Explain, in a (complete) sentence or two, your reasoning.

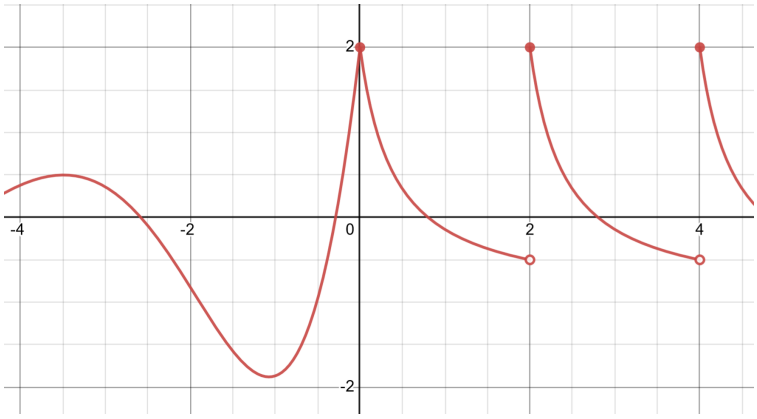
1. **True** or **False**: As x increases to 1000, the function $f(x) = \frac{1}{x}$ gets closer to 0, so the limit as x goes to 1000 is 0. Justify your answer.

2. **True** or **False**: If $\lim_{x\to a} f(x) = \infty$ and $\lim_{x\to a} g(x) = \infty$, then $\lim_{x\to a}[f(x) - g(x)] = 0$.

3. **True** or **False**: If $\lim_{x\to a} f(x) = L$, then that means if x_1 is closer to a than x_2 is, then $f(x_1)$ will be closer to L than $f(x_2)$ is.

4. Consider the function
$$k(x) = \begin{cases} x^2 & x \text{ is rational} \\ -x^2 & x \text{ is irrational} \end{cases}$$
Then
   A. there is no a for which $\lim_{x\to a} f(x)$ exists
   B. there might be some a for which $\lim_{x\to a} f(x)$ exists, but it is impossible to say for sure without more information
   C. The number $a = 0$ is the only number for which $\lim_{x\to a} f(x)$ exists
   D. The limit $\lim_{x\to a} f(x)$ exists for infinitely may a.

5. Consider the following graph of the function $m(x)$:



A. $\lim_{x\to 0} m \circ m(x) = 2$

B. $\lim_{x\to 0} m \circ m(x) = -\frac{1}{2}$

C. $\lim_{x\to 0} m \circ m(x) = 0$

D. $\lim_{x\to 0} m \circ m(x)$ does not exist

6. Without using a calculator, estimate how many solutions there are to the equation

$$\sin(x) = \frac{x}{100}$$

Explain your reasoning. (Hint: try graphing)

7. Is it true that for any functions f, g, and h, we have the equation

$$(f + g) \circ h(x) = [f \circ h + g \circ h](x)$$

Is it true that

$$f \circ (g + h)(x) = [f \circ g + f \circ h](x)$$

If it is true, try to explain why, if it is false, give an example of three functions where the equation fails.

8. Consider the function $q(t) = \frac{t-2}{2t+3}$.

   (a) What are the domain and range of $q(t)$?

   (b) Find a formula for the inverse function $q^{-1}(t)$. What are its domain and range?

   (c) Graph $q(t)$ and $q^{-1}(t)$ in the same plot. Can you see any relationship between the two graphs?

   (d) Find a formula for $f \circ f(x)$. What are the domain and range of $f \circ f(x)$?