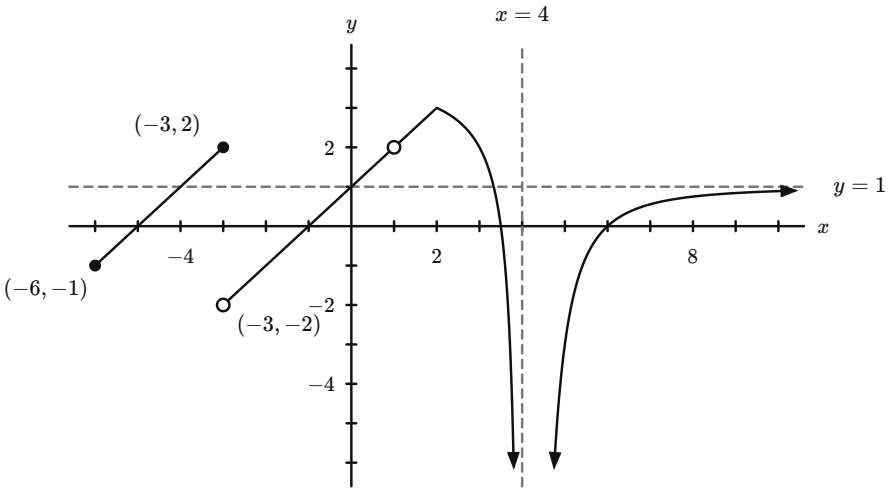
Calculus 1 Unit 1 worksheet: What a limit is: graphs and tables

Name _____ Date _____ Period _____

1. The graph of a function g is drawn below. Its domain is $x \geq -6$, the tick marks are 1 unit apart, and the dashed lines are $x = 4$ and $y = 1$.



(a) Find $\lim_{x \to -6^+} g(x)$. Why is $\lim_{x \to -6} g(x)$ not asked for?

(b) Find $\lim_{x \to -3^-} g(x)$, $\lim_{x \to -3^+} g(x)$, $\lim_{x \to -3} g(x)$ and $g(-3)$.

(c) Find $\lim_{x \to 1} g(x)$ and $g(1)$.

(d) Describe $g(x)$ as $x \to 4^-$ and as $x \to 4^+$, in limit notation. Is there a number L with $\lim_{x \to 4} g(x) = L$?

(e) Find $\lim_{x \to \infty} g(x)$.

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2. A series $a_1 + a_2 + a_3 + \cdots$ has partial sums $S_n = \dfrac{5n}{n+2}$.

(a) Find S_1, S_2, S_3, S_{98} and S_{998}.

(b) Find $\lim_{n\to\infty} S_n$, and explain why the partial sums close in on it. What is the sum of the series?

(c) Find a_1, a_2 and a_3, and show that the series is not geometric.

3. Let $f(x) = (1+x)^{1/x}$, which is undefined at $x = 0$. Use a calculator.

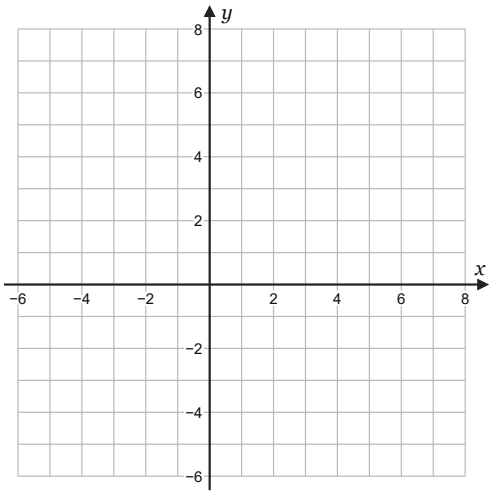
(a) Find $f(x)$ at $x = -0.1$, -0.01, -0.001, 0.001, 0.01 and 0.1, to five decimal places.

(b) Describe how the outputs on each side behave, and estimate $\lim_{x\to 0} f(x)$ to three decimal places.

(c) The limit is a number met earlier in the course. Which number?

4. Sketch the graph of one function f that has all of these properties. Draw each closed dot and open circle, draw each asymptote dashed, and use arrows where the graph goes on.

- $\lim_{x\to -2} f(x) = 3$, and $f(-2) = -1$
- $\lim_{x\to 1^-} f(x) = 2$, $\lim_{x\to 1^+} f(x) = -1$, and $f(1) = 2$
- $\lim_{x\to 4} f(x) = -\infty$
- $\lim_{x\to\infty} f(x) = 0$ and $\lim_{x\to -\infty} f(x) = \infty$



5. Decide whether each situation can happen. If it can, give an example (a formula or a described graph). If it cannot, explain why.

(a) The graph of f crosses the line $y = 2$ infinitely many times, and $\lim_{x\to\infty} f(x) = 2$.

(b) $\lim_{x\to 1} f(x) = 5$ and $\lim_{x\to 1^+} f(x) = 4$.

(c) $\lim_{x\to 0^-} f(x) = 3$, while $\lim_{x\to 0^+} f(x)$ does not exist.

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