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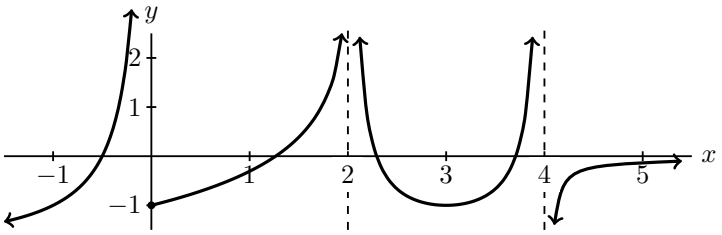
04 – Infinite Limits

Definition: Infinite Limits (Informally)

We write $\lim_{x\to a} f(x) = \infty$ if the values of $f(x)$ can be made as large as we want for all x sufficiently close to a, *but not equal to* a.

- We similarly define $\lim_{x\to a^+} f(x) = \infty$, $\lim_{x\to a^-} f(x) = \infty$, $\lim_{x\to a} f(x) = -\infty$, etc.

1. Suppose the graph of a function $h(x)$ is given below.



(a) $\lim_{x\to 0^-} h(x) =$

(b) $\lim_{x\to 0^+} h(x) =$

(c) $\lim_{x\to 0} h(x) =$

(d) $\lim_{x\to 2^-} h(x) =$

(e) $\lim_{x\to 2^+} h(x) =$

(f) $\lim_{x\to 2} h(x) =$

(g) $\lim_{x\to 4^-} h(x) =$

(h) $\lim_{x\to 4^+} h(x) =$

(i) $\lim_{x\to 4} h(x) =$

Definition: Vertical Asymptote

A vertical line $x = a$ is called a **vertical asymptote** of the curve $y = f(x)$ if at least one of the following are true: $\lim_{x\to a^+} f(x) = \pm\infty$ or $\lim_{x\to a^-} f(x) = \pm\infty$.

2. What are the vertical asymptotes of the graph of $y = h(x)$ above?

3. Compute each of the following by first sketching a graph.

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

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

4. Let $f(x) = \dfrac{2x}{x-3}$. Answer the following by plugging in x-values closer and closer to 3.

(a) $\lim_{x \to 3^-} f(x) =$

(b) $\lim_{x \to 3^+} f(x) =$

(c) $\lim_{x \to 3} f(x) =$

(d) Is the line $x = 3$ an asymptote of the graph $y = f(x)$. Why or why not?

5. Compute each of the following by first sketching a graph.

(a) $\lim_{x \to 0^+} \ln x =$

(b) $\lim_{x \to \frac{\pi}{2}} \sin x =$