

Lesson 4.4: L'Hospital's Rule

Some limits cannot be found using algebraic methods. If direct substitution produces one of these two indeterminate forms $\left(\frac{0}{0} \text{ or } \frac{\pm\infty}{\pm\infty}\right)$, then a rule known as _____ Rule may help you find the limit.

L'Hospital's Rule

Examples:

$$1. \lim_{x \rightarrow \infty} \frac{x}{e^x}$$

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

$$3. \lim_{x \rightarrow 0} \frac{x}{e^x}$$

$$4. \lim_{x \rightarrow 0^-} \frac{e^x}{x}$$

$$5. \lim_{x \rightarrow 0} \frac{3-3e^{3x}}{x}$$

$$6. \lim_{x \rightarrow -\infty} x^2 e^x$$

$$7. \lim_{x \rightarrow 1} \left(\frac{1}{\ln(x)} - \frac{1}{x-1} \right)$$

$$8. \lim_{x \rightarrow -1} \frac{2x^2-2}{x+1}$$

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

The following limits are not $\frac{0}{0}$ or $\frac{\pm\infty}{\pm\infty}$ forms. Identify the form and tell which are indeterminate.

Entry #: _____

10. $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$

11. $\lim_{x \rightarrow 0^+} x^x$

12. $\lim_{x \rightarrow \infty} x^{\frac{1}{x}}$

13. $\lim_{x \rightarrow 0^+} (\sin(x))^{\frac{1}{x}}$

Find the following limits.

14. $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$

15. $\lim_{x \rightarrow \infty} x^{\frac{1}{x}}$