
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.*

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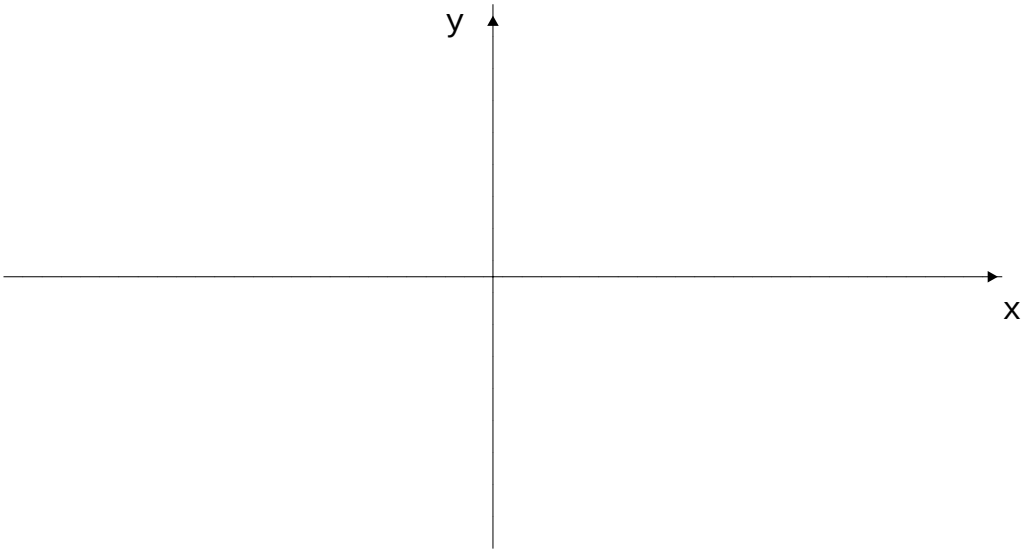
1. (10 pts.) On the coordinate system below sketch the graph of the function g defined below. Label very carefully.

$$g(x) = \begin{cases} (x - 1)^2 & , \quad x \geq 1 \\ 1 - x & , \quad x < 1 \end{cases}$$



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2. (10 pts.) If $f(x) = 3x^2 - x$, 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 $f(x) = x^2 - 3x$ and $g(x) = (x - 4)^{1/2}$. Obtain a formula for each of the following functions and state clearly what their domains are:

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

dom(f + g) =

(b) $(f \cdot g)(x) =$

dom(f · g) =

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

dom(f/g) =

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

dom(f - g) =

(e) $(g \circ f) =$

dom(g∘f) =

5. (5 pts.) Express $f(x) = 2 \cdot \tan^2(3x^3)$ 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) $\lim_{x \to +2} \dfrac{x + 2}{x^2 - 4} =$

(b) $\lim_{x \to -2} \dfrac{x + 2}{x^2 - 4} =$

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

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

7. (10 pts.) Suppose that

$$h(x) = \begin{cases} x^2 - 3x + 7 & \text{, if } x < 1 \\ 10 & \text{, if } x = 1 \\ 5x & \text{, if } x > 1 \end{cases}$$

Evaluate the following limits:

(a) $\lim_{x \to 1^+} h(x) =$

(b) $\lim_{x \to 1^-} h(x) =$

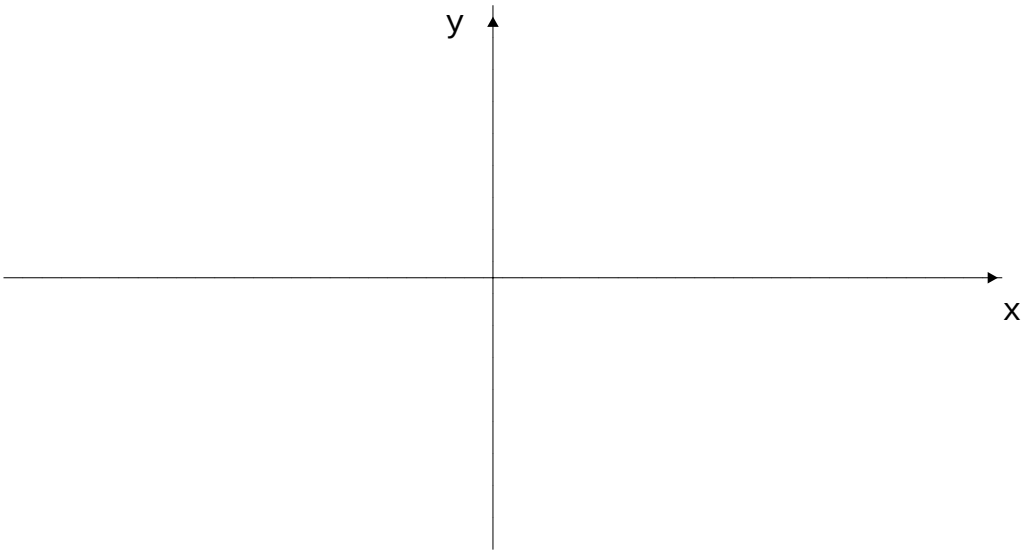
(c) What can you conclude from parts (a) and (b)? Why??

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

(a) $\lim_{x \to \infty} ((x^2 + 36x)^{1/2} - x) =$

(b) $\lim_{x \to 0} \dfrac{(x + 36)^{1/2} - 6}{x} =$

9. (10 pts.) Sketch the curve defined by the parametric equations $x = 1 + \cos(t)$ and $y = -1 - \sin(t)$ with $0 \le t \le 2\pi$ 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:

$$f(x) = 8x - |x - 1|$$

11. (5 pts.) Given $\lim_{x \to a} [3f(x) - 2g(x)] = -2$ and $\lim_{x \to a} g(x) = -4$,

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

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