Using L'Hôpital's Rule

Learning Objectives

- Apply L'Hôpital's Rule in the 0/0 case

- Apply L'Hôpital's Rule in the infinity/infinity case

- Determine when to apply L'Hôpital's Rule

Apply L'Hôpital's Rule in the 0/0 case

1. Find the value of $\lim\limits_{x \to 0} \frac{e^x - 1}{x^3}$ using L'Hôpital's Rule.

Apply L'Hôpital's Rule in the infinity/infinity case

2. Find the value of $\lim\limits_{x \to \infty} \frac{e^x - 1}{x^3}$ using L'Hôpital's Rule.

Determine when to apply L'Hôpital's Rule

3. For each of the limits below, determine if L'Hôpital's Rule applies.

    a. $\lim\limits_{x\to\infty} \dfrac{\ln x}{x^2}$

    b. $\lim\limits_{x\to 0} \dfrac{e^{-x}}{\ln(x+1)}$

    c. $\lim\limits_{x\to 1} \dfrac{x^2-1}{\ln x}$

    d. $\lim\limits_{x\to -\infty} \dfrac{e^x}{\ln(x^2+1)}$

    e. $\lim\limits_{x\to\infty} xe^{-x}$

- If an expression is of the form $0 \cdot \infty$, rewrite the expression so that you have $0/0$ or ∞/∞.
- If you have 1^∞, then the log of the function can be rewritten in a form where L'Hôpital's will apply, but if the limit of the logged function is L, then the limit of the original function is e^L.

ANSWER KEY

1. ∞

2. ∞

3. a. yes ∞/∞, b. no, c. yes $0/0$, d. no, e. if rewritten as $\lim\limits_{x \to \infty} \dfrac{x}{e^x}$ ∞/∞