Math 111 Exam #1
September 28, 2016

Time: 1 hour and 25 minutes
Instructions: Show all work for full credit. No outside materials or calculators allowed.
Extra Space: Use the backs of each sheet for extra space. Clearly label when doing so.

Name: _____

ID #: _____

Instructor/Section: _____

"I pledge by my honor that I have abided by the NJIT Academic Integrity Code."

_____ (Signature)

Problem(s)	Score	Total

1. Show that the graph of $f(x) = 3x^3 + 5x - 11 = 0$ has a solution between x=1 and x=2. State which theorem you use to show this. **(7 points)**

2. Evaluate the following limits, allowing $+\infty$ and $-\infty$ as possible values of a limit. If the limit does not exist, explain why. Show all work. **(10 points)**

a. $\lim\limits_{x\to 0} \dfrac{\sqrt{x^2+9}-3}{x^2}$

b. $\lim\limits_{x\to 0} \dfrac{-x^2+5x-6}{x^2-4}$

3. Evaluate the following limits, allowing $+\infty$ and $-\infty$ as possible values of a limit. If the limit does not exist, explain why. Show all work. **(10 points)**
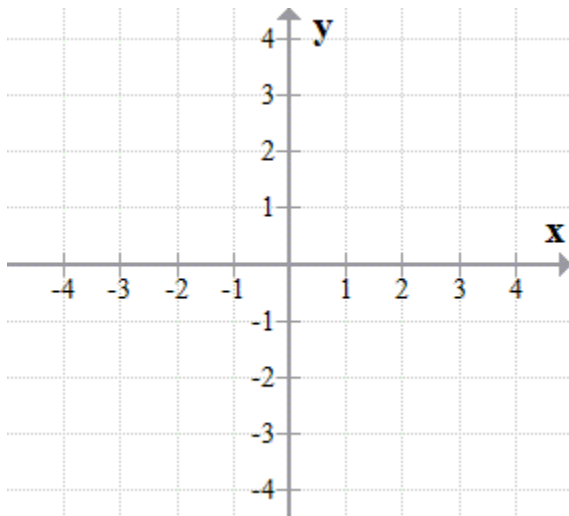
a. $\lim\limits_{x \to 0} \dfrac{\tan(2x)}{x}$

b. $\lim\limits_{x \to \infty} \dfrac{x^2\sqrt{x}-4x+8}{3x^3}$

4. Graph the following rational functions. Find the equations of any asymptotes and include them on the graph, along with any x and y intercepts **(16 points)**

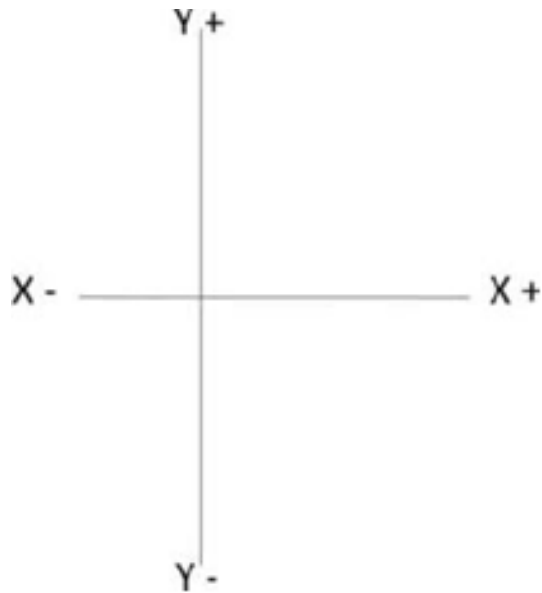   a. $y = \dfrac{x^2}{2x+4}$
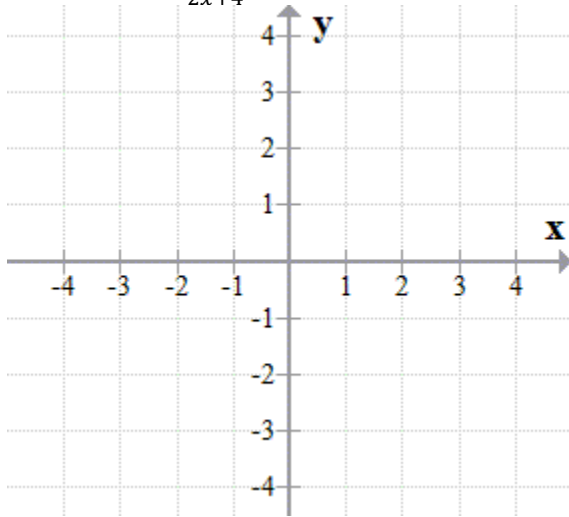
   b. $y = \dfrac{-8}{x^2-4}$

5. For what value(s) of the constant 'a' would f(x) be continuous at every x? **(5 points)**

$$f(x) = \begin{cases} a^2x - 2a & x \geq 2 \\ 12 & x < 2 \end{cases}$$

6. Given $f(x) = \begin{cases} \ln(x) + 1, & x < 1 \\ 0, & x = 1 \\ x^2, & x > 1 \end{cases}$

    a. Sketch f(x) **(4 points)**

    b. Find $\lim\limits_{x \to 1} f(x)$. Show all work, including left and right limits. **(4 points)**

    c. Determine if the graph is continuous at x=1 **(4 points)**

Y +

X -   X +

Y -

7. Given the graph of the piecewise function f(x), answer the following **(6 points)**:

   a. Find $\lim\limits_{x \to 2} f(x)$ or explain why it does not exist (Show all work, including left and right limits)
   b. Find f'(-4), the derivative of the function at x = – 4
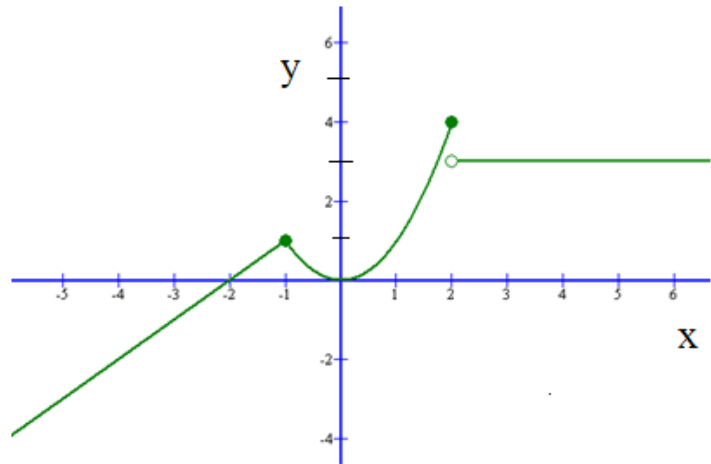
8. Using the definition of the derivative as a difference quotient, find dy/dx for $y = 2x - x^2$ **(7 points)**

9. Consider the function $y = \sqrt{x}$
   a. Using the definition of the derivative as a difference quotient, find dy/dx **(7 points)**

   b. Find the equation of the tangent line to this curve at $x = 4$ **(5 points)**

c. (continued from previous page): Graph both the function and its tangent line on the
   following xy-axis (show all x and y-intercepts): **(5 points)**
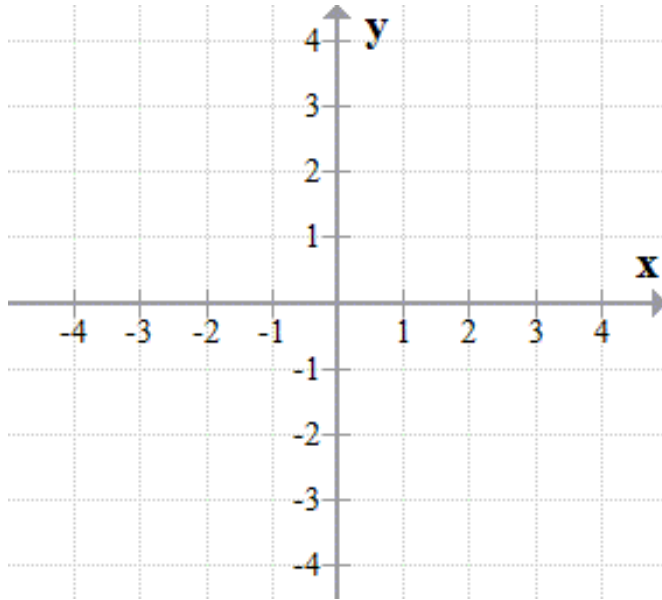
10. The graphs below show the motion of four particles (A, B, C, and D) and their position x(t)
    in feet with respect to time (t) in seconds. Answer the following: **(2 points each)**
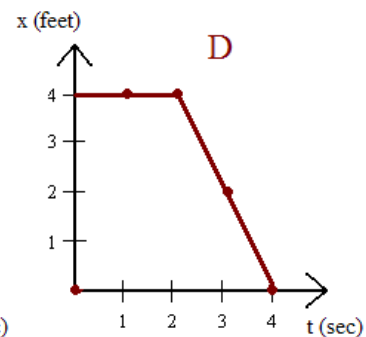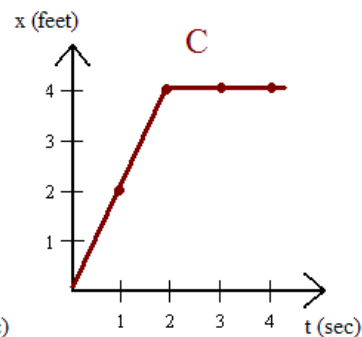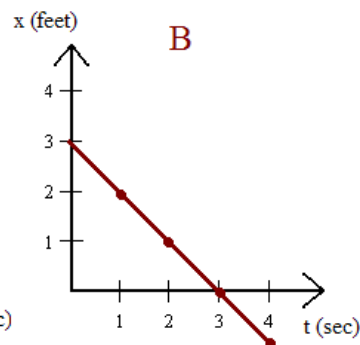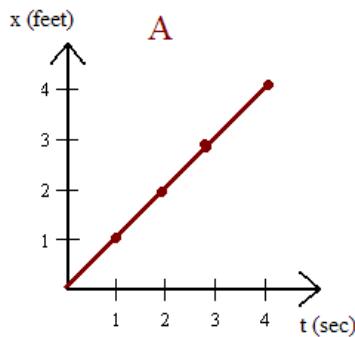
a. What is the average speed of particle C between 0 and 4 seconds? _____

b. Which particle is moving fastest at t=1 second? _____

c. What is the velocity of the particle from part (b) at t=1 second? _____

d. Which particle(s) have a velocity of 0 feet/sec at t=3 seconds? _____

e. Which particle(s) are moving during the entire time between 0 and 4 seconds? _____