

Name: _____

Instructor: _____

Math 10550, Exam I
September 18, 3023

- The Honor Code is in effect for this examination. All work is to be your own.
- 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 11 pages of the test.

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!					
1.	(a)	(b)	(c)	(d)	(e)
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9.	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)

Please do NOT write in this box.	
Multiple Choice	_____
11.	_____
12.	_____
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Total	_____

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Multiple Choice

1.(6 pts.) Compute $\lim_{x \rightarrow -1^-} \frac{x^2 + x}{x^2 + 2x + 1}$

- (a) $+\infty$ (b) Does not exist and is not ∞ or $-\infty$.
(c) 0 (d) -1
(e) $-\infty$

2.(6 pts.) For what values of c is the function f given by

$$f(x) = \begin{cases} x^2 + c^2x - 3 & x < 2 \\ cx + 5 & x \geq 2 \end{cases}$$

continuous at $x = 2$?

- (a) $c = 2$ only
(b) $c = 1$ only
(c) $c = 2$ and $c = -1$
(d) $c = 0$ only
(e) No value of c makes f continuous at $x = 2$

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3.(6 pts.) Let $f(x) = \sqrt{2x^2 + 1}$. Which of the following limits equals $f'(2)$?

(a) $\lim_{h \rightarrow 0} \frac{\sqrt{2(x+h)^2 + 1} - \sqrt{2x^2 + 1}}{h}$

(b) $\lim_{x \rightarrow 0} \frac{\sqrt{2x^2 + 1} - 3}{x}$

(c) $\lim_{h \rightarrow 2} \frac{\sqrt{2(x+h)^2 + 1} - 3}{h}$

(d) $\lim_{h \rightarrow 2} \frac{\sqrt{2(x+h)^2 + 1} - \sqrt{2x^2 + 1}}{h}$

(e) $\lim_{x \rightarrow 2} \frac{\sqrt{2x^2 + 1} - 3}{x - 2}$

4.(6 pts.) Assume that $f(x)$ is a continuous function which takes the following values:

x	-1	0	1	2
f(x)	-10	10	-1	3

Which of the following conclusions can we make by using the Intermediate Value Theorem:

(a) $f(x) = ax^3 + bx^2 + cx + d$ for some constants a, b, c and d .

(b) $f(x) = 0$ has at least three solutions.

(c) $f(x) = 0$ has exactly one solution.

(d) $f(x) = 0$ has exactly three solutions.

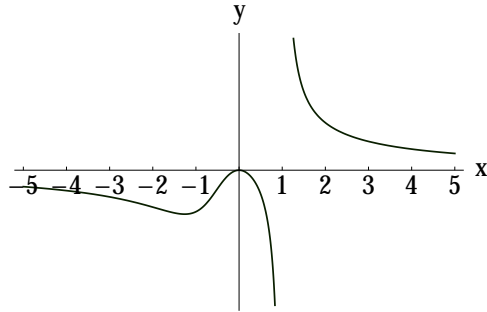
(e) $f(x) = 0$ has at most three solutions.

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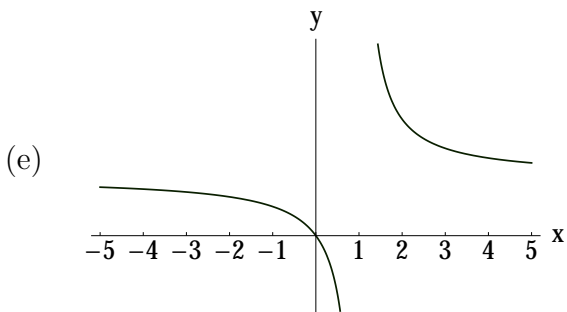
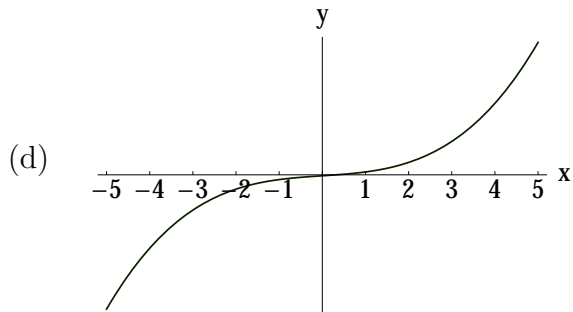
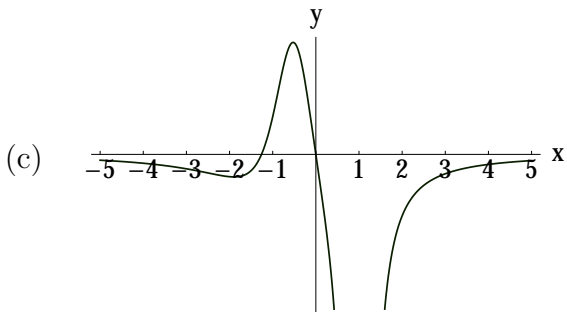
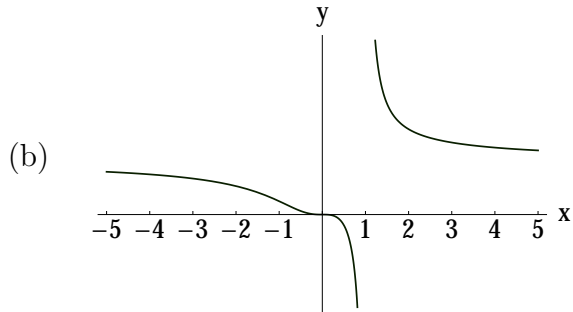
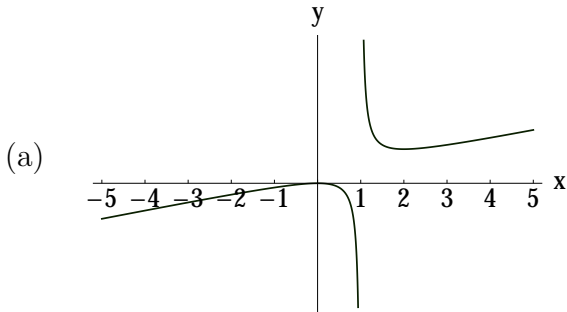
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5. (6 pts.)

The graph of $f(x)$ is shown below:



Which of the following is the graph of $f'(x)$?



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6.(6 pts.) Find $f'(x)$, if

$$f(x) = 2x^2 \sin(\sqrt{x}) + \frac{1}{\sqrt{x}}.$$

(a) $-\sqrt{x^3} \cos(\sqrt{x}) + 4x \sin(\sqrt{x}) - \frac{1}{2\sqrt{x^3}}$

(b) $2x^2 \cos(\sqrt{x}) + 4x \sin(\sqrt{x}) - \frac{1}{2\sqrt{x^3}}$

(c) $-\sqrt{x^3} \cos(\sqrt{x}) + \sin(\sqrt{x}) + \frac{1}{2\sqrt{x^3}}$

(d) $\sqrt{x^3} \cos(\sqrt{x}) + 4x \sin(\sqrt{x}) - \frac{1}{2\sqrt{x^3}}$

(e) $4x \cos(\sqrt{x}) - \frac{1}{2\sqrt{x^3}}$

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7.(6 pts.) Find the derivative of $f(x) = \tan(\sin(x^2))$.

(a) $2x \cot(\sin(x^2)) \cos(x^2)$

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

(c) $2x \sec^2(\sin(x^2)) \sin(x^2)$

(d) $\cot(\sin(x^2)) \cos(x^2)$

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

8.(6 pts.) If $f(x) = x \sin x + \cos x$, find $f''(x)$.

(a) $f''(x) = -\sin x - \cos x$

(b) $f''(x) = -x \sin x + \cos x$

(c) $f''(x) = x \cos x + \sin x$

(d) $f''(x) = 3 \cos x - x \sin x$

(e) $f''(x) = -x \sin x - \cos x$

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9.(6 pts.) Let $h(x) = f \circ g(x) - \frac{f(x)}{g(x)}$. If $f(3) = 0$, $g(3) = 1$, $f'(3) = 3$, $g'(3) = 4$, $f'(1) = 7$, and $g'(2) = 5$, then find $h'(3)$.

- (a) 0 (b) 30 (c) 25 (d) 10 (e) 20

10.(6 pts.) If $f(x) = x^3 - 3x^2 - 9x + 7$, find the x -coordinates of all points on the curve with horizontal tangent line.

- (a) $x = 0$ and $x = 1$
(b) $x = 4$ and $x = -2$
(c) $x = -3$ and $x = 1$
(d) $x = 3$ and $x = -1$
(e) No points on the curve have horizontal tangent line.

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Partial Credit

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

11.(13 pts.) Find the derivative of

$$f(x) = \sqrt{x+1}$$

using the limit definition of the derivative.

Please include all of the details in your calculation.

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12.(14 pts.) Let $y = x^2 + x$.

(a) Find the equation of the tangent line through the point $(-1, 0)$.

(b) Find all points on the curve whose tangent line goes through the point $(2, 5)$.

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13.(13 pts.) Show that there is at least one solution of the equation

$$x^2 = 2 + \sin(\pi x).$$

Justify your answer, identify the theorem you use and explain why the theorem applies.

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Rough Work

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