Name: _____

Instructor: _____

Math 125, Exam II
October 26, 2004

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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.

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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)

Please do NOT write in this box.

Multiple Choice	_____
8.	_____
9.	_____
10.	_____
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Multiple Choice

1.(8 pts.) A (right) cylinder with height one–third of the base radius has volume that grows at a constant rate of 1 feet^3/sec. How fast is the radius changing when the radius is 2 feet?

(a) $\frac{1}{16\pi}$ feet/sec. (b) $\frac{1}{\pi}$ feet/sec. (c) $\frac{1}{4\pi}$ feet/sec.

(d) $\frac{3}{8\pi}$ feet/sec. (e) 4π feet/sec.

2.(8 pts.) What is the linear (or, equivalently, differential) approximation to $\sqrt[3]{63.9}$?

(a) $8 - \frac{1}{160}$ (b) $8 + \frac{1}{160}$ (c) $4 + \frac{1}{480}$ (d) $4 - \frac{1}{480}$ (e) 4

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3.(8 pts.) On the interval $-1 \leq x \leq 3$, what are the x–coordinates of the absolute (global) maximum and absolute (global) minimum of $f(x) = x^3 - 6x^2 + 9x + 2$?

(a) Maximum: $x = 1$, Minimum: $x = -1$

(b) Maximum: $x = -1$, Minimum: $x = 3$

(c) Maximum: $x = 2$, Minimum: $x = -1$

(d) Maximum: $x = 2$, Minimum: $x = 3$

(e) Maximum: $x = 1$, Minimum: $x = 3$

4.(8 pts.) Find the critical numbers of $f(\theta) = \dfrac{\theta}{2} + \cos(\theta)$ on $0 \leq \theta \leq \pi$.

(a) $0, \dfrac{\pi}{6}, \dfrac{5\pi}{6}, \pi$ (b) $\dfrac{\pi}{6}, \dfrac{5\pi}{6}$ (c) $\dfrac{\pi}{3}, \dfrac{2\pi}{3}$

(d) $0, \pi$ (e) $0, \dfrac{\pi}{3}, \dfrac{2\pi}{3}, \pi$

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5.(8 pts.) Suppose that $f(x)$ is continuous and differentiable for all real numbers. If $1 \leq f'(x) \leq 3$ and $f(0) = 2$, what is the largest $f(x)$ can be at $x = 4$?

(a) 12 (b) 6 (c) 18 (d) 2 (e) 14

6.(8 pts.) Consider the function

$$f(x) = \frac{3x^3 - 3}{(2x+2)(x^2 - 7x + 10)}.$$

Which of the following are true?

(a) f has a horizontal asymptotes at $y = 3/2, -3/2$ and vertical asymptotes at $x = 1, 2, 5$.

(b) f has a horizontal asymptote at $y = 3/2$ and vertical asymptotes at $x = -1, 2, 5$.

(c) f has a horizontal asymptote at $y = 1$ and vertical asymptotes at $x = -1, 2, 5$.

(d) f has a horizontal asymptote at $y = 3/2$ and vertical asymptotes at $x = 1, 2, 5$.

(e) f has a horizontal asymptote at $y = 1$ and vertical asymptotes at $x = 2, 5$.

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7.(8 pts.) Find the following limit

$$\lim_{x\to\infty} \sqrt{x^3+6x^2} - \sqrt{(x+2)^3}.$$

(a) Does Not Exist (b) 6 (c) $-\infty$

(d) ∞ (e) 0

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Partial Credit

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

8.(10 pts.) Consider the function $f(x) = x^3 + 4x + 2$.

(a.) (5 pts.) Show that $f(x)$ has *at least one* root between $x = -1$ and $x = 1$. If you use a theorem, make sure you name it and verify all hypotheses.

(b.) (5 pts.) Show that $f(x)$ has *exactly one* root. If you use a theorem, make sure you name it and verify all hypotheses.

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9.(10 pts.) The angle of elevation of the sun is decreasing at a rate of $\frac{1}{3}$ radians per second (see Figure 1). How fast is the shadow cast by a 100–foot tall building increasing

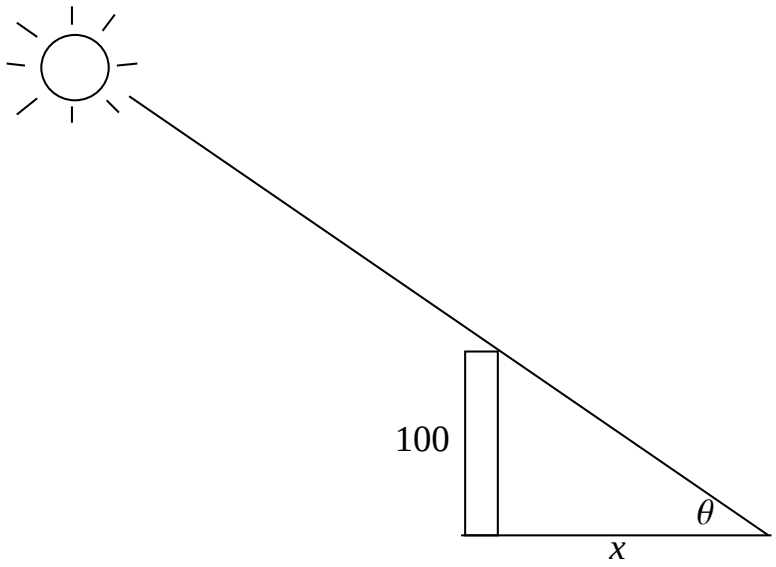

FIGURE 1. Geometry of Problem 9

when the angle of elevation of the sun is $\frac{\pi}{4}$ radians?

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10.(12 pts.) Consider the function $f(x) = x^4 - 4x^3 + 16$.

(a.) (3 pts.) Identify the intervals of increase or decrease.

(b.) (3 pts.) Find the local maximum and minimum values.

(c.) (3 pts.) Find the intervals of concavity and the inflection points.

(d.) (3 pts.) Use the information from parts (a)–(c) to sketch the graph.

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11.(12 pts.) Consider a function $f(x)$ whose derivative, $f'(x)$, is given in Figure 2.

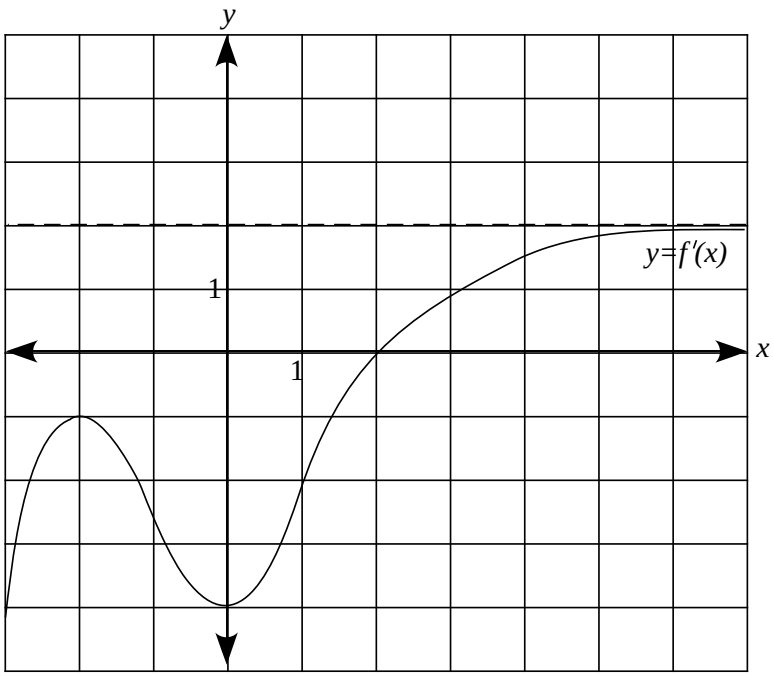

FIGURE 2. Plot of $f'(x)$ (Problem 11)

(a.) (4 pts.) On what intervals is f increasing or decreasing?
(b.) (4 pts.) For what values of x does f have a local maximum or minimum?
(c.) (4 pts.) Sketch the graph of f''.

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