Name: ______________________________

Instructor: __________________________

Math 10550, Exam II
October 11, 2012

- 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 9 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)

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Multiple Choice	______________
11.	______________
12.	______________
13.	______________
Total	______________

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Multiple Choice

1.(6 pts.) The critical numbers of $f(x) = \dfrac{1}{6}x^2 - x^{1/3}$ are

(a) $x = 0, x = 1, x = -1$

(b) $x = 0, x = -1$

(c) $x = 0, x = 1$

(d) $x = -1, x = 1$

(e) $x = 1$

2.(6 pts.) Given $f'(x) = \dfrac{x^2 - 1}{(x^2 + 1)^3}$, which of the following statements is true? (Note: you are given f', not f.)

(a) f has no local maximum.

(b) f has a local maximum at $x = 1$ and a local minimum at $x = -1$.

(c) f has no local minimum.

(d) f has a local maximum at $x = -1$.

(e) f has a local minimum at both $x = -1$ and $x = 1$.

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3.(6 pts.) Evaluate the following limit

$$\lim_{x\to-\infty} \frac{\sqrt{9x^2+7x^{1/3}}}{8x+7}.$$

(a) $-\dfrac{9}{8}$ (b) $-\dfrac{3}{8}$ (c) $\dfrac{3}{8}$ (d) $\dfrac{9}{8}$ (e) 1

4.(6 pts.) Evaluate

$$\lim_{x\to\infty} \left(\sqrt{x^2+x}-x\right).$$

(a) $\dfrac{1}{4}$ (b) 0 (c) $\dfrac{1}{2}$

(d) 2 (e) It does not exist as a real number.

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5.(6 pts.) The number of inflection points of $f(x) = x^4 + 4x^3 + 12x^2$ is

(a) 1 (b) 3 (c) 2 (d) 4 (e) 0

6.(6 pts.) Consider the function $f(x) = x + \dfrac{1}{x}$, defined for $0 < x \leq 10$. Which statement below is correct?
(Note that all statements apply to the behavior of f in the given interval.)

(a) f has precisely one critical point.

(b) The graph of f is concave down (on the entire interval).

(c) f has no minimum and f is decreasing (on the entire interval).

(d) f has precisely one inflection point.

(e) f has no maximum and f is decreasing (on the entire interval) .

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7.(6 pts.) Suppose $f(x)$ is continuous on $[0,1]$ and differentiable on $(0,1)$. If $f(0) = 0$ and $0 \le f'(x) \le \frac{1}{2}$, what is the largest $f(x)$ can be when $x = 1$?

(a) 1 (b) 2 (c) $\frac{1}{4}$

(d) 0 (e) $\frac{1}{2}$

8.(6 pts.) The linearization $L(x)$ of the function $f(x) = (x+1)\cos x$ at 0 (or $a = 0$) is

(a) $-x$ (b) x

(c) $2x + 2$ (d) $x + 1$

(e) $-x + 2$

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9.(6 pts.) Use a linear approximation to estimate $\sin \dfrac{\pi}{50}$.

(a) $\dfrac{1}{50}$ (b) $\dfrac{\pi}{50}$ (c) $\dfrac{\pi}{5}$

(d) 0.374 (e) $\dfrac{\sqrt{2}}{2}$

10.(6 pts.) Let

$$f(x) = \frac{1}{3}x^3 - \frac{3}{2}x^2 + 2x + 10.$$

On which of the intervals given below is the graph of f **both** increasing and concave upward (on the entire interval)?

(a) $(-\infty, \frac{3}{2})$ (b) $(-\infty, 2)$ (c) $(2, \infty)$

(d) $(1, 2)$ (e) $(\frac{3}{2}, 2)$

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Partial Credit

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

11.(12 pts.) Show that there is precisely *one* (real) root of the equation

$$x^5 + 4x - 3 = 0.$$

Justify your answer and identify the theorem(s) you use.

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12.(13 pts.) An eccentric mathematician enjoys inflating and releasing *cube-shaped* balloons. Assume that gas is being pumped into the balloon at the rate of three cubic feet per second. When the edge is one foot long, what is the rate of change of the *surface area* of the balloon?

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13.(15 pts.) Consider the function $f(x) = 3x^4 - 4x^3 + 2012$ defined on $(-\infty, \infty)$.
(1) Find the intervals on which f is increasing and decreasing.

(2) Find the intervals on which f is concave up and concave down and the points of inflection of f.

(3) Give the x and y values for the global/absolute minimum of f on the interval $(-\infty, \infty)$. Justify your answer.

Global min. at $(x, y) =$ _____________.

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13. ______________

Total ______________