Objectives:

- Practice deciding when to use l'Hospital's rule.

- Use l'Hospital's rule together with logarithmic differentiation to find limits that have exponential indeterminate forms.

List of Indeterminate Forms:

Remember: We can only use l'Hospital's rule to find $\lim\limits_{x \to \infty} f(x)$ if this limit has

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Even if the limit has this form, l'Hospital's rule may not be the only way to find the limit.

If the limit does not have form $\frac{0}{0}$ or $\frac{\infty}{\infty}$, we can try to rewrite the function so it does have one of these forms and then apply l'Hospital's rule.

Examples:

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

2. $\lim\limits_{x \to \infty} \left(1 + \frac{1}{x}\right)^x$

Practice with l'Hôpital's Rule: For each limit:

(a) Write the form of the limit AND state whether the form is indeterminate.

(b) Find the limit or show that the limit does not exist.
    If you use l'Hôpital's rule, state why you can use the rule.

1. $\lim\limits_{x \to 0} \dfrac{(\sin(x))^2}{x}$

2. $\lim\limits_{x \to \frac{\pi}{2}} \dfrac{\sin(x) - 1}{x}$

3. $\lim\limits_{x \to 0} \dfrac{2^x - 1}{x}$

4. $\lim\limits_{x \to \infty} \dfrac{x^2}{e^x}$

5. $\lim\limits_{x \to 0^+} \sqrt{x}\ln(x)$

6. $\lim\limits_{x \to \infty} \left(1 + \dfrac{2}{x}\right)^{3x}$

7. $\lim\limits_{x \to 0^+} x^{\sin(x)}$

8. $\lim\limits_{x \to \infty} \dfrac{\ln(x)}{\sqrt[3]{x}}$