

This Worksheet will be collected at the end of your recitation section on **Thursday, November 3rd**.

4.8. L'Hôpital's Rule

1. Compute the following limits using L'Hospital's rule:

a) $\lim_{x \rightarrow \infty} \frac{e^x}{x^3}$ (*Hint: use L'Hospital's rule 3 times*)

b) $\lim_{x \rightarrow \infty} \frac{e^x}{x^n}$ for any integer $n > 0$ (*Hint: use L'Hospital's rule n times*)

2. The following are examples of limits in **indeterminant form of type $0 \cdot \infty$** . Compute each limits by rewriting it to obtain one the indeterminant forms $0/0$ or $\pm\infty/\infty$, then apply L'Hospital's rule.

a) $\lim_{x \rightarrow -\infty} x e^x$

b) $\lim_{x \rightarrow 0^+} x \ln(x)$

3. The following are examples of limits in **indeterminant form of type** $\infty - \infty$. Compute each limits by rewriting it to obtain one the indeterminant forms $0/0$ or $\pm\infty/\infty$, then apply L'Hospital's rule.

a) $\lim_{x \rightarrow 0} \left(\frac{1}{x} - \frac{1}{\ln(x+1)} \right)$

b) $\lim_{x \rightarrow \infty} \sqrt{x^2 + 1} - x$ (*Hint: multiply by a fraction in order to use difference of squares*)

4. The following are examples of limits in **indeterminant form of type 0^0 , ∞^0 or 1^∞** (we call these **indeterminant powers**). Compute each limits by applying the natural log, and reducing to one of the previous cases in order to apply L'Hospital's rule.

a) $\lim_{x \rightarrow 0} x^x$

b) $\lim_{x \rightarrow 0^+} (1 + \sin(4x))^{\cot(x)}$

4.7. Applied Optimization

5. A hemisphere of radius 1 cm sits on a horizontal plane. An inscribed cylinder stands with its axis vertical, the center of its base at the center of the sphere, and its top circular rim touching the hemisphere. Find the radius and height of the cylinder of maximum volume.

6. A bicyclist leaves from a point heading north at 3 o'clock going 15 mph. A motorcyclist traveling at 60 mph arrives at that spot at 5 o'clock from the east. At what time were the two cyclists closest?

Questionnaire:

Below are a few questions which are completely optional, and are meant to benefit you. Please only fill out what you feel comfortable with.

1. Is there anyone in class that you'd like to be grouped with next week?

2. Did you feel you worked well with your group this week?

3. Any other comments?

Grading Rubric:

Attendance: /20

Participation: /20

Completeness: /60