1-8 Videos Guide

1-8a

- l'Hôspital's Rule for indeterminant forms
  - Suppose that f and g are differentiable and $g'(x) \neq 0$ on an open interval I that contains a (except possibly at a). Suppose that

    $\lim_{x \to a} f(x) = 0$ and $\lim_{x \to a} = g(x) = 0$

    or that $\lim_{x \to a} f(x) = \pm\infty$ and $\lim_{x \to a} = g(x) = \pm\infty$

    Then $\lim_{x \to a} \frac{f(x)}{g(x)} = \lim_{x \to a} \frac{f'(x)}{g'(x)}$ if the limit on the right-hand side exists or is ∞ or $-\infty$

- Indeterminant forms
  - $\frac{0}{0}$, $\frac{\infty}{\infty}$, $0 \cdot \infty$, $\infty - \infty$, 0^0, ∞^0, and 1^∞

Exercises:

Find the limit. Use l'Hôspital's Rule where appropriate. If there is a more elementary method, consider using it. If l'Hôspital's Rule doesn't apply, explain why.

1-8b

- $\lim_{x \to 0} \frac{x^2}{1 - \cos x}$
- $\lim_{\theta \to \pi} \frac{1 + \cos \theta}{1 - \cos \theta}$
- $\lim_{x \to \infty} \frac{\ln \sqrt{x}}{x^2}$
- $\lim_{x \to 0} \frac{\sinh x - x}{x^3}$

1-8c

- $\lim_{t \to 0} \frac{8^t - 5^t}{t}$
- $\lim_{x \to a^+} \frac{\cos x \ln(x - a)}{\ln(e^x - e^a)}$

1-8d

- $\lim_{x \to -\infty} x \ln\left(1 - \frac{1}{x}\right)$
- $\lim_{x \to 1^+} [\ln(x^7 - 1) - \ln(x^5 - 1)]$

1-8e

- $\lim_{x \to 0^+} (\tan 2x)^x$

1-8f

- $\lim_{x \to \infty} \left(1 + \frac{a}{x}\right)^{bx}$

1-8g

Proof:

- l'Hôspital's Rule