MA123 — Elem. Calculus Spring 2016
Final Exam 2016-05-05

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
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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 2016 Exam 4 Short Answer Questions

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

4 pts 1. Find the **critical numbers** (also called critical values), if any, of $f(x) = xe^{8x}$.

6 pts 2. Evaluate $\int_0^T 2x\left(x^2+1\right)^5 dx$. Show steps clearly. 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.

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

$$\lim_{n\to\infty} \frac{(Cn+1)^2}{5n^3+9n^2+4n+3}$$

Possibilities:

(a) $\frac{1}{5}C^2$

(b) $\frac{1}{21}C$

(c) $\frac{1}{125}C^2$

(d) 0

(e) ∞

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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.

$$\lim_{n\to\infty} \frac{1}{n}\sum_{k=1}^{n} \frac{9k^2}{n^2}$$

Possibilities:

(a) 3

(b) 2

(c) 1

(d) 4

(e) 5

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

$$\int_5^x \frac{7}{t^3}\,\mathrm{d}t$$

Possibilities:

(a) $7\ln(|x^3|) - 7\ln(5^3)$

(b) $14\sqrt{x} - 14\sqrt{5}$

(c) $-\frac{7}{2}(x^{-2}) + \frac{7}{2}(5^{-2})$

(d) $7\sqrt{x}$

(e) $\frac{7}{\frac{1}{4}x^4} - \frac{28}{625}$

6. Find the average of $f(x) = x^2$ over [1,17].

Possibilities:

(a) 102.33

(b) 18.00

(c) 144.50

(d) 145.00

(e) 1637.33

7. Find the value of x at which

$$F(x) = \int_3^x (|t| + 4)\ \mathrm{d}t$$

takes its minimum value on the interval $[8, 900]$.

Possibilities:

(a) 900

(b) 8

(c) 3

(d) 12

(e) 408536.0

8. Evaluate the integral

$$\int_0^x (4t + 8)^{15}\ \mathrm{d}t$$

Possibilities:

(a) $\frac{1}{16}(4x + 8)^{16} - \frac{8^{16}}{16}$

(b) $\frac{1}{4(16)}(4x + 8)^{16} - \frac{8^{16}}{4(16)}$

(c) $16(4x + 8)^{16} - 15 \cdot 8^{16}$

(d) $\frac{1}{15}(4x + 8)^{15} - \frac{8^{15}}{15}$

(e) $\frac{1}{16}x^{16} - \frac{8^{16}}{16}$

9. A car is traveling due east. Its velocity (in miles per hour) at time t hours is given by $v(t) = -2.4t^2 + 14t + 60$. How far did the car travel during the first 5 hours of the trip?

Possibilities:

(a) 10.0 miles

(b) 75.0 miles

(c) 375.0 miles

(d) 350.0 miles

(e) 70.0 miles

10. Compute $\lim_{t \to 3} \dfrac{t^2 + 4t - 21}{t^2 + 5t - 24}$

Possibilities:

(a) $\frac{8}{11}$

(b) $\frac{9}{11}$

(c) $\frac{10}{11}$

(d) 1

(e) The limit does not exist.

11. Let $f(x) = 2x^2 + 3x + 7$. Find a value c between $x = 4$ and $x = 8$, so that the average rate of change of $f(x)$ from $x = 4$ to $x = 8$ is equal to the instantaneous rate of change of $f(x)$ at $x = c$.

Possibilities:

(a) 5

(b) 6

(c) 7

(d) 8

(e) 9

12. How many years will it take an investment to triple in value if the interest rate is 9% compounded continuously?

Possibilities:

(a) 12.21 years

(b) 13.73 years

(c) 15.69 years

(d) 18.31 years

(e) 21.97 years

13. The tangent line to the graph of f at $x = 4$ has equation $y = 8(x - 4) + 3$. Find $f(4)$ and $f'(4)$.

Possibilities:

(a) $f(8) = 3, \quad f'(8) = 4$

(b) $f(4) = 8, \quad f'(4) = 3$

(c) $f(3) = 8, \quad f'(3) = 4$

(d) $f(3) = 4, \quad f'(3) = 8$

(e) $f(4) = 3, \quad f'(4) = 8$

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

Possibilities:

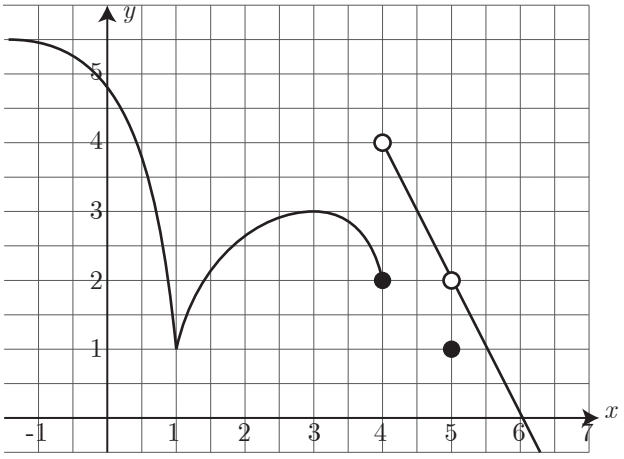
(a) x=1, x=3, x=4, and x=5

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

(c) x=4 and x=5

(d) x=4 only

(e) x=1 and x=3



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

Possibilities:

(a) $96x^4 + 8x^2$

(b) $24x^3 + 4x + 3$

(c) $72x^2 + 16$

(d) $24x^3 + 36x^2 + 28x + 11$

(e) $72x^2 + 4$

16. Find the derivative, $f'(x)$, if $f(x) = (2 + 6x)\ln(7 + 3x)$.

Possibilities:

(a) $(6)\ln(7 + 3x) + \dfrac{2 + 6x}{x}$

(b) $\dfrac{6}{7 + 3x}$

(c) $6 + \dfrac{3}{7 + 3x}$

(d) $(6)\ln(7 + 3x) + \dfrac{6 + 18x}{7 + 3x}$

(e) $\dfrac{9}{7 + 3x}$

17. Suppose $F(x) = (g(x))^3 + 9$. If $g(2) = 7$, $g'(2) = 13$, and $g''(2) = 5$, then find $F'(2)$.

Possibilities:

(a) $(3)(7^2) + 9$

(b) $7^3 + 9$

(c) 5

(d) $13^3 + 9$

(e) $(3)(7^2)(13)$

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18. Suppose the derivative of $g(t)$ is $g'(t) = -12(t-4)(t-8)$. For t in which interval(s) is g concave up?

Possibilities:

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

(b) $(6, \infty)$

(c) $(-\infty, 4) \cup (8, \infty)$

(d) $(4, 6) \cup (8, 12)$

(e) $(4, 8)$

19. An open box is to be made out of a 12-inch by 14-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) 1.85 inches

(b) 1.95 inches

(c) 2.05 inches

(d) 2.15 inches

(e) 2.25 inches

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20. A cylindrical water tank with its circular base parallel to the ground is being filled at the rate of 80 cubic feet per minute. The radius of the tank is 5 feet. How fast is the level of the water in the tank rising when the tank is half full?

Possibilities:

(a) 12566.37 feet per minute

(b) 0.51 feet per minute

(c) 1.02 feet per minute

(d) 6283.19 feet per minute

(e) 2513.27 feet per minute

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 $A = \frac{bh}{2}$

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

(c) Rectangle $A = lw$

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

3. Volumes:

(a) Rectangular Solid $V = lwh$

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

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

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

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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