

Indeterminate Forms of Limits

Form	Example 1	Example 2
$\frac{0}{0}$	$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$	$\lim_{x \rightarrow 1} \frac{x^3 - 1}{x - 1} = 3$
$\frac{\infty}{\infty}$	$\lim_{x \rightarrow \infty} \frac{x^2}{1 + 3x^2} = \frac{1}{3}$	$\lim_{x \rightarrow \infty} \frac{x^3}{e^{2x}} = 0$
$\infty - \infty$	$\lim_{x \rightarrow 1^+} \left(\frac{1}{\ln x} - \frac{1}{x - 1} \right) = \frac{1}{2}$	$\lim_{x \rightarrow \frac{\pi}{2}^+} (\sec x - \tan x) = 0$
$0 \cdot \infty$	$\lim_{x \rightarrow \infty} x \sin \frac{1}{x} = 1$	$\lim_{x \rightarrow 0^+} x \ln x = 0$
0^0	$\lim_{x \rightarrow 0^+} x^x = 1$	$\lim_{x \rightarrow 0^+} (e^{-1/x})^x = e^{-1}$
1^∞	$\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x} \right)^x = e$	$\lim_{x \rightarrow 0^+} (1 + \sin x)^{\cot x} = 1$
∞^0	$\lim_{x \rightarrow \frac{\pi}{2}^-} (\tan x)^{\cos x} = 1$	$\lim_{x \rightarrow \infty} (e^x)^{1/x} = e$

The following forms are **determinate**.

$$\infty + \infty \rightarrow \infty$$

$$-\infty - \infty \rightarrow -\infty$$

$$(0^+)^{\infty} \rightarrow 0$$

$$(0^+)^{-\infty} \rightarrow \infty$$

$$\frac{0}{\infty} \rightarrow 0$$

$$\frac{\infty}{0^+} \rightarrow \infty \quad \text{and} \quad \frac{\infty}{0^-} \rightarrow -\infty$$