4.5 L'Hopital's Rule
Fri Oct 28

- Do Now
- Differentiate the numerator and denominator of each fraction separately
- 1) $\dfrac{x^2-4}{x-2}$
- 2) $\dfrac{1-\sin x}{\cos x}$

Quiz Review

- Retakes?

Indeterminate forms

- An indeterminate form is a value that we are unable to evaluate. Each indeterminate form type is defined by the expression that can't be evaluated
- Examples of indeterminate forms:

$$\frac{0}{0} \quad \frac{\infty}{\infty} \quad 0 \cdot \infty \quad \infty \pm \infty \quad 0^0 \quad \infty^0$$

L'Hopital's Rule

- We can use L'Hopital's Rule to solve difficult limits that are indeterminate forms
- Thm-

$$\lim_{x \to c} \frac{f(x)}{g(x)} = \lim_{x \to c} \frac{f'(x)}{g'(x)}$$

- We can take the derivative of the numerator and denominator separately, and it will not affect the limit.

Ex 1.5

- Evaluate $\lim_{x \to 0} \frac{\sin x}{x}$

Ex 1.6

- Evaluate $\lim_{x \to 0} \frac{1 - \cos x}{x^2}$

Ex 1.7

- You can only use L'Hopital's Rule if the limit has an indeterminate form!

$$\lim_{x \to 0} \frac{x^2}{e^x - 1}$$

Some proofs

- F(x) = e^x grows faster than any polynomial

You try

- Evaluate the limits using L'Hopital's Rule
- 1) $\lim_{x \to 0} \frac{\sin x}{2x}$
- 2) $\lim_{x \to 0} \frac{e^x}{x^2}$
- 3) $\lim_{x \to 2} \frac{x-2}{x^2-4}$

Closure:

- Journal Entry: What is L'Hopital's Rule? Can we use it for every limit? Why/whynot?

- HW: p.246 #1 7 17 25 31 41 49 56 59 61 65 70 74