MA123 — Elem. Calculus Spring 2017
Final Exam 2017-05-03

Name: ____________________ **Sec.:** ________

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a b c d e

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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)

Spring 2017 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 $f(x) = (5x+2)^4$ at $x = 0$.

Equation: $y =$ ______________________________

2. Evaluate $\int_1^T \left(x^3 + \frac{1}{x^{12}} \right) dx$. 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	8	13	20	24	32

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

Possibilities:

(a) 104

(b) 144

(c) 169

(d) 208

(e) 194

4. Suppose that the average value of $f(x)$ on $[6, 10]$ is 68. Find the value of $\int_6^{10} f(x)\,\mathrm{d}x$.

Possibilities:

(a) 302

(b) 544

(c) 272

(d) 2176

(e) 136

5. Evaluate the definite integral

$$\int_2^x 12\sqrt{t}\ \mathrm{d}t$$

Possibilities:

(a) $12\sqrt{x}$

(b) $12x^{\frac{3}{2}} - 12 \cdot 2^{\frac{3}{2}}$

(c) $24\sqrt{x} - 24\sqrt{2}$

(d) $\frac{12}{\sqrt{x}} - \frac{12}{\sqrt{2}}$

(e) $8x^{\frac{3}{2}} - 8 \cdot 2^{\frac{3}{2}}$

6. Given the function $f(x) = \begin{cases} x & \text{if } x < 54 \\ 54 & \text{if } x \geq 54 \end{cases}$

evaluate the definite integral

$$\int_0^{64} f(x)\ \mathrm{d}x$$

Possibilities:

(a) 1995

(b) 1996

(c) 1997

(d) 1998

(e) 1999

7. Let

$$F(x) = \int_0^x \left(t^2 - 7t\right)\, \mathrm{d}t$$

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

Possibilities:

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

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

(c) 7

(d) 0

(e) $\frac{665}{6}$

8. Suppose a rock is dropped from a martian cliff. After t seconds, its speed in feet per second is $v(t) = \frac{61}{5}t$, at least until it lands. If the rock lands after 8 seconds, how high (in feet) is the cliff?

Possibilities:

(a) $\frac{61}{40}$ feet

(b) 8 feet

(c) 4 feet

(d) $\frac{488}{5}$ feet

(e) $\frac{1952}{5}$ feet

9. Evaluate the integral

$$\int_0^T 6e^{6x+2}\ \mathrm{d}x$$

Possibilities:

(a) $6e^{6T+2} - 6e^2$

(b) $6e^{6T+2}$

(c) $6e^T - 6$

(d) $e^{6T+2} - e^2$

(e) $\frac{6}{3}e^{6T+3}$

10. Suppose that $\int_6^{23} f(x)\,\mathrm{d}x = 8$. Find the value of $\int_6^{23} (3f(x) + 2)\ \mathrm{d}x$.

Possibilities:

(a) 58

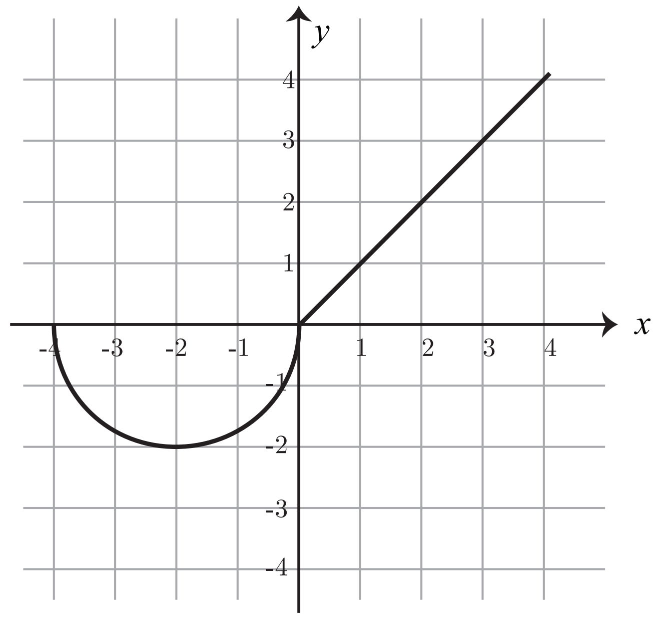
(b) 41

(c) 70

(d) 26

(e) 30

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



Possibilities:

(a) -14.28

(b) 14.28

(c) -4.56

(d) 1.72

(e) $-.28$

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12. Let $f(x) = x^3$. 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) 243

(b) 7

(c) $\dfrac{9}{\sqrt{3}}$

(d) $\dfrac{9}{\sqrt{5}}$

(e) $\dfrac{\sqrt{3}}{9}$

13. Compute $\lim_{t \to 1} \dfrac{t^2 + 8t - 9}{t^2 - 8t + 7}$

Possibilities:

(a) $-\frac{2}{3}$

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

(c) 0

(d) 1

(e) The limit does not exist.

14. Find the limit

$$\lim_{n \to \infty} \frac{(2n+3)^2}{17n^2 + 13}$$

Possibilities:

(a) The limit does not exist or approaches infinity

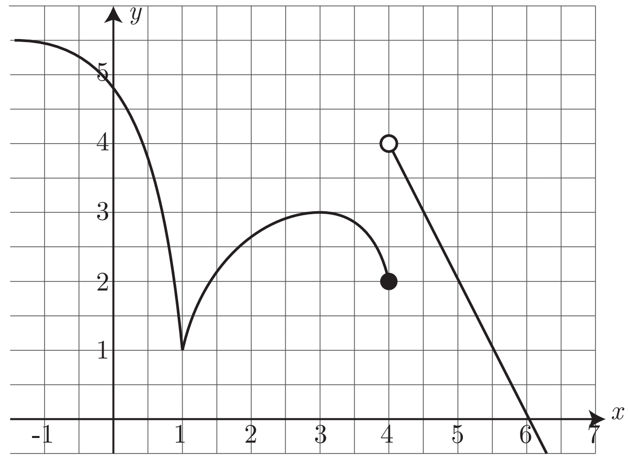
(b) $\dfrac{9}{13}$

(c) $\dfrac{2}{17}$

(d) $\dfrac{4}{13}$

(e) $\dfrac{4}{17}$

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



Possibilities:

(a) x=1 only

(b) x=1 and x=4

(c) x=4 only

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

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

16. Find the derivative, $f'(x)$, if $f(x) = (20x + 50)\ln(6x + 2)$.

Possibilities:

(a) $(20x + 50) \cdot \frac{1}{6x+2} + 20\ln(6x + 2)$

(b) $(20x + 50) \cdot \frac{6}{6x+2} + 20\ln(6x + 2)$

(c) $6e^{6x+2} + 20$

(d) $20 \cdot \frac{6}{6x+2}$

(e) $20\ln(6x + 2)$

17. If $f(x) = x^7 + 6x^5 + 2x^4 + 3x^2 + 7$ then find the second derivative $f''(x)$:

Possibilities:

(a) $42x^5 + 120x^3 + 24x^2 + 6$

(b) $7x^6 + 21x^5 + 65x^4 + 103x^3 + 93x^2 + 51x + 12$

(c) $42x^5 + 190x^3 + 24x^2 + 74x + 10$

(d) $49x^7 + 150x^5 + 32x^4 + 12x^2$

(e) $7x^6 + 30x^4 + 8x^3 + 6x$

18. Suppose $g(8) = 7$ and $g'(8) = 4$. Find $F'(8)$ if

$$F(x) = \frac{x^2 + 1}{g(x)}$$

Possibilities:

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

(b) 4

(c) $-\frac{144}{7}$

(d) $-\frac{148}{49}$

(e) $\frac{144}{49}$

19. Suppose the derivative of $g(t)$ is $g'(t) = 11t^2 - 88t + 132$. For t in which interval(s) is g concave up?

Possibilities:

(a) $(-\infty, 2) \cup (6, \infty)$

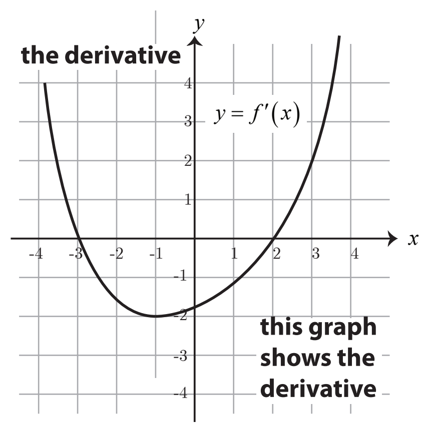
(b) $(2, 6)$

(c) $(4, \infty)$

(d) $(-\infty, 4)$

(e) $(2, 4) \cup (6, 11)$

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) $(-1, \infty)$

(b) $(-3, 2)$

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

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

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

21. Boyle's Law states that when a sample gas is compressed at a constant temperature, the pressure P and volume V satisfy the equation $PV = c$, where c is a constant. Suppose that at a certain instant the volume is 46 cubic centimeters, the pressure is 5 kPa, and the pressure is increasing at a rate of 4 kPa/min. At what rate is the volume decreasing at this instant?

Possibilities:

(a) $\frac{183}{5}$ cubic centimeters per minute

(b) $\frac{184}{5}$ cubic centimeters per minute

(c) 37 cubic centimeters per minute

(d) $\frac{186}{5}$ cubic centimeters per minute

(e) $\frac{187}{5}$ cubic centimeters per minute

22. A landscape architect wishes to enclose a rectangular garden on one side by a brick wall costing \$50 per foot, and on the other three sides by a metal fence costing \$10 per foot. If the area of the garden is 100 square feet, find the lowest possible cost to enclose the garden.

Possibilities:

(a) \$693.32

(b) \$693.82

(c) \$692.32

(d) \$692.82

(e) \$694.32

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 $V = \dfrac{1}{3}\pi r^2 h$

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