Name: _____

Math 10550, Final Exam:
December 12, 2011

Instructor: _____

- The Honor Code is in effect for this examination, including keeping your answer sheet under cover.
- No calculators are to be used.
- The exam lasts for two hours.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 14 pages of the test.

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

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12.	(a)	(b)	(c)	(d)	(e)						
13.	(a)	(b)	(c)	(d)	(e)						
14.	(a)	(b)	(c)	(d)	(e)						

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Multiple Choice

1.(6 pts.) Find the limit

$$\lim_{t\to 0}\frac{\sqrt{t+25}-5}{t}.$$

(a) $\frac{1}{10}$ (b) $\frac{1}{\sqrt{10}}$ (c) 5

(d) 1 (e) $\frac{1}{5}$

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

$$f(x)=\begin{cases}\dfrac{1-x}{x^2-3x+2} & x\neq 1\\ a & x=1\end{cases}$$

continuous everywhere?

(a) $a=-\frac{1}{2}$ (b) $a=-1$ (c) $a=0$

(d) $a=1$ (e) No value of a makes f continuous everywhere

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

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

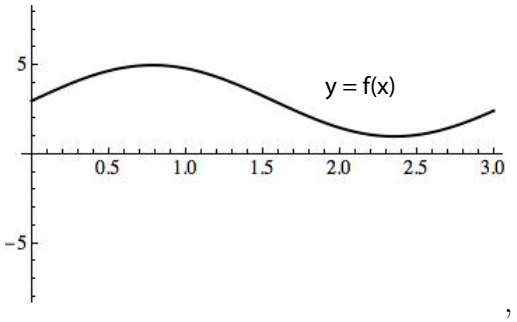
(b) $\dfrac{-(x-2)^3\cos x - 3(x-2)^2\sin x}{(x-2)^6}$

(c) $\dfrac{(x-2)^3\cos x - 3(x-2)^2\sin x}{(x-2)^6}$

(d) $\dfrac{(x-2)^3\cos x - 3(x-2)^2\sin x}{9(x-2)^4}$

(e) $\dfrac{\cos x}{3(x-2)^2}$

4.(6 pts.) The graph of $y = f(x)$ is shown on the left below. On the right the graphs of three functions labeled A, B, and C are shown. One of the three graphs on the right is the graph of $f'(x)$, and one is the graph of $f''(x)$. What is the correct labeling?



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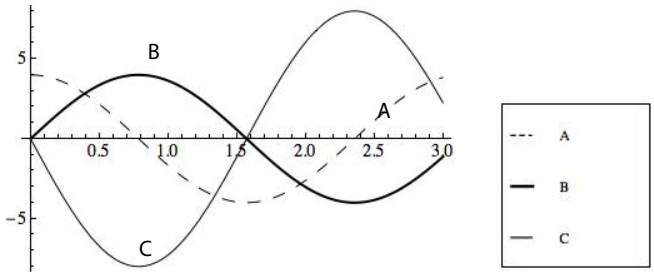

(a) $A = f'$, $B = f''$.

(b) $B = f'$, $C = f''$.

(c) $B = f'$, $C = f''$.

(d) $A = f'$, $C = f''$.

(e) $C = f'$, $B = f''$.

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Functions

5.(6 pts.) If

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

what is $f'(x)$?

(a) $\dfrac{1}{2\sqrt{1+\sqrt{x}}}$ (b) $\dfrac{\sqrt{x}}{4\sqrt{1+\sqrt{x}}}$ (c) $\dfrac{1}{\sqrt{1+\sqrt{x}}}$

(d) $\dfrac{1}{4\sqrt{x}\sqrt{1+\sqrt{x}}}$ (e) $\dfrac{\sqrt{x}}{\sqrt{1+\sqrt{x}}}$

6.(6 pts.) Compute the derivative y' of the curve

$$2x^3 + xy = y^2,$$

at the point on the curve when $x = 1$ and $y = 2$.

(a) $\dfrac{8}{3}$ (b) $\dfrac{7}{4}$ (c) 1 (d) 2 (e) $\dfrac{1}{3}$

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7.(6 pts.) Evaluate the following limit

$$\lim_{x \to 0} \frac{\sin(3x^2)}{x}.$$

(a) 3 (b) 1 (c) 0 (d) ∞ (e) $\frac{1}{3}$

8.(6 pts.) Two cyclists are approaching a town, one cycling due east at 20 miles per hour and the other cycling due south at 25 miles per hour. How fast is the distance between the bicycles decreasing when the eastbound cyclist is 40 miles from the town and the southbound cyclist is 30 miles from the town?

(a) 31 m. p.h. (b) 12 m.p.h. (c) 42 m.p.h.

(d) 55 m.p.h. (e) 35 m.p.h.

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9.(6 pts.) Find the linearization of the function $f(x) = \sqrt[5]{x}$ at $a = 32$ and use it to approximate the number $\sqrt[5]{34}$. Which of the following gives the resulting approximation?

(a) 2 (b) $\frac{21}{20}$ (c) $\frac{81}{40}$ (d) $\frac{19}{20}$ (e) $\frac{79}{40}$

10.(6 pts.) Find the absolute maximum of the function

$$f(x) = x^3 - 3x + 5$$

on the interval $[-1, 3]$.

(a) 3 (b) 7 (c) 30 (d) 23 (e) 1

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11.(6 pts.) Let $f(x) = (x-1)^2(x-2)$. Find the critical points of f and classify them. Which of the following is true?

(a) f has a local maximum at $x = 1$ and a local minimum at $x = 2$.

(b) f has a point of inflection at $x = 1$ and a local minimum at $x = 5/3$.

(c) f has a local minimum at $x = 1$ and a local maximum at $x = 5/3$.

(d) f has a local maximum at $x = 1$ and a local minimum at $x = 5/3$.

(e) f has a local minimum at $x = 1$ and a local maximum at $x = 2$.

12.(6 pts.) Let $f(x) = x^4 - 8x^3 + 10x + 10550$. Which of the following is true?

(a) The graph of f is concave up on the intervals $(-\infty, 0)$ and $(4, \infty)$.

(b) The graph of f is concave up on the intervals $(-\infty, 0)$ and $(1, 2)$.

(c) The graph of f is concave up on the interval $(0, 4)$.

(d) The graph of f is concave up on the intervals $(0, 1)$ and $(2, \infty)$.

(e) The graph of f is concave down everywhere on its domain.

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13.(6 pts.) The equation of the slant asymptote of the curve

$$y = \frac{2x^3 + x^2 + 3x + 2}{x^2 + 1}$$

is:

(a) $y = 2x + 3$ (b) $y = 2x - 1$ (c) $y = 2x + 1$

(d) $y = x - 1$ (e) $y = x + 1$

14.(6 pts.) Consider the function

$$f(x) = \frac{\sqrt{4x^2 + 2}}{x + 1}.$$

Find all horizontal and vertical asymptotes of f.

(a) Horizontal asymptotes : $y = 1$, Vertical asymptotes: $x = 2$.

(b) Horizontal asymptotes : $y = 2$ and $y = -2$, Vertical asymptotes: $x = -1$.

(c) Horizontal asymptotes : $y = 2$ and $y = -2$, Vertical asymptotes: $x = 1$ and $x = -1$.

(d) Horizontal asymptotes : $y = 2$ only, Vertical asymptotes: $x = -1$.

(e) Horizontal asymptotes : $y = -1$, Vertical asymptotes: $x = 2$ and $x = -2$.

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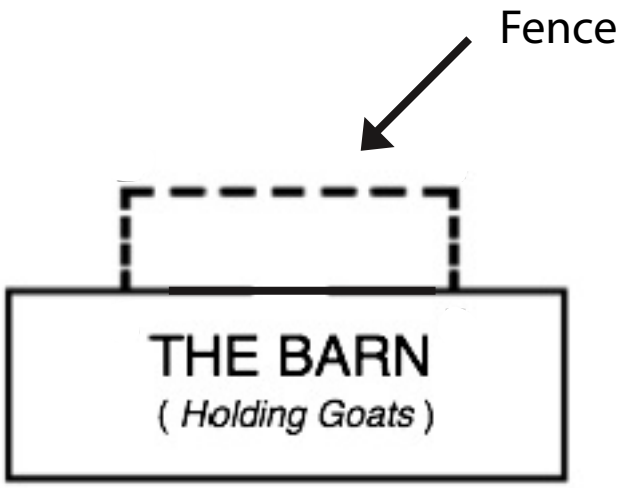
15.(6 pts.) Mr. McDonald (*the one who had a farm*) wants to use 24 ft of fence to build a rectangular corral around the door of his goat barn, as shown in the figure. Of course, being frugal, he wants to enclose as much area as he can with his 24 ft of fence. What is the maximal area he can enclose in the corral?



(a) 48 ft^2 (b) 36 ft^2 (c) 72 ft^2

(d) 64 ft^2 (e) none of the above.

16.(6 pts.) Newton's method is used to find a root of the equation

$$x^4 + x^2 + x - 3 = 0.$$

If $x_1 = -1$, find x_2.

(a) $-\frac{7}{2}$ (b) $\frac{2}{5}$ (c) 0 (d) -2 (e) $-\frac{7}{5}$

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17.(6 pts.) Which of the following definite integrals is equal to the limit of the Riemann sum:

$$\lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{i}{n}\right)^2 \cos\left(\frac{i}{n}\right)\frac{1}{n}.$$

(a) $\displaystyle\int_0^2 x^2 \cos x \, dx$ (b) $\displaystyle\int_0^1 x^2 \cos x \, dx$ (c) $\displaystyle\int_0^1 \cos x \, dx$

(d) $\displaystyle\int_0^1 x^3 \cos x \, dx$ (e) $\displaystyle\int_0^2 x^3 \cos x \, dx$

18.(6 pts.) if $f(x) = \displaystyle\int_0^{x^3} \sin(t^2)\, dt$, find $f'(x)$.

(a) $3x^2 \sin(x^6)$ (b) $\sin(x^2)$ (c) $3x^2 \sin(x^6) - 1$

(d) $\sin(x^6) - \sin(1)$ (e) $\sin(x^6)$

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19.(6 pts.) The velocity of a particle moving in a straight line is given by

$$v(t) = t^2 - 6t + 5, \quad \text{ft. per second.}$$

What is the **distance travelled** by the particle from $t = 0$ to $t = 2$?

(a) $\frac{2}{3}$ feet (b) $\frac{5}{3}$ feet (c) $\frac{12}{3}$ feet

(d) $\frac{19}{3}$ feet (e) $\frac{7}{3}$ feet

20.(6 pts.) Evaluate the integral

$$\int_0^1 \frac{x}{\sqrt{x^2+1}}\, dx.$$

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

(d) $2\sqrt{2}+1$ (e) $\sqrt{2}-1$

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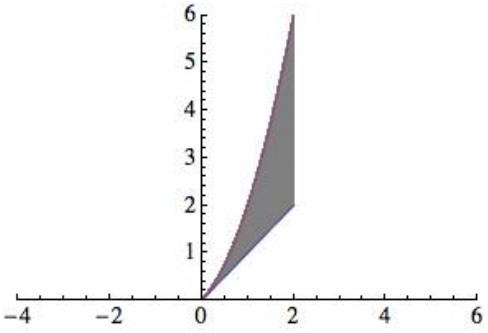
21.(6 pts.) Find the **area** of the region between the curves $y = x^2 - 2x$, $y = 2 - x$?

(a) $\frac{1}{6}$ (b) 2 (c) $\frac{3}{2}$ (d) $1 + \frac{\sqrt{2}}{7}$ (e) $\frac{9}{2}$

22.(6 pts.) Which of the following integrals represents the volume of the solid formed by revolving the region between $y = x^2 + x$ and the lines $y = x$, $x = 0$ and $x = 2$ **around the x-axis**?



(a) $\int_0^6 \pi y^2 - \pi(y^2 + y)^2 \, dy$

(b) $\int_0^2 2\pi x(x^2 + x) - 2\pi x^2 \, dx$

(c) $\int_0^6 2\pi y^2 - 2\pi y(y^2 + y) \, dy$

(d) $\int_0^2 \pi(x^2 + x)^2 - \pi x^2 \, dx$

(e) $\int_0^2 2\pi(x^2 + x)^2 - 2\pi x^2 \, dx$

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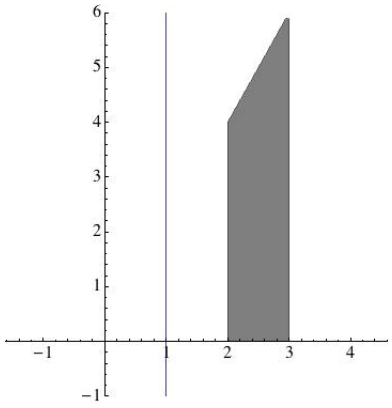
23.(6 pts.) Find the volume of the solid obtained when the region bounded by the lines $y = 2x$, $y = 0$, $x = 2$ and $x = 3$ is rotated about the line $x = 1$.



(a) $\frac{7\pi}{3}$ (b) $\frac{46\pi}{3}$ (c) $\frac{108\pi}{3}$ (d) $\frac{54\pi}{3}$ (e) $\frac{14\pi}{3}$

24.(6 pts.) A rope 30 feet long and weighing 0.5 lb/ft hangs over the edge of a building which is 30 feet tall. How much work is done in pulling the rope to the top of the building?

(a) 225 ft/lbs (b) 100 ft/lbs (c) 36 ft/lbs

(d) 120 ft/lbs (e) 550 ft/lbs

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25.(6 pts.) Let $f(x) = \sin^2 x \cos x$. Find its average value on the interval $[0, \pi/2]$.

(a) 3 (b) $\frac{2\pi}{3}$ (c) $\frac{2}{3\pi}$ (d) $\frac{1}{3\pi}$ (e) $\frac{1}{3}$

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