**Limit Laws**

1. Discuss if \( \lim_{x \to 2} f(x) = 5 \), must \( f \) be defined at \( x = 2 \)? If it is, must \( f(2) = 5 \)?

2. Discuss if \( f(2) = 5 \), must \( \lim_{x \to 2} \) exist? If it does, must the limit equal 5?

3. Consider the function \( s(x) = 3 + 2 \cos \theta \). Determine the average rate of change of \( s(x) \) on the interval \([0, \pi]\). Then repeat the process for the interval \([\pi, 2\pi]\).

4. Consider the following functions. If the limit exists, determine what it is. If it does not exists, explain why not.
   
   (a) \( \lim_{x \to 3} (x - 4)^{2009} \)

   (b) \( \lim_{x \to 1} \frac{x^3 - 1}{x^4 - 1} \)

   (c) \( \lim_{x \to 2} \frac{x^4 - 16}{x^3 - 8} \)

5. Using the limit laws, determine the following limit. You may only use one law at a time and you must name the law used in each step.

   \[
   \lim_{t \to 3} = \frac{\sqrt{7(t^2 - 4t + 10)}}{2(t + 1)(t - 4)}.
   \]

6. Using the right triangle definition of \( \sin \theta \), explain why \(-|\theta| \leq \sin \theta \leq |\theta|\), for all \( \theta \). Then use the sandwich theorem to prove

   \[
   \lim_{x \to 0} \sin x = 0.
   \]