Name: _____

Instructor: _____

Math 10550, Exam I
September 23, 2014

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- No calculators.
- The exam lasts for 1 hour and 15 min.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 12 pages of the test.

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

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Please do NOT write in this box.

Multiple Choice_____

11. _____

12. _____

13. _____

14. _____

Total _____

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Multiple Choice

1.(6 pts.) Evaluate the following limit:

$$\lim_{x\to 3} \frac{\sqrt{x^2+7}-4}{x-3}.$$

(a) $\frac{6}{8}$ (b) 0 (c) $\frac{1}{10}$ (d) 6 (e) 1

2.(6 pts.) Evaluate the following limit:

$$\lim_{x\to -2} \frac{x^2+3x+2}{(x+2)|x+1|}.$$

(a) 2

(b) The limit does not exist

(c) -1

(d) -2

(e) 1

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3.(6 pts.) For what value a is the function f given by

$$f(x) = \begin{cases} \dfrac{x+2}{x^2+x+1} & x > 0 \\ a & x = 0 \\ \dfrac{x^2-1}{x-1} & x < 0 \end{cases}$$

continuous at $x = 0$?

(a) $\dfrac{3}{2}$

(b) 1

(c) 2

(d) 0

(e) No value of a makes f continuous at $x = 0$

4.(6 pts.) Find $f'(2)$, if

$$f(x) = \frac{\sqrt{x}+2}{\cos(\pi x)}.$$

(a) f is not differentiable at 2.

(b) $\dfrac{1}{2\sqrt{2}}$

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

(d) $\pi(\sqrt{2}+2)$

(e) $\dfrac{1}{2\sqrt{2}} - \pi(\sqrt{2}+2)$

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5.(6 pts.) Find the derivative of $f(x) = \cos(\cos(x^3))$.

(a) $\sin(\sin(3x^2))$

(b) $3x^2 - \sin(\cos(x^3)) - \sin(x^3)$

(c) $\sin(\cos(x^3))\sin(\sin(x^3))\sin(\sin(3x^2))$

(d) $3x^2\sin(x^3)\sin(\sin(x^3))$

(e) $3x^2\sin(x^3)\sin(\cos(x^3))$

6.(6 pts.) Compute $f'(1)$, if

$$f(x) = (x+1)^{3/2}(x^2+x+1).$$

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

(b) $\frac{-3\sqrt{2}}{2}$

(c) 2

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

(e) $\frac{9\sqrt{2}}{2} + 16$

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7.(6 pts.) If $f(x) = \dfrac{1}{1-x}$, find $f^{(2)}(x)$.

(a) $\dfrac{2}{(1-x)^3}$ (b) $\dfrac{6}{(1-x)^4}$ (c) $\dfrac{-1}{(1-x)^3}$

(d) $\dfrac{1}{(1-x)^4}$ (e) $\dfrac{-1}{(1-x)^2}$

8.(6 pts.) Find the equation of the tangent line to the curve $y = \sqrt{x} + \dfrac{1}{x}$ at $x = 4$.

(a) $y - \dfrac{3}{2} = \dfrac{-5}{4}(x-4)$ (b) $y - \dfrac{9}{4} = \dfrac{5}{16}(x-4)$

(c) $y - \dfrac{3}{2} = \dfrac{5}{16}(x-4)$ (d) $y - \dfrac{9}{4} = \dfrac{3}{16}(x-4)$

(e) $y - \dfrac{9}{4} = \dfrac{-3}{4}(x-4)$

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9.(6 pts.) Find y', if

$$3x^2 + x^2y + xy^2 = 1.$$

(a) $\dfrac{-3x^2}{x^2 + xy}$

(b) $\dfrac{-6x}{x^2 + xy}$

(c) $\dfrac{-(6x + 2xy + y^2)}{x^2 + 2xy}$

(d) $\dfrac{-(x^2 + 4xy + 6x)}{x^2}$

(e) $\dfrac{-(2xy + 6x)}{x^2}$

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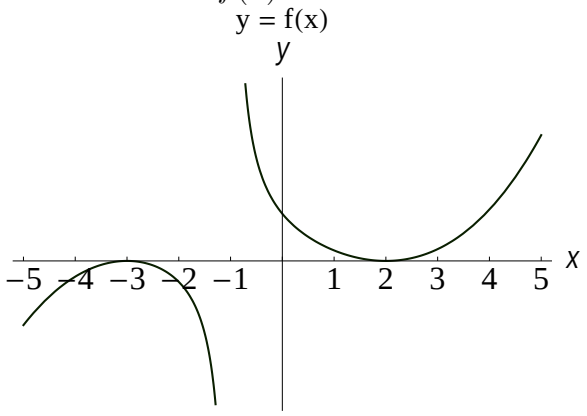
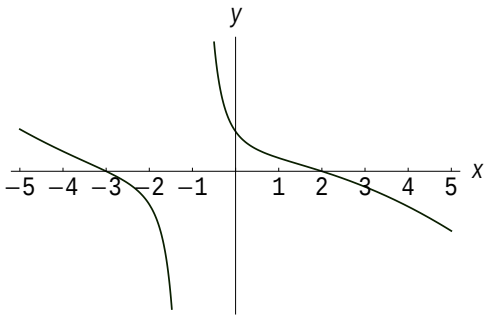
10.(6 pts.) The graph of the function $f(x)$ is shown below:

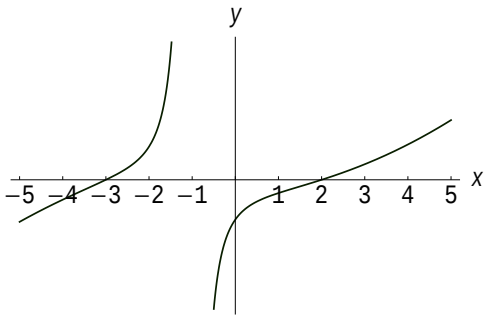


The graph of $f(x)$ has a vertical asymptote at $x = -1$.
Which of the following is the graph of $f'(x)$?
(all of the graphs below have vertical asymptotes at $x = -1$).

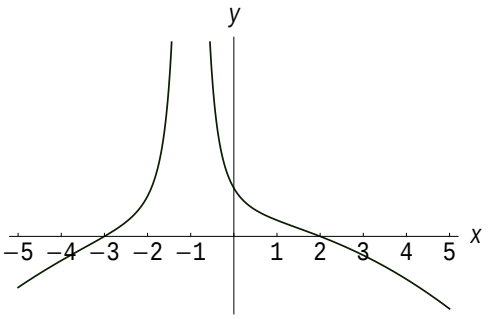
(a)



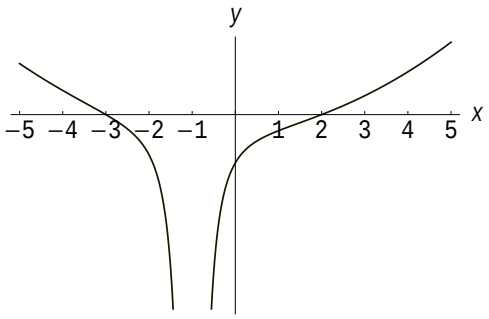
(b)



(c)



(d)



(e) None of the above.

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Partial Credit

You must show your work on the partial credit problems to receive credit!

11.(8 pts.) Use the Squeeze/Sandwich Theorem to find

$$\lim_{x \to 0} x^4 \sin\left(\frac{1}{x^2+2}\right).$$

Justify each step in your argument.

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12.(12 pts.) Find the derivative of

$$f(x) = \frac{x}{x-2}$$

using the limit definition of the derivative.
Please include all of the details in your calculation.

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13.(10 pts.) Consider the following table of function values:

	$x = 1$	$x = 2$
$f(x)$	-1	3
$f'(x)$	1	2
$g(x)$	2	1
$g'(x)$	-2	-1

(Show all of your work below for credit)

(a) Find $\left(\frac{f}{g}\right)'(1)$.

(b) Find $(f \circ g)'(2)$.

Note: $(f \circ g)(x) = f(g(x))$.

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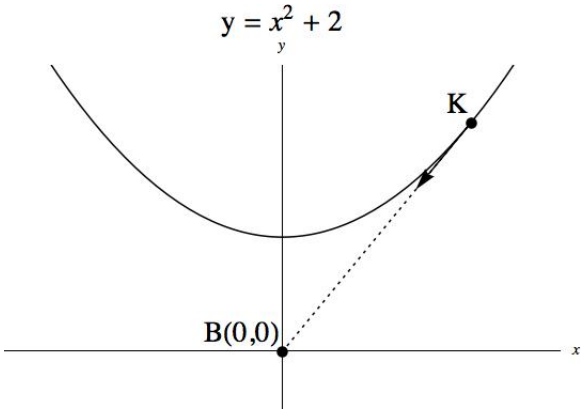
14.(10 pts.) Katniss is moving along the parabola $y = x^2 + 2$ shown below. As she moves, the x coordinate of her position is decreasing. She is shooting arrows at a a bunch of malevolent baboons which are attacking her as she moves. Her movements are limited so that when her arrow leaves the bow it will follow the path of the tangent line to the curve (in the direction in which x is decreasing as shown below). An angry baboon is positioned at the point $B(0, 0)$. What are the coordinates of the point K on the curve at which Katniss should release an arrow in order to hit this baboon?



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Rough Work

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