2.1 Rates of Change and Limits AP AB Calculus



- 1. Place your pencil on the graph
- Trace along the graph...STOP when you are about to hit the point where x = 5, but you don't actually hit that point (get infinitely close!)
- 3. What are you about to hit? _____
- 4. What is *f*(5) = _____
- 5. Will $\lim_{x \to a} f(x)$ always be the same value as f(a)? Can you draw a sketch of a graph in which they are NOT equal?



3 ways to solve a limit:

Tabular

Find $\lim_{x \to 1} \frac{x^2 - 1}{x - 1}$

| x approaches 1 from the left \Longrightarrow | | | | x approaches 1 from the right | | | |
|--|-----|------|-------|-------------------------------|-------|------|-----|
| x | 0.9 | 0.99 | 0.999 | 1 | 1.001 | 1.01 | 1.1 |
| f(x) | | | | | | | |

Graphically
$$\lim_{x \to 2} f(x) =
\\
\lim_{x \to 0} f(x) =
\\
\lim_{x \to 0} f(x) =
\\
\lim_{x \to -1} f(x) =
\\
What do you think the $\lim_{x \to -4} f(x) =?$ Algebraically$$

One Sided Limits



Properties of Limits: Limits of Sums, Differences, Products, Powers, Roots, and

Quotients:

Sum Rule
$$\lim_{x \to a} [f(x) + g(x)] =$$

2. Difference Rule
$$\lim_{x \to a} [f(x) - g(x)] =$$

3. Product Rule $\lim_{x \to a} [f(x) * g(x)] =$

- 4. Constant Multiple Rule $\lim_{x \to a} [k * f(x)] =$
- 5. Power Rule

$$\lim_{x \to a} \left[f(x) \right]^n =$$

6. Quotient Rule

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

Sandwich Theorem

1.

Show that $\lim_{x\to 0} x^2 \sin x = 0$