Name: _____

Instructor: _____

Math 10550, Exam II
October 16, 2008

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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 9 pages of the test.

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

1.	(a)	(b)	(c)	(d)	(e)
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Multiple Choice	_____
11.	_____
12.	_____
13.	_____
Total	_____

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Multiple Choice

1.(7 pts.) Find an equation for the tangent line to

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

at the point $(\frac{\pi}{4}, 0)$.

(a) $y = \sqrt{2}x - \dfrac{\sqrt{2}\pi}{2}$

(b) $y = \sqrt{2}x - \dfrac{\sqrt{2}\pi}{4}$

(c) $y = \sqrt{2}x$

(d) $y = 0$

(e) $y = \dfrac{\sqrt{2}}{2}x - \dfrac{\sqrt{2}\pi}{4}$

2.(7 pts.) Find the derivative of

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

(a) $y' = \dfrac{-2x}{\sqrt{1+x^2}}\cos(\sqrt{1+x^2})$

(b) $y' = \dfrac{1}{2\sqrt{1+x^2}}\cos(\sqrt{1+x^2})$

(c) $y' = \dfrac{x}{\sqrt{1+x^2}}\cos(\sqrt{1+x^2})$

(d) $y' = x\cos(\sqrt{1+x^2})$

(e) $y' = x\sqrt{1+x^2}\cos(\sqrt{1+x^2})$

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3.(7 pts.) Find y' if

$$y^5 + x^2y^3 = 1 + x^4y.$$

(a) $y' = \dfrac{y(4x^3 - 5y^3)}{x^2(3y^2 - x^2)}$

(b) $y' = \dfrac{2xy(2x^2 - y^2)}{5y^4 + 3x^2y^2 - x^4}$

(c) Can not be determined from the given information.

(d) $y' = \dfrac{xy(4x^2 - 2y^2 - 3xy)}{5y^4 - x^4}$

(e) $y' = \dfrac{x(4x^2y + x^3 - 2y^3)}{y^2(5y^2 + 3x^2)}$

4.(7 pts.) A boy is flying a kite and has let 100 feet of string out. He does not let anymore string out and does not reel any more in. The wind is blowing the kite up higher, and the angle between the string of the kite and the horizontal is increasing at a rate of 2 radians/second. How quickly is the kite rising when the angle is $\pi/4$?

(a) $25\sqrt{2}$ ft/sec. (b) 100 ft/sec. (c) $100\sqrt{2}$ ft/sec.

(d) 25 ft/sec. (e) $50\sqrt{2}$ ft/sec.

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5.(7 pts.) Use linear approximation to estimate $\sqrt[5]{(1.005)^8}$.

(a) $\sqrt[5]{(1.005)^8} \approx 1.003$ (b) $\sqrt[5]{(1.005)^8} \approx 1.016$ (c) $\sqrt[5]{(1.005)^8} \approx 1.008$

(d) $\sqrt[5]{(1.005)^8} \approx 1.005$ (e) $\sqrt[5]{(1.005)^8} \approx 1.009$

6.(7 pts.) Find the absolute maximum and minimum of

$$f(x) = x - 4\sqrt{x}$$

on the closed interval $[0, 9]$, if they exist.

(a) Absolute max at $(x, y) = (0, 0)$; absolute min at $(x, y) = (9, -3)$.

(b) Absolute max at $(x, y) = (9, 1/3)$; absolute min at $(x, y) = (4, 0)$.

(c) No absolute max; absolute min at $(x, y) = (4, -4)$.

(d) f has no absolute max or absolute min on the interval $[0, 9]$.

(e) Absolute max at $(x, y) = (0, 0)$; absolute min at $(x, y) = (4, -4)$.

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7.(7 pts.) Let

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

Determine whether or not f satisfies the hypothesis of the Mean Value Theorem on the interval $[0, 2]$. If it does, find all numbers c that satisfy the conclusion of the Mean Value Theorem.

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

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

(c) $c = 1$

(d) $c = \sqrt{3}$

(e) No such c exists.

8.(7 pts.) Let

$$f(x) = \frac{1}{5}x^5 - \frac{2}{3}x^3 + x.$$

Find the intervals where f is concave up.

(a) $(-\infty, \infty)$

(b) $(-1, 1)$

(c) nowhere

(d) $(-\infty, 0) \cup (1, \infty)$

(e) $(-1, 0) \cup (1, \infty)$

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9.(7 pts.) Evaluate the limit

$$\lim_{x\to\infty} \frac{2-3x^2+x^3}{6x^3+5x^2+4x}$$

(a) $-\infty$ (b) ∞ (c) 0

(d) $\frac{1}{6}$ (e) $\frac{1}{3}$

10.(7 pts.) Consider the function

$$f(x) = \frac{x^2}{x^2+9}.$$

One of the following statements is true. Which one?

(a) The line $y = 1$ is a horizontal asymptote of f, and f has a global minimum at $x = 0$.

(b) f has no horizontal asymptotes, and f has a global maximum at $x = -3$.

(c) The line $y = 1$ is a horizontal asymptote of f, and f has a local maximum at $x = 0$.

(d) The line $y = 0$ is a horizontal asymptote of f, and f has a global minimum at $x = 0$.

(e) f has no horizontal asymptotes, and f has a global minimum at $x = -3$.

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Partial Credit

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

11.(10 pts.) The position of a particle is given by

$$s(t) = t^2(9 - t), \qquad \text{for } 0 \leq t \leq 9.$$

(a) When is the particle moving in the positive direction?

(b) What is the total distance travelled between $t = 0$ seconds and $t = 9$ seconds?

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12.(10 pts.) A paper cup has the shape of a cone with height 9 cm and radius 3 cm at the top of the cup. If water is poured into the cup at a rate of 2 cm^3/sec., how fast is the water level in the cup rising when the water is 3 cm deep? Hint: The volume of a cone of height h and radius r is $V = \frac{1}{3}\pi r^2 h$.

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13.(10 pts.) Let

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

(a) What are the critical numbers for f?

(b) On what intervals is the function increasing?

(c) What are the local max?

(d) What are the local min?

(e) Is there a global max or min?

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