



AP Calculus BC

Topic: L'Hôpital's Rule

Instructions

Solve the following problems. Show all your work clearly.

Practice Problems

1. Evaluate the following limits using L'Hôpital's Rule:

(i) $\lim_{x \rightarrow \infty} \frac{x}{e^x}$

(ii) $\lim_{x \rightarrow 0^+} \frac{\ln(x)}{1/x}$

(iii) $\lim_{x \rightarrow 0} \frac{\sin(x)}{x}$

2. Determine whether L'Hôpital's Rule applies and evaluate the limit if possible:

(i) $\lim_{x \rightarrow 1} \frac{x^2-1}{x-1}$

(ii) $\lim_{x \rightarrow \infty} \frac{\sqrt{x}}{x}$

(iii) $\lim_{x \rightarrow 0} \frac{e^x-1}{x}$

3. Find the horizontal asymptotes of the following functions using limits:

(i) $f(x) = \frac{2x}{x^2+1}$

(ii) $f(x) = \frac{x^2}{e^x}$

(iii) $f(x) = \frac{\ln(x)}{x}$

4. Evaluate the following indeterminate forms using L'Hôpital's Rule:

- (i) $\lim_{x \rightarrow \infty} \frac{x^3}{e^x}$
- (ii) $\lim_{x \rightarrow 0^+} x \ln(x)$
- (iii) $\lim_{x \rightarrow \infty} \frac{\ln(x)}{\sqrt{x}}$

Challenge Problem

1. Prove that $\lim_{x \rightarrow 0} \frac{e^x - 1 - x}{x^2} = \frac{1}{2}$ using L'Hôpital's Rule.

Multiple Choice Questions

1. What is $\lim_{x \rightarrow 0} \frac{\sin(2x)}{x}$?
 - a. 0
 - b. 2
 - c. 1
 - d. Does not exist
2. Evaluate $\lim_{x \rightarrow \infty} \frac{\ln(x)}{x}$:
 - a. 0
 - b. 1
 - c. ∞
 - d. Does not exist
3. If $f(x) = \frac{e^x}{x}$, find $\lim_{x \rightarrow \infty} f(x)$:
 - a. 0
 - b. 1
 - c. ∞
 - d. Does not exist
4. What is $\lim_{x \rightarrow 0} \frac{\ln(1+x)}{x}$?
 - a. 1
 - b. 0
 - c. ∞
 - d. Does not exist

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