Name: _____

Instructor: _____

Math 10550, Exam 1,
September 20, 2011.

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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.

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Please do NOT write in this box.

Multiple Choice_____

11. _____

12. _____

13. _____

14. _____

Total _____

Name: _____

Instructor: _____

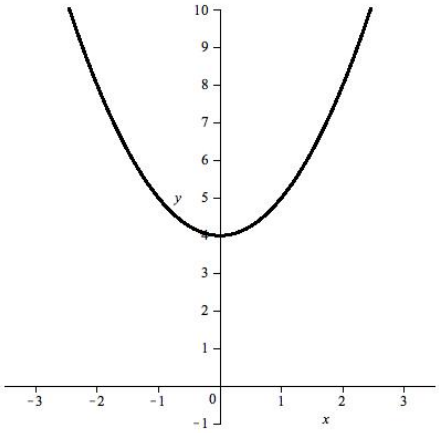
Multiple Choice

1.(6 pts.) Let $f(x) = x^2$ and $g(x) = x + 3$. Which of the following is the graph of the equation

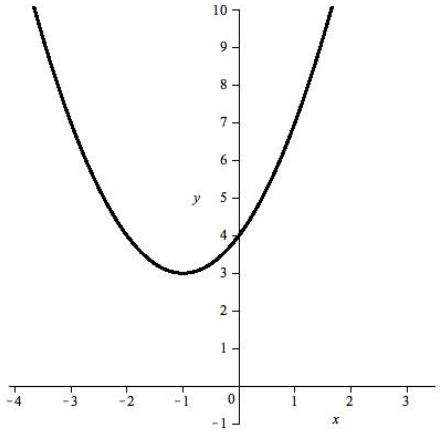
$$y = 1 + f(g(x))?$$

(Note that the label for each graph is given on the lower left of the graph.)

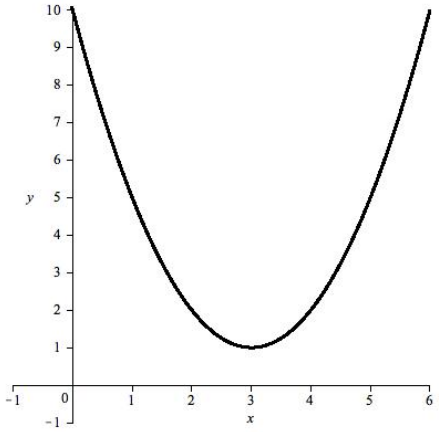
(a)



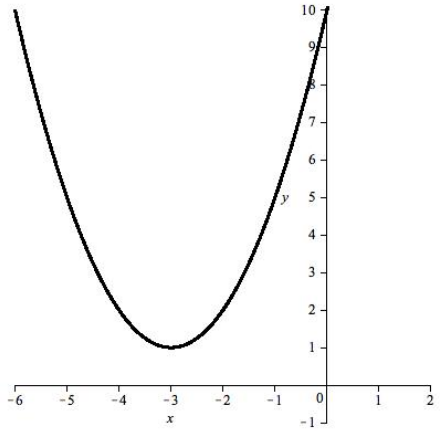
(b)



(c)



(d)



(e) None of the above

Name: _____

Instructor: _____

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

$$f(x) = \begin{cases} \dfrac{c\sqrt{x} - c}{x - 1} & x > 1 \\ \\ x - c & x \leq 1 \end{cases}$$

continuous everywhere?

(a) $c = 1$ (b) $c = \dfrac{2}{3}$ (c) $c = \dfrac{1}{2}$

(d) $c = 0$ (e) $c = -\dfrac{1}{2}$

Name: _____

Instructor: _____

3.(6 pts.) Compute $\lim_{x\to 2^-} \dfrac{4-x^2}{x^2-4x+4}$

(a) 2 (b) $-\infty$

(c) $+\infty$ (d) 4

(e) Does not exist and is not ∞ or $-\infty$.

4.(6 pts.) Compute

$$\lim_{x\to \frac{\pi}{2}} \frac{\sin x}{\left(x-\frac{\pi}{2}\right)^2}$$

(a) $+\infty$ (b) $-\infty$

(c) Does not exist and is not ∞ or $-\infty$. (d) 0

(e) 1

Name: _____

Instructor: _____

5.(6 pts.) A particle is moving on a vertical axis. The height of the particle after t seconds is given by the function

$$H(t) = 400 - t^2 - \sqrt{t} \text{ meters.}$$

Which of the following limits gives the velocity of the particle after 4 seconds (when $t = 4$)?

(a) $\lim_{h\to 4} \dfrac{400 - (4+h)^2 - \sqrt{4+h}}{h}$

(b) $\lim_{h\to 0} \dfrac{400 - (4+h)^2 - \sqrt{4+h} - 382}{h}$

(c) $\lim_{h\to 0} \dfrac{400 - (h)^2 - \sqrt{h} - 382}{h}$

(d) $\lim_{h\to 4} \dfrac{400 - (4+h)^2 - \sqrt{4+h} - 382}{h}$

(e) $\lim_{h\to 0} \dfrac{400 - (4+h)^2 - \sqrt{4+h}}{h}$

6.(6 pts.) Let $f(x) = \sqrt[7]{x^3} + \sqrt{x}\sin x$. What is $f'(x)$?

(a) $\dfrac{3}{7\sqrt[7]{x^4}} + \sqrt{x}\cos x + \dfrac{\sin x}{2\sqrt{x}}$

(b) $\sqrt[7]{3x^2} + \dfrac{\sin x}{2\sqrt{x}}$

(c) $\dfrac{3}{7\sqrt[7]{x^4}} + \dfrac{\cos x}{2\sqrt{x}}$

(d) $\sqrt[7]{3x^2} + \sin x + \sqrt{x}\cos x$

(e) $\dfrac{3}{7\sqrt[7]{x^4}} + \dfrac{\sin x}{2\sqrt{x}}$

Name: _____

Instructor: _____

7.(6 pts.) Find the equation of the tangent line to $y = x^2 \cos x + 1$ at $x = \dfrac{\pi}{2}$.

(a) $y - 1 = (-\dfrac{\pi^2}{4} + 1)(x - \dfrac{\pi}{2})$

(b) $y - 1 = -\pi(x - \dfrac{\pi}{2})$

(c) $y = -\dfrac{\pi^2}{4}x$

(d) $y - 1 = -\dfrac{\pi^2}{4}(x - \dfrac{\pi}{2})$

(e) $y = \pi x + 1$

8.(6 pts.) Let $f(x) = \cos(x^2 + 2x - 1)$. Find $f'(x)$.

(a) $(2x + 2)\cos(x^2 + 2x - 1)$

(b) $-\sin(x^2 + 2x - 1)$

(c) $-\sin(x^2 + 2x - 1) + \cos(2x + 2)$

(d) $(2x + 2)\sin(x^2 + 2x - 1)$

(e) $-(2x + 2)\sin(x^2 + 2x - 1)$

Name: _____

Instructor: _____

9.(6 pts.) For $f(x) = (x^3 + 2)\sin x$, find $f''(x)$.

(a) $6x\sin x + 6x^2\cos x - (x^3 + 2)\sin x$

(b) $6x\sin x - (x^3 + 2)\sin x$

(c) $6x\sin x + 3x^2\cos x - (x^3 + 2)\sin x$

(d) $-6x\sin x$

(e) $6x\sin x - 6x^2\cos x - (x^3 + 2)\sin x$

Name: _____

Instructor: _____

10.(6 pts.) If $f(x) = \dfrac{x^3+2}{x^{100}-x}$, find $f'(x)$.

(a) $\dfrac{(x^{100}-x)(3x^2)+(x^3+2)(100x^{99}-1)}{(x^{100}-x)^2}$

(b) $\dfrac{(x^{100}-x)(3x^2)-(x^3+2)(100x^{99}-1)}{(x^{100}-x)^2}$

(c) $\dfrac{(x^3+2)(100x^{99}-1)-(x^{100}-x)(3x^2)}{(x^{100}-x)^2}$

(d) $\dfrac{3x^2}{100x^{99}-1}$

(e) $\dfrac{(x^{100}-x)(3x^2)-(x^3+2)(100x^{99}-1)}{(x^3+2)^2}$

Name: _____

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Partial Credit

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

11.(10 pts.) Show that the function

$$f(x) = 3x - 1 - x^3$$

has a root in the interval $[1, 2]$.

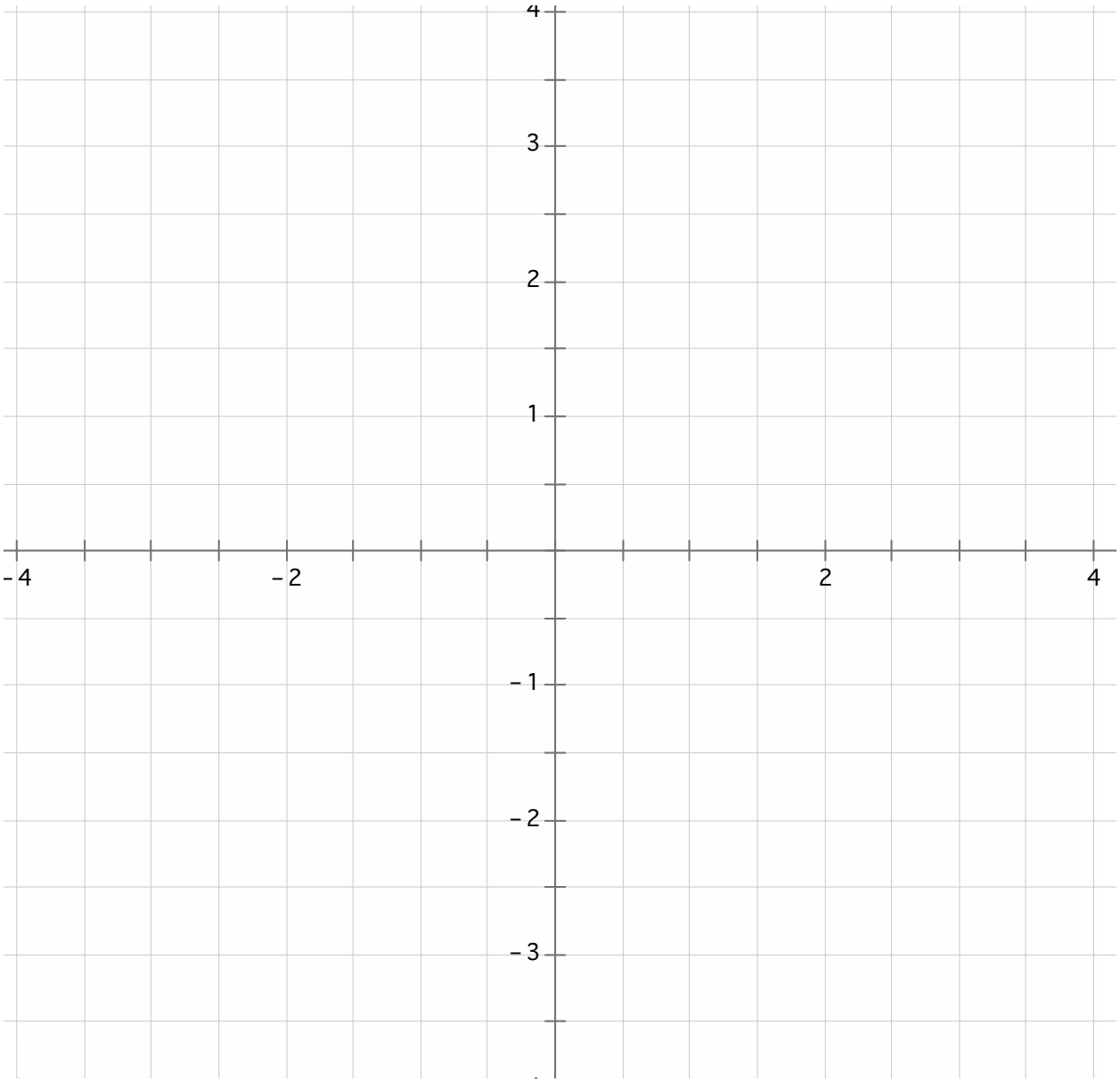
Make sure to identify which theorem you use and verify that all of the conditions for its use are satisfied for full credit.

Name: _____

Instructor: _____

12.(6 pts.) Give a rough sketch of the graph of a continuous function $y = f(x)$ below, for which

$$f(0) = -1 \quad f'(0) = 1, \quad f(2) = 3, \quad f'(2) = 0, \quad f(-2) = 0, \quad f'(-2) = -1,$$



Name: _____

Instructor: _____

13.(12 pts.) Consider the curve given by $y = \frac{x^3}{3} + x^2 + x + 1$.

(a) One of the tangent lines to the curve is horizontal. Find its equation.

(b) Two of the tangent lines to the curve are parallel to the line $y = x$. Find their equations.

Name: _____

Instructor: _____

14.(12 pts.) Consider the following table of function values:

	$x = 2$	$x = 3$
$f(x)$	2	-1
$g(x)$	$\sqrt{3}$	1
$f'(x)$	$\sqrt{2}$	2
$g'(x)$	1/2	1/2

(a) Find $(f + g)'(2)$

(b) Find $\left(\frac{f}{g}\right)'(3)$.

(c) Find $h'(2)$ where $h(x) = f([g(x)]^2)$.

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