Name: ______________________________

Instructor: __________________________

Math 10550, Exam 2
October 16, 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 10 pages of the test.

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

1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)
5.	(a)	(b)	(c)	(d)	(e)
6.	(a)	(b)	(c)	(d)	(e)
7.	(a)	(b)	(c)	(d)	(e)
8.	(a)	(b)	(c)	(d)	(e)
9.	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)

Please do NOT write in this box.

Multiple Choice	______
11.	______
12.	______
13.	______
14.	______
Total	______

Name: ______________________________

Instructor: __________________________

Multiple Choice

1.(6 pts.) A cylinder has constant height $h = 2$ m, but the radius is changing. If the volume is increasing at a rate of 16 m^3/sec., how fast is the radius changing when the radius is 4 m.

(a) 8 m/sec. (b) 1 m/sec. (c) $\frac{1}{\pi}$ m/sec.

(d) 4 m/sec. (e) $\frac{4}{\pi}$ m/sec.

2.(6 pts.) A beetle is moving along a straight line, with position given by $s(t) = \sin(t) + \cos(t)$. How much distance does it travel from $t = 0$ to $t = \pi/3$?

(a) $\frac{\sqrt{3}-1}{2}$

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

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

(d) $\frac{\sqrt{3}}{2}$

(e) None of the above.

Name: ______________________________

Instructor: ___________________________

3.(6 pts.) Find the linearization $L(x)$ of the function $f(x) = \tan(x)$ at $\frac{\pi}{4}$.

(a) $1 - \frac{\pi}{\sqrt{2}} + \sqrt{2}x$

(b) $1 - \frac{\pi}{8} + \frac{x}{2}$

(c) $1 - \frac{\pi}{2} + 2x$

(d) $1 + \frac{\pi}{2} + 2x$

(e) Does not exist; $\tan(x)$ is not differentiable at $\frac{\pi}{4}$

4.(6 pts.) Use linear approximation of $f(x) = \sqrt{3+x}$ at $a = 1$ to estimate $\sqrt{3.6}$.

(a) 1.9

(b) 1.8

(c) 2.1

(d) 2.2

(e) 3.8

Name: ______________________________

Instructor: __________________________

5.(6 pts.) Consider the function $f(x) = x^{1/3}(x+1)^2$. Which of the following is a complete list of the critical points of f?

(a) $1,\ 1/7,\ 0$ (b) $-1/4,\ 0,\ 1$ (c) $-1,\ 0$

(d) $0,\ -1/7,\ -1$ (e) $-1,\ -1/7$

6.(6 pts.) Let

$$f(\theta) = \frac{\theta^2}{4} + \cos(\theta) \quad \text{where} \quad 0 \le \theta \le \pi.$$

Which of the following statements is true about the graph of f?

(a) It is concave up on the interval $\left(0, \frac{\pi}{3}\right)$ and concave down on the interval $\left(\frac{\pi}{3}, \pi\right)$.

(b) It is concave up on the interval $\left(0, \pi\right)$.

(c) It is concave up on the interval $\left(\frac{\pi}{3}, \frac{2\pi}{3}\right)$ and concave down on the intervals $\left(0, \frac{\pi}{3}\right)$ and $\left(\frac{2\pi}{3}, \pi\right)$.

(d) It is concave up on the intervals $\left(0, \frac{\pi}{3}\right)$ and $\left(\frac{2\pi}{3}, \pi\right)$ and concave down on the interval $\left(\frac{\pi}{3}, \frac{2\pi}{3}\right)$.

(e) It is concave up on the interval $\left(\frac{\pi}{3}, \pi\right)$ and concave down on the interval $\left(0, \frac{\pi}{3}\right)$.

Name: ______________________________

Instructor: __________________________

7.(6 pts.) Consider the function $f(x) = x^3 - 3x^2 - 9x + 2014$. Which of the following statements is true?

(a) f has a local maximum at $x = -1$, a local minimum at $x = 3$, a point of inflection at $x = 1$.

(b) f has a local maximum at $x = 1$, a local minimum at $x = -1$, a point of inflection at $x = 3$.

(c) f has a local maximum at $x = 3$, a local minimum at $x = -1$, a point of inflection at $x = 1$.

(d) f has a local maximum at $x = -1$, a local minimum at $x = 1$, a point of inflection at $x = 3$.

(e) f has a local maximum at $x = 3$, a local minimum at $x = 1$, a point of inflection at $x = -1$.

8.(6 pts.) Evaluate $\lim_{x \to -\infty} \dfrac{\sqrt{2x^2 + 1}}{x - 4}$.

(a) 2 (b) -4 (c) $\sqrt{2}$ (d) $-\sqrt{2}$ (e) -2

Name: ____________________________

Instructor: ________________________

9.(6 pts.) The **derivative and second derivative** of the function $f(x)$ are given by

$$f'(x) = \frac{(x-2)(x-3)}{x} \qquad \text{and} \qquad f''(x) = 1 - \frac{6}{x^2} \ .$$

On which of the following intervals is $f(x)$ it both decreasing and concave up?

(a) $(\sqrt{6}, 3)$ (b) $(0, 2)$ (c) $(-\sqrt{6}, 0)$ (d) $(3, \infty)$

(e) It is impossible for a function to be decreasing and concave up on an interval.

10.(6 pts.) What is the minimum value of the function $f(t) = 2x^3 - 3x^2 - 12t + 6$ on the interval $[-2, 3]$?

(a) 13 (b) -14 (c) -3 (d) -7 (e) 2

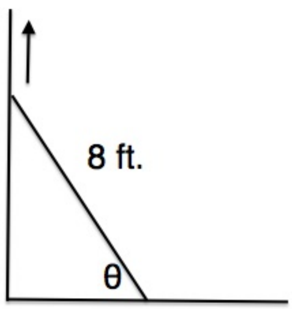
Name: ______________________________

Instructor: __________________________

Partial Credit

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

11.(12 pts.) A ladder 8 ft long leans against a vertical wall. The top of the ladder is pulled up from the floor at a rate of 2 ft/second. Let θ be the angle between the ladder and the ground. Find $\dfrac{d\theta}{dt}$ when the bottom of the ladder is 4 ft away from the wall.



Name: ____________________________

Instructor: _________________________

12.(12 pts.) Show that the equation

$$x^7 + 2x^5 + 5x + 4 = 0$$

has one and exactly one real solution. Identify the theorem(s) you are using.

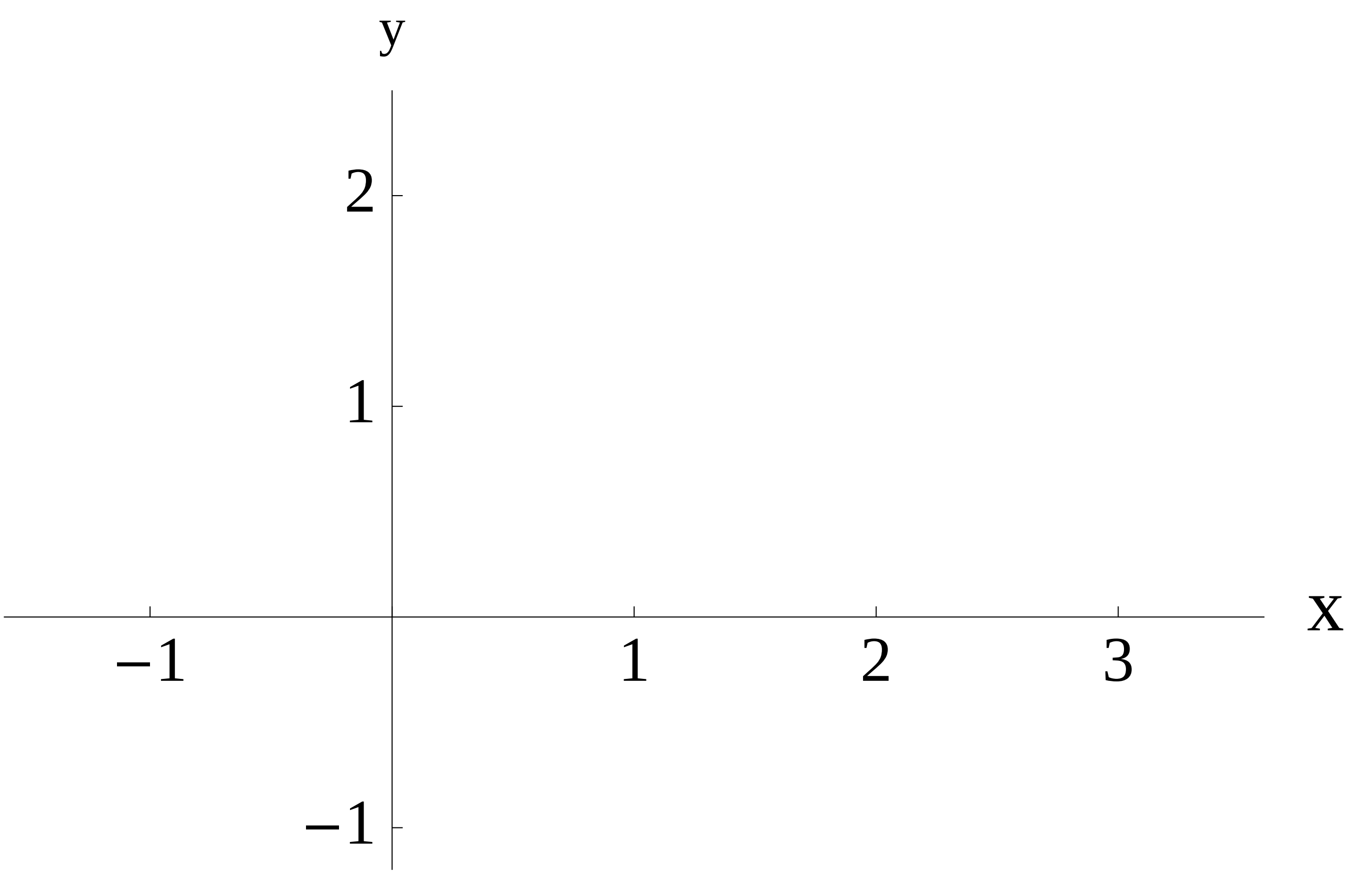
Name: ______________________________

Instructor: __________________________

13.(13 pts.)
The table below shows what is known about a function f which is **defined and continuous** on the interval $[-1, 3]$. The table gives the values (or the sign) of f, f' and f'' at the points given (D.N.E indicates that the derivative does not exist at that point) and tells whether f' and f'' are positive or negative on the intervals given.

x	-1	$(-1,0)$	0	$(0,1)$	1	$(1,2)$	2	$(2,3)$	3
$f(x)$	2		1		0		1		-0.5
$f'(x)$		< 0		< 0	0	> 0	$D.N.E.$	< 0	
$f''(x)$		< 0		> 0	> 0	> 0		> 0	

Sketch the graph of a function $f(x)$ satisfying the above data.



Name: ____________________________

Instructor: ________________________

14.(3 pts.) You will earn 3 points if your instructor can read your name easily on the front page of the exam and you mark the answer boxes with an X (as opposed to a circle or any other mark).

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Multiple Choice ____________

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13. ____________

14. ____________

Total ____________