Math 111 Exam 3, April 11, 2012

Read each problem carefully and show ALL your work. No calculators. You may not use methods beyond what we have covered in the course to date.

1. (10 points) For $f(x) = x - 4\sqrt{x}$, find the domain of *f*. Find all critical points (give the *x* and *y* values) and find all local and global (absolute) maxima and minima (give the *x* and *y* values) of *f* on [0, 25].

2. (10 points) If the acceleration of a particle moving in a straight line is given by $a(t) = 8e^{2t}$ for $t \geq 0$ and the velocity at time zero is $v(0) = 1$ and the position at time zero is $s(0) = 2$, find $v(t)$ (the velocity as a function of time).

3. (20 pts) If $f(x) = \dfrac{x^3}{3x^2+1}$; $f'(x) = \dfrac{3x^2(x^2+1)}{(3x^2+1)^2}$; and $f''(x) = \dfrac{-6x(x-1)(x+1)}{(3x^2+1)^3}$:
   a. On what intervals (in *x*) does the curve lie above the *x*-axis?
   b. On what intervals (in *x*) is *f* increasing?
   c. On what intervals (in *x*) is *f* concave up?
   d. Find all local maxima and minima (give the *x* and *y* values) of *f*.
   e. Find all inflection points (give the *x* and *y* values) of *f*.
   f. Find all asymptotes (vertical, horizontal and slant) of *f*.
   g. Find all intercepts.
   h. Sketch the curve.

4. (20 pts: 5 each) Find the limits:

   a. $\lim\limits_{t\to 1} \dfrac{t^2-1}{5t^4-7t^2+2}$

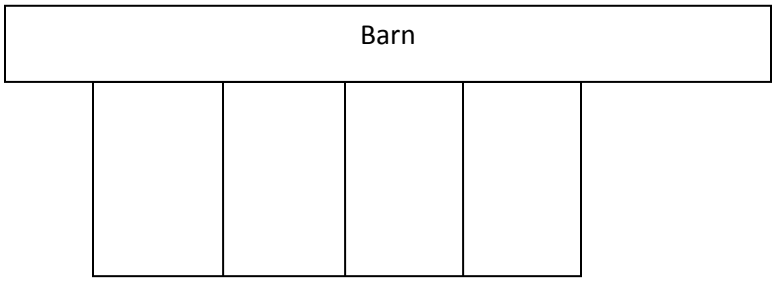
   b. $\lim\limits_{\theta\to 0} \dfrac{3^{\sin\theta}-1}{\theta}$

   c. $\lim\limits_{x\to -\infty} \dfrac{\sqrt{3x^2-7}}{x-\pi}$

   d. $\lim\limits_{x\to 0} (1+4x)^{3/x}$

5. (8 points) If $f(x) = x^5 - ax^3 + bx$ (where *a* and *b* are constants) has a critical point when $x = 1$ and an inflection point when $x = -1$. Find *a* and *b*.

6. (16 pts) A rancher has 400 feet of fence for construction of a rectangular corral with a barn forming one side of the corral. The corral is to have 4 rectangular regions – with one side of fencing parallel to the barn and 5 sides of fencing perpendicular to the barn, as shown. What dimensions of the corral maximize the enclosed area? Justify that it is a maximum.



7. (16 pts: 8 points each part)
   a. Use linearization to approximate $\sqrt[3]{29}$.
   b. Use one step Newton's method (pick a reasonable starting guess, x_0) to compute x_1 for $x^3 - 29 = 0$

Math 111 Exam 3 April 11, 2012

Name: (Print)

Student ID:

Instructor's Name:

Signature*:

Your signature above affirms that this examination is completed in accordance with the NJIT Academic Integrity Code.

Problem	Score	Out of
1		10
2		10
3		20
4		20
5		8
6		16
7		16
Total		100

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(place you answers on the lines below, show work at bottom of this page and the next page).

a. On what intervals (in x) does the curve lie above the x-axis?

_____

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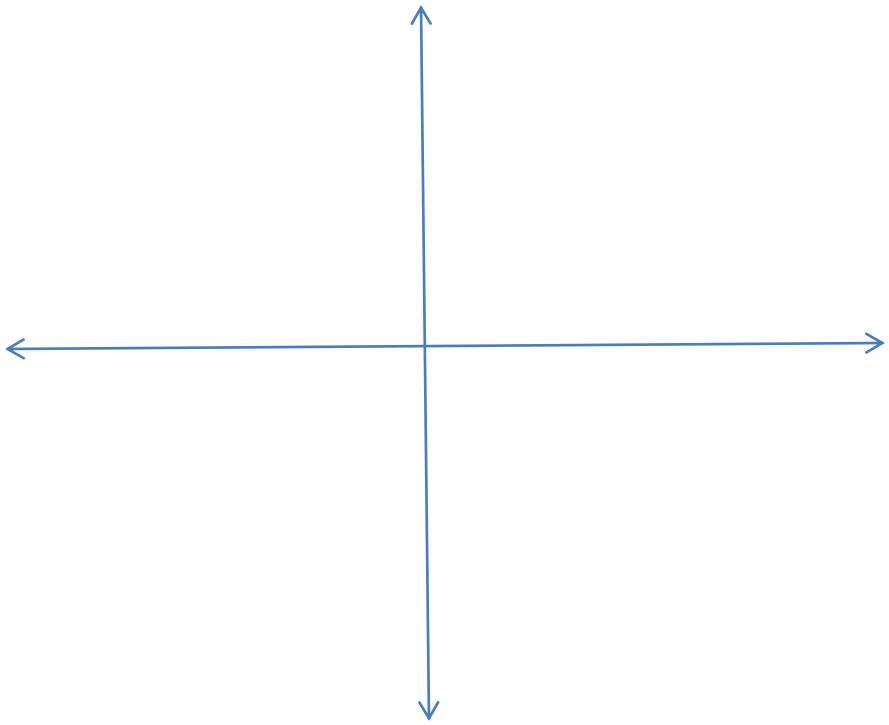

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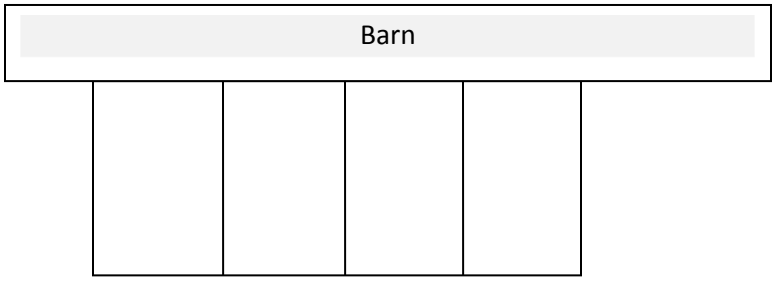

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