 60$

(d) $f(t)$ is never decreasing

(e) $t < 60$

---

4. Where is the function $f(t) = t^4 - 12t^3 - 1$ concave up?

Possibilities:

(a) $t > 9$

(b) $f(t)$ is always concave up

(c) $t < 9$

(d) $t < 0$ and $t > 6$

(e) $0 < t < 6$

---

5. Suppose the derivative of $g(t)$ is $g'(t) = 8(t-2)(t-6)(t-4)$. For t in which interval(s) is g increasing?

Possibilities:

(a) $(-\infty, 4 - \frac{2}{3}\sqrt{3}) \cup (4 + \frac{2}{3}\sqrt{3}, \infty)$

(b) $(-\infty, 2) \cup (4, 6)$

(c) $(4 - \frac{2}{3}\sqrt{3}, 4 + \frac{2}{3}\sqrt{3})$

(d) $(2, 4) \cup (6, \infty)$

(e) $(2, 4) \cup (6, 8)$

6. Suppose the derivative of $g(t)$ is $g'(t) = 14(t-2)(t-8)$. For t in which interval(s) is g concave up?

Possibilities:

(a) $(-\infty, 2) \cup (8, \infty)$

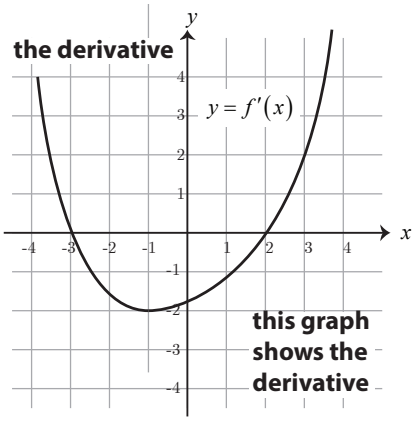
(b) $(-\infty, 5)$

(c) $(2, 8)$

(d) $(2, 5) \cup (8, 14)$

(e) $(5, \infty)$

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



Possibilities:

(a) $(-\infty, -1)$

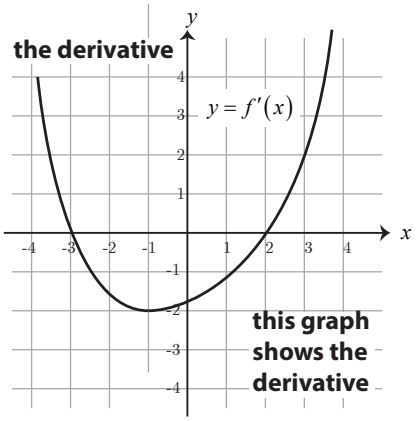
(b) $(-3, 2)$

(c) $(-1, \infty)$

(d) $(-2, \infty)$

(e) $(-\infty, -3)$ and $(2, \infty)$

8. The following is the graph of the derivative, $f'(x)$, of the function $f(x)$.
Where is the original function $f(x)$ concave up?



Possibilities:

(a) $(-1, \infty)$

(b) $(-\infty, -3)$ and $(2, \infty)$

(c) $(-3, 2)$

(d) $(-2, \infty)$

(e) $(-\infty, -1)$

9. 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) $\frac{9261}{8}$

(b) 1372

(c) 0

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

(e) 420

10. A box is constructed out of two different types of metal. The metal for the top and bottom, which are both square, costs \$3 per square foot, and the metal for the four sides costs \$11 per square foot. The box has a volume of 30 cubic feet. If we find the dimensions that minimize cost, what is the length of the base?

Possibilities:

(a) 5.29 feet

(b) 5.79 feet

(c) 4.29 feet

(d) 4.79 feet

(e) 6.29 feet

11. Suppose the derivative of $H(s)$ is given by $H'(s) = 1/(s^2 + 8)$. Find the value of s in the interval $[-10, 10]$ where $H(s)$ takes on its maximum.

Possibilities:

(a) 10

(b) $-\frac{1}{8}$

(c) 8

(d) -10

(e) -8

12. Find the critical numbers of the function $f(x) = 2xe^{17x}$.

Possibilities:

(a) $-\dfrac{2}{17}, 0$

(b) 0

(c) $-\dfrac{1}{17}$

(d) $-\dfrac{2}{17}$

(e) $-\dfrac{1}{17}, 0, e^{17}$

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

Possibilities:

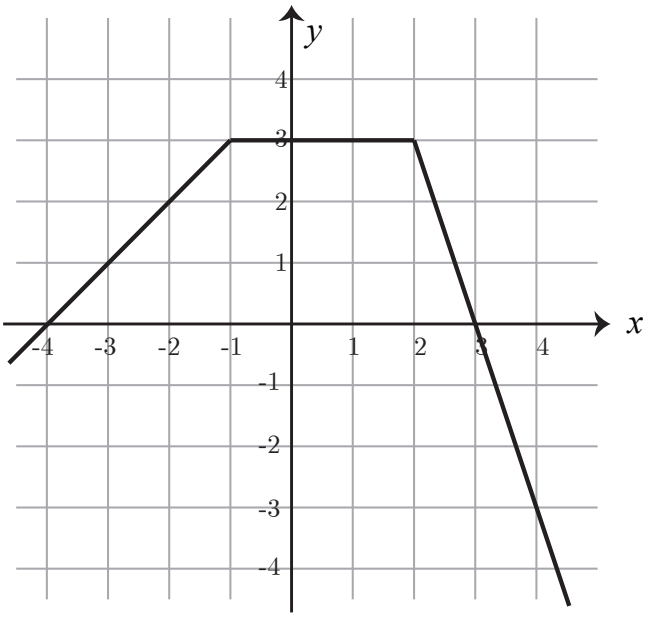
(a) 17.5

(b) 12

(c) 16

(d) 14.5

(e) 19



14. The graph of $y = f(x)$ shown below includes a semicircle and a straight line. Evaluate the definite integral $\int_{-4}^{4} f(x)\,\mathrm{d}x$. Use $\pi = 3.14$.

Possibilities:

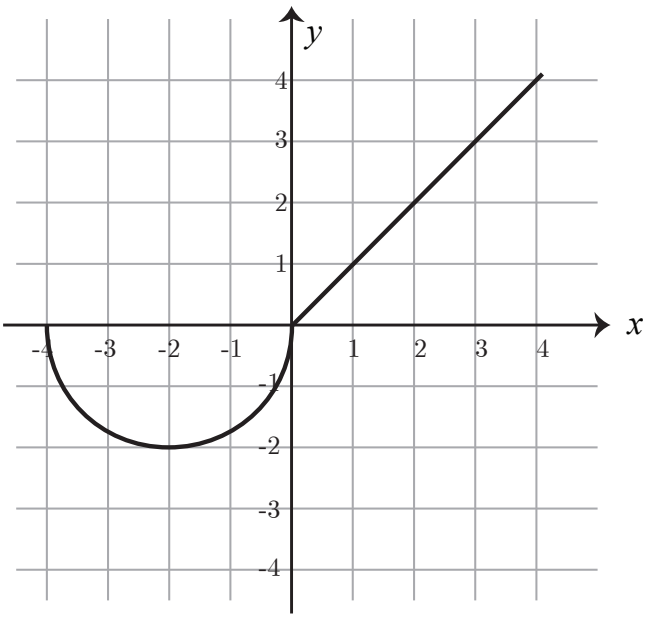
(a) -4.56

(b) 14.28

(c) -14.28

(d) $-.28$

(e) 1.72



15. Given the function $f(x) = \begin{cases} x & \text{if } x < 38 \\ 38 & \text{if } x \geq 38 \end{cases}$

evaluate the definite integral

$$\int_0^{48} f(x)\ \mathrm{d}x$$

Possibilities:

(a) 1102

(b) 1103

(c) 1104

(d) 1105

(e) 1106

16. Suppose that $\int_{10}^{24} f(x)\,\mathrm{d}x = 17$ and $\int_{1}^{24} f(x)\,\mathrm{d}x = 8$. Find the value of $\int_{1}^{10} f(x)\,\mathrm{d}x$.

Possibilities:

(a) -25

(b) -9

(c) -1

(d) 25

(e) 9

17. Suppose that $\int_2^{24} f(x)\,\mathrm{d}x = 11$. Find the value of $\int_2^{24} (3f(x) + 2)\,\mathrm{d}x$.

Possibilities:

(a) 81

(b) 35

(c) 55

(d) 77

(e) 39

18. Find the average value of $f(x)$ on the interval $[5, 13]$ given that $f(x) = \begin{cases} 70 & \text{if } x < 8 \\ -10 & \text{if } x \geq 8. \end{cases}$

Possibilities:

(a) -10

(b) 6

(c) 80

(d) 30

(e) 20

19. Estimate the area under the graph of $y = -x^2 + 30x$ for x between 1 and 7, by using a partition that consists of 3 equal subintervals of $[1, 7]$ and use the left endpoint of each subinterval as a sample point.

Possibilities:

(a) 792

(b) 606

(c) 470

(d) 734

(e) 367

20. Suppose you estimate the area under the graph of $f(x) = x^3$ from $x = 6$ to $x = 46$ by adding the areas of the rectangles as follows: partition the interval into 20 equal subintervals and use the right endpoint of each interval to determine the height of the rectangle. What is the area of the 9th rectangle?

Possibilities:

(a) 13824

(b) 24380

(c) 27648

(d) 21296

(e) 1218240

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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