L'Hopital's Rule

Indeterminate Forms: $\frac{0}{0}$ $\frac{\infty}{\infty}$ $\infty - \infty$ $0 \cdot \infty$ 1^{∞} ∞^{0} 0^{0}

These are indeterminate because they don't guarantee that a limit exists, nor do they indicate what the limit is, if one does exist.

L'Hopital's Rule: Let f and g be functions that are differentiable on an open interval (a, b) containing c, except possibly at c itself. Assume $g'(x) \neq 0$ for all x in (a, b), except possibly at c itself. If the limit of $f(x)/g(x)$ as x approaches c produces the indeterminate form $\frac{0}{0}$ or $\pm\frac{\infty}{\infty}$, then

$$\lim_{x \to c} \frac{f(x)}{g(x)} = \lim_{x \to c} \frac{f'(x)}{g'(x)}$$

provided the limit on the right exists (or is infinite).

1. $\lim_{x \to 0} \frac{e^{3x} - x - 1}{x}$

2. $\lim_{x \to \infty} \frac{x}{lnx}$

3. $\lim_{x \to \infty} \frac{x^2}{e^x}$

4. $\lim_{x \to \infty} xsin\frac{1}{x}$

5. $\lim_{x \to \infty} e^{-x} \sqrt{x}$

6. $\lim_{x \to \infty} (1 + x)^{\frac{1}{x}}$

7. $\lim_{x \to 0^+} (sinx)^x$

8. $\lim_{x \to 0} (\frac{1}{sinx} - \frac{1}{x})$

9. $\lim_{x \to 0^+} \sqrt{x}\, \ln x$

10. $\lim_{x \to 0^+} x^{\frac{ln2}{(1+lnx)}}$

11. $\lim_{x \to 0} (x+1)^{\frac{ln2}{x}}$