**Read Me First:**   *Show all essential work very neatly. Use correct notation when presenting your computations and arguments. Write using complete sentences. Be careful.   Remember this: "=" denotes "equals" , "⟹" denotes "implies" , and "⟺" denotes "is equivalent to".   Do not "box" your answers. Communicate. Show me the magic on the page.*

1. (10 pts.)   On the coordinate system below sketch the graph of the function g defined below. Label very carefully.

$$g(x) = \begin{cases} (x + 1)^2 & , \quad x \geq -1 \\ 1 + x & , \quad x < -1 \end{cases}$$
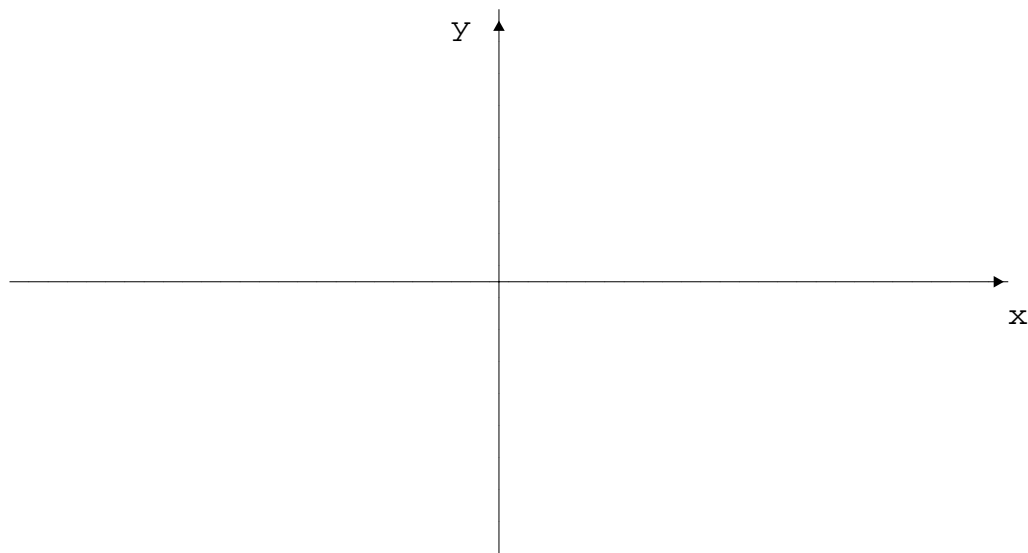
2. (10 pts.) If $f(x) = 2x^2 - 3x$, find

$$\frac{f(x + h) - f(x)}{h} ,$$

and simplify as much as possible algebraically. Kindly observe that there are no limits of any sort being taken here.

$$\frac{f(x + h) - f(x)}{h} =$$

3. (5 pts.) Using complete sentences and appropriate notation, provide the precise mathematical definition of a **function** f //

4. (10 pts.)   Suppose $f(x) = x^2 - 4x$ and $g(x) = (x - 5)^{1/2}$. Obtain a formula for each of the following functions and state clearly what their domains are:

(a) (f + g)(x) =

     dom(f + g) =

(b) (f·g)(x) =

     dom(f·g) =

(c) (f/g)(x) =

     dom(f/g) =

(d) (f - g)(x)   =

     dom(f - g)   =

(e) (g∘f)   =

     dom(g∘f) =

5. (5 pts.)   Express $f(x) = 2 \cdot \sec^2(5x^3)$ as the composition of two functions g and h with f = g∘h, that is find g and h so that f(x) = (g∘h)(x).

g(x) =

h(x) =

Now check your work by correctly computing (g∘h)(x). [DETAILS REQUIRED!!]

6. (20 pts.) For each of the following, find the limit if the limit exists. If the limit fails to exist, say so. Be as precise as possible here. [Work on the back of page two when you run out of room here.]

(a) $\displaystyle\lim_{x \to +3} \frac{x + 3}{x^2 - 9} =$

(b) $\displaystyle\lim_{x \to -3} \frac{x + 3}{x^2 - 9} =$

(c) $\displaystyle\lim_{t \to +\infty} \frac{6 - 14t^3}{2t^4 + 3} =$

(d) $\displaystyle\lim_{x \to +\infty} \frac{7x^4 - 3x^5}{x^5 + 3x^4} =$

7. (10 pts.)   Suppose that

$$h(x) = \begin{cases} x^2 - 3x + 7 & , \text{ if } \quad x < -1 \\ 10 & , \text{ if } \quad x = -1 \\ -11x & , \text{ if } \quad x > -1 \end{cases}$$

Evaluate the following limits:

(a) $\lim\limits_{x \to -1^+} h(x) =$
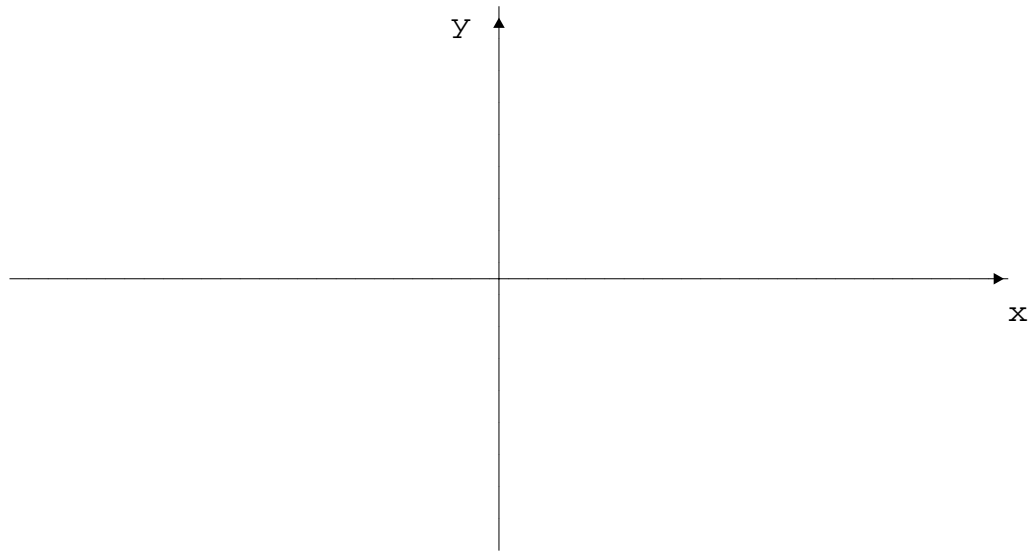
(b) $\lim\limits_{x \to -1^-} h(x) =$

(c) What can you conclude from parts (a) and (b)? Why??

8. (10 pts.)   Evaluate each of the following thorny limits:

(a) $\lim\limits_{x \to \infty} ((x^2 + 25x)^{1/2} - x) =$

(b) $\lim\limits_{x \to 0} \dfrac{(x + 25)^{1/2} - 5}{x} =$

9. (10 pts.) Sketch the curve defined by the parametric
equations x = -1 + cos(t) and y = 1 - sin(t) with 0 ≤ t ≤ 2π   by
eliminating the parameter, and indicate the direction of
increasing t.

10. (5 pts.)   Express the following function in piecewise
defined form without using absolute values:

$$f(x) = 5x - |x - 1|$$

11. (5 pts.)   Given $\lim_{x \to a} [3f(x) - 2g(x)] = 3$ and $\lim_{x \to a} g(x) = -3$,

$\lim_{x \to a} f(x) =$

$\lim_{x \to a} [g(x)]^3 =$