Infinite Limits

Limits which occur at vertical asymptotes are called infinite limits.

Notation: $\lim_{x\to c} f(x) = \infty$ (or $-\infty$)

Ex: $f(x) = \dfrac{4}{x-3}$

Notice, looking at the graph of $f(x)$, $\lim_{x\to 3^-} f(x) = -\infty$ and $\lim_{x\to 3^+} f(x) = \infty$

**CAUTION: Saying the limit equals ∞ does NOT mean the limit exists, instead it describes *how* it does *not* exist.

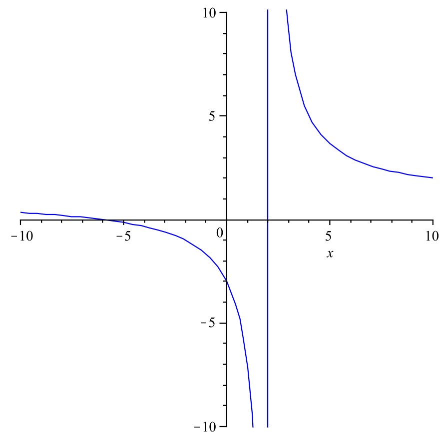
Finding Verticle Asymptotes

1. Cancel any common factors ($\leftarrow$ these are holes in $f(x)$; a hole removes only one point).

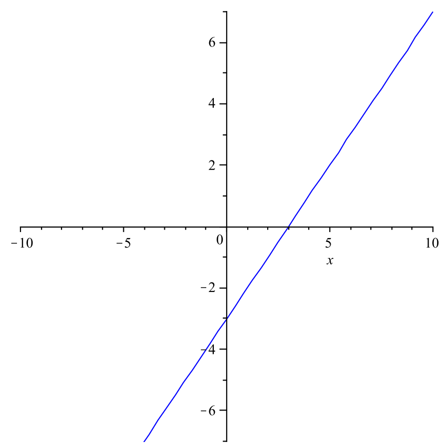
2. Set denominator equal to zero. Asymptotes usually happen because of division by zero.

Ex:

$$f(x) = \frac{x+6}{x-2}$$

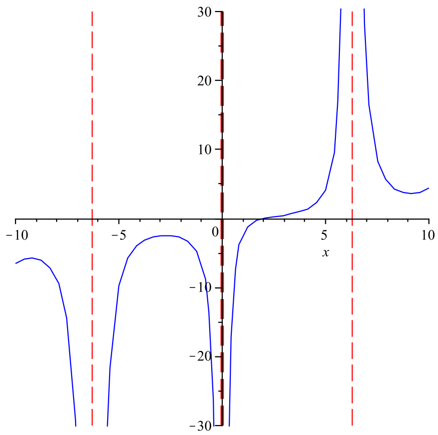


$f(x) = \dfrac{x^2 + x - 12}{x+4}$. Why do you think there is no asymptote this time?



[When you factor out the numerator, notice that the $(x+4)$'s cancel, leaving you with $f(x) = x - 3$. Therefore, we have a discontinuity at $x = -4$ which appears as a hole in the graph.]

$f(x) = \dfrac{x-2}{1-cos(x)}$. Why are there many asymptotes this time?



**If $x = c$ gives $\frac{0}{0}$ (indeterminant form) after all common factors are canceled, alternate methods are required.