

Name _____ MA135 Final Exam A December 17, 2012

Instructor _____ Section _____

Be sure to show all of your work. All solutions should use calculus techniques from this course. Unsupported answers will receive no credit! Calculators are not allowed on this exam. You may only use the formula sheet and scratch paper supplied with this exam. Good Luck!!

Prob No.	Max Pts	Points	Prob No.	Max Pts	Points
1	18		8	17	
2	18		9	18	
3	18		10	18	
4	18		11	18	
5	17		12	18	
6	18		13	18	
7	18		14	18	
Subtotal	125		Subtotal	125	

Grand Total	
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1. (9 points each) You do not need to simplify your answers.

a. Find $\lim_{t \rightarrow 81} \frac{81 - t}{9 - \sqrt{t}}$.

b. Find all values of x such that $\log_2(x^2 + 6x - 12) = 2$.

2. (9 points each) A scientist has 27 grams of radioactive goo. Two hours later, her sample has decayed to 5 grams.

a. Find a formula for the amount $G(t)$ of radioactive goo remaining after t hours.

b. When will she have one gram of goo remaining?

G(t)=	
1 gram remains after	

4

3. (9 points each)

a. Find $\frac{dy}{dx}$ if $y = \frac{x \cos x}{e^x}$.

b. Find $\frac{dy}{dx}$ if $y = -2x^6\sqrt{x} + \frac{7}{x^3\sqrt{x}}$.

4.

a. (10 points) If $x^3 + 3x^2y - 4y^2 = 16$, find $\frac{dy}{dx}$ at $(2, 2)$.

$\frac{dy}{dx} =$	
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b. (8 points) If $y = x^{\sin x}$, $0 < x < \pi$, find $\frac{dy}{dx}$ as a function of x .

$\frac{dy}{dx} =$	
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5. (17 points) The length of a rectangle is increasing at 4 ft/min and its width is decreasing at 3 ft/min. At what rate is the area of the rectangle changing when its length is 9 ft and its width is 5 ft? Is the area of the rectangle increasing or decreasing?

6. (18 points) Let $f(x) = 2\sqrt{3x + 3}$. Use linear approximation or differentials to approximate $f(2.03)$. You do not need to simplify your answer.

7. (18 points) Spiderman has been selling radioactive spiders at a price of \$40 per spider and at this price mad scientists have been buying 45 spiders per month. Spidey¹ wishes to raise the price and estimates that for each \$1 increase in price, 3 fewer spiders will be sold each month. If each spider costs Spidey \$29, at which price should Spidey sell the spiders so as to maximize profit?

8. (17 points) Find the absolute maximum and minimum of the function $f(x) = \frac{9}{x} + x - 3$ on the interval $[1, 9]$.

Absolute max =	
Absolute min =	

¹This is Spiderman's nickname.

9. (18 pts) Find the intervals where the function $y = x - \frac{4}{x^2}$ is increasing and decreasing, concave up, and concave down. Find all horizontal, vertical asymptotes, relative extrema, and inflections. Write “none” in the blank if there are none.

Increasing	
Decreasing	
Concave up	
Concave down	
Horizontal asymptotes	
Vertical asymptotes	
Relative maxima	
Relative minima	
Inflections	

10. (9 points each)

a. Find $\lim_{x \rightarrow 1} \frac{x^{10} - 1}{x^3 - 1}$.

$\lim_{x \rightarrow 1} \frac{x^{10} - 1}{x^3 - 1} =$	
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b. Find $\lim_{x \rightarrow 0} \frac{\sin(x^2)}{\cos(3x) - 1}$.

$\lim_{x \rightarrow 0} \frac{\sin(x^2)}{\cos(3x) - 1} =$	
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11. (9 points each)

a. Find the area under the curve $y = \frac{1}{x^3}$ from $x = 3$ to $x = 5$.

Area =	
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b. A particle travels along the x -axis in such a way that its acceleration at time t is $a(t) = \sqrt{t} + t^2$. If it starts at the origin with an initial velocity of 2 (that is, $s(0) = 0$, and $v(0) = 2$), determine its position and velocity when $t = 1$. You do not need to simplify your answers!

$s(1) =$	
$v(1) =$	

12. (18 points) Find $\int \frac{x^2 + 3x + 2}{\sqrt{x}} dx$.

13. (18 points) Find $\int \frac{x + 1}{x^2 + 2x + 5} dx$.

14. (9 points each)

a. Find $\int_1^2 x(4x+1)^{75} dx$.

$\int_1^2 x(4x+1)^{75} dx =$	
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You do not need to simplify this answer!

b. If $F(x) = \int_1^{x^3} \sin t^3 dt$, find $F'(x)$.

$F'(x) =$	
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