MA123 — Elem. Calculus Spring 2015
Final Exam 2015-05-06

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)

Spring 2015 Exam 4 Short Answer Questions

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

1. Compute the following integral: $\int_1^T \frac{6x^5+x}{x^3}\,dx$.

Final answer: ______________________________

2. Let $F(x)=\ln(3x+g(x))$. Find the **slope** of the tangent line to the graph of $y=F(x)$ at $x=2$, given $g(2)=11$ and $g'(2)=-1$.

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.

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3. Find the limit as n tends to infinity. Here C is a fixed real number.

$$\lim_{n\to\infty} \frac{(3n+1)^2}{Cn^2+7n+4}$$

Possibilities:

(a) 0

(b) ∞

(c) $\dfrac{9}{C^2}$

(d) $\dfrac{3}{C+11}$

(e) $\dfrac{9}{C}$

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4. Evaluate the limit as n tends to infinity. Note: you will have to use some of the summation formulas (see formula sheet on backpage) to simplify.

$$\lim_{n\to\infty} \sum_{k=1}^{n} \left(8 + k\frac{6}{n}\right)\frac{6}{n}$$

Possibilities:

(a) 0

(b) 66

(c) 8

(d) 6

(e) 84

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

$$\int_7^x \frac{4}{t}\ \mathrm{d}t$$

Possibilities:

(a) $-\frac{4}{x^2} + \frac{4}{49}$

(b) $4\sqrt{x}$

(c) $4\ln(|x|) - 4\ln(7)$

(d) $8\sqrt{x} - 8\sqrt{7}$

(e) $\frac{4}{\frac{1}{2}x^2} - \frac{8}{49}$

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

$$F(x) = \int_1^{x+9} \left(t^2 + 8t + 2\right)\ \mathrm{d}t$$

Possibilities:

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

(b) $(x+9)^2 + 8(x+9) + 2$

(c) $2x + 8$

(d) $\frac{1}{3}(x+9)^3 + \frac{8}{2}(x+9)^2 + 2(x+9) - \left(\frac{1}{3}1^3 + \frac{8}{2}1^2 + 2(1)\right)$

(e) $x^2 + 8x + 2$

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7. Find the value of x at which

$$F(x) = \int_2^x \left(-t^4 - t^2 - 8\right)\ \mathrm{d}t$$

takes its minimum value on the interval $[9, 300]$.

Possibilities:

(a) 28

(b) $\frac{376}{15}$

(c) 2

(d) 300

(e) 9

8. Evaluate the integral

$$\int_0^x (8t+9)^2\ \mathrm{d}t$$

Possibilities:

(a) $\dfrac{1}{3}x^3 - \dfrac{9^3}{3}$

(b) $\dfrac{1}{3}(8x+9)^3 - \dfrac{9^3}{3}$

(c) $\dfrac{1}{2}(8x+9)^2 - \dfrac{9^2}{2}$

(d) $3(8x+9)^3 - 2 \cdot 9^3$

(e) $\dfrac{1}{8(3)}(8x+9)^3 - \dfrac{9^3}{8(3)}$

9. 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 10 seconds, how high (in feet) is the cliff?

Possibilities:

(a) 5 feet

(b) 610 feet

(c) 122 feet

(d) 10 feet

(e) $\frac{61}{50}$ feet

10. Compute $\displaystyle\lim_{t\to 2} \frac{t^2 - 9t + 14}{t^2 - 10t + 16}$

Possibilities:

(a) $\frac{5}{6}$

(b) 1

(c) $\frac{7}{6}$

(d) $\frac{4}{3}$

(e) The limit does not exist.

11. Find the average rate of change of $f(x) = \ln x$ from $x = 64$ to $x = 81$.

Possibilities:

(a) $\dfrac{\ln(64) + \ln(81)}{2}$

(b) $\dfrac{1}{2}(81)^{-1} - \dfrac{1}{2}(64)^{-1}$

(c) $\dfrac{1}{64} - \dfrac{1}{81}$

(d) $\dfrac{\ln(81) - \ln(64)}{81 - 64}$

(e) $\dfrac{\ln(81) - \ln(64)}{\ln(64) - \ln(81)}$

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12. Solve the equation $5x^2 + 106xy + 3y = 2$ for y in terms of x

Possibilities:

(a) $y = \dfrac{-106 \pm \sqrt{11176}}{10}$

(b) $y = \dfrac{106x + 3}{5x^2 - 2}$

(c) $y = \dfrac{2 - 5x^2}{106x + 3}$

(d) $y = \dfrac{2 - 5x^2 - 106x}{3}$

(e) $y = \dfrac{5x^2 - 2}{106x + 3}$

---

13. The tangent line to the graph of f at $x = 8$ has equation $y = 9(x - 8) + 2$. Find $f(8)$ and $f'(8)$.

Possibilities:

(a) $f(9) = 2, \quad f'(9) = 8$

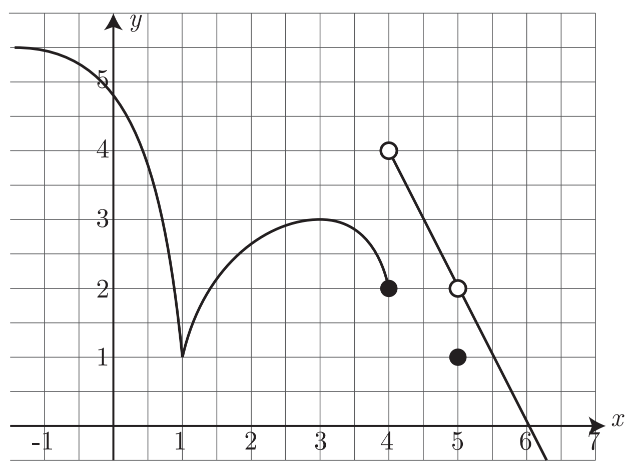
(b) $f(8) = 9, \quad f'(8) = 2$

(c) $f(2) = 8, \quad f'(2) = 9$

(d) $f(8) = 2, \quad f'(8) = 9$

(e) $f(2) = 9, \quad f'(2) = 8$

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



Possibilities:

(a) x=4 and x=5

(b) x=1 and x=3

(c) x=1, x=4, and x=5

(d) x=1, x=3, x=4, and x=5

(e) x=4 only

15. Find the derivative, $f'(x)$, of $f(x) = 4x^3$

Possibilities:

(a) $-3x^{(1/4)}$

(b) x^3

(c) $12x^2$

(d) x^4

(e) $\frac{1}{4}x^4$

16. Suppose that $f(x) = \log(g(x))$, but that the formula for $g(x)$ is too complicated to write down. When $x = 2$, the value and derivative of g are measured: $g(2) = 3$, and $g'(2) = 9$. What is $f'(2)$?

Possibilities:

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

(b) 3

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

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

(e) $\frac{1}{3}$

17. Find the derivative, $f'(x)$, if $f(x) = \sqrt{9x + x^3}$.

Possibilities:

(a) $\frac{1}{2}(9x + x^3)^{(-1/2)}(9 + 3x^2)$

(b) $-\frac{1}{2}(9x + x^3)^{(1/2)}(9 + 2x^3)$

(c) $\frac{1}{2}(9x + x^3)^{(-1/2)}$

(d) $\frac{1}{2}(9 + 3x^2)^{(-1/2)}$

(e) $\frac{1}{2}(9x + x^3)^{(-1/2)}(9 + 3x^2)(3 \cdot 2x^1)$

18. Suppose the derivative of $g(t)$ is $g'(t) = -9(t - 8)(t - 2)(t - 3)$. For t in which interval(s) is g increasing?

Possibilities:

(a) $(-9, 2) \cup (3, 8)$

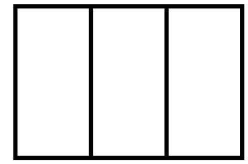
(b) $(\frac{13}{3} - \frac{1}{3}\sqrt{31}, \frac{13}{3} + \frac{1}{3}\sqrt{31})$

(c) $(-\infty, \frac{13}{3} - \frac{1}{3}\sqrt{31}) \cup (\frac{13}{3} + \frac{1}{3}\sqrt{31}, \infty)$

(d) $(-\infty, 2) \cup (3, 8)$

(e) $(2, 3) \cup (8, \infty)$

19. A farmer builds a rectangular pen with 3 vertical partitions (4 vertical sides) using 400 feet of fencing. What is the maximum possible total area of the pen?



Possibilities:

(a) 4000

(b) 10000

(c) 5000

(d) 400

(e) 20000

20. Two birds leave the same tree at different times, one traveling due East, and the other traveling due North. At 2pm the eastbound bird is traveling at 10 mph and is 30 miles from the tree, while the northbound bird is traveling at 25 mph and is 40 miles from the tree. At what rate is the distance between the birds increasing?

Possibilities:

(a) $5\sqrt{29}$ mph

(b) 50 mph

(c) 2600 mph

(d) 35 mph

(e) 26 mph

Some Formulas

1. Summation formulas:

$$\sum_{k=1}^{n} k = \frac{n(n+1)}{2}$$

$$\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$$

2. Areas:

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

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

(c) Rectangle $A = lw$

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

3. Volumes:

(a) Rectangular Solid $V = lwh$

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

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

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

4. Distance:

(a) Distance between (x_1, y_1) and (x_2, y_2)

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

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