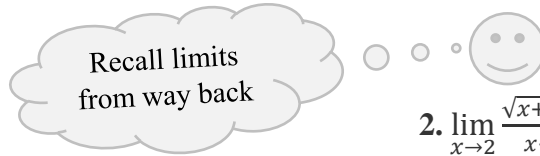


L'Hôpital's Rule

Evaluate each limit.

1. $\lim_{x \rightarrow 3} \frac{x^2 - 9}{x - 3}$



2. $\lim_{x \rightarrow 2} \frac{\sqrt{x+2} - 2}{x - 2}$

3. $\lim_{x \rightarrow \infty} \frac{x^2 - 9}{x - 3}$

4. $\lim_{x \rightarrow \infty} \frac{x - 3}{x^2 - 9}$

L'Hôpital's Rule

If $\lim_{x \rightarrow a} f(x) = 0$ and $\lim_{x \rightarrow a} g(x) = 0$

and $f(x)$ and $g(x)$ are differentiable and where $g'(a) \neq 0$,

$$\text{then } \lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \lim_{x \rightarrow a} \frac{f'(x)}{g'(x)}.$$

What does this mean?

Using L'Hôpital's Rule

Example 1:

$$\lim_{x \rightarrow 3} \frac{x^2 - 9}{x - 3}$$

Example 2:

$$\lim_{x \rightarrow 2} \frac{\sqrt{x+2} - 2}{x - 2}$$

Example 3:

$$\lim_{x \rightarrow \infty} \frac{x^2 - 9}{x - 3}$$

Example 4:

$$\lim_{x \rightarrow \infty} \frac{x - 3}{x^2 - 9}$$

More Indeterminate Forms

$$\infty \cdot 0, \infty - \infty, 1^\infty, 0^0, \infty^0$$

Example 1:

$$\lim_{x \rightarrow 0} \left(\frac{1}{x} - \cot x \right)$$

Example 2:

$$\lim_{x \rightarrow 0} (\cot x (x^2 + 5x))$$

Example 3:

$$\lim_{x \rightarrow 0^+} \sqrt{x} \ln x$$