Section 6.5 L'Hospital's Rule

When we were calculating limits, we saw methods for dealing with the following limits:

$$\lim_{x\to 4}\frac{x^2-16}{x-4} \qquad\qquad \lim_{x\to\infty}\frac{4x^2-5x}{1-3x^2}$$

substitution resulted in $\frac{0}{0}$ | substitution resulted in $\frac{\infty}{\infty}$

indeterminate forms

L'Hospital's Rule → systematic way for the evaluation of indeterminate forms

$$\lim_{x\to a}\frac{f(x)}{g(x)}=\lim_{x\to a}\frac{f'(x)}{g'(x)}$$ where $g'(x),\ f'(x)$ are differentiable and $g'(x)\neq 0$

limit of a quotient of two functions = limit of their quotient of their derivatives

Evaluate $\lim_{x\to 0}\frac{\sin x}{x}$

→

Example: Evaluate $\lim_{x\to 1}\frac{x^8-1}{x^5-1}$

Example: Evaluate $\lim_{x\to 1}\frac{5x^4-4x^2-1}{10-x-9x^3}$

Example: Evaluate $\lim_{x\to 0}\frac{x^2}{1-\cos x}$

→

Example: Evaluate $\lim_{x \to 0} \frac{\sec^2 x - 1}{3x^2}$

Example: Evaluate $\lim_{x \to 1} \frac{x^2 - x}{x^2 + 1}$

Other indeterminate Forms 0^0 1^∞ ∞^0 $\longrightarrow$ use logarithms