# 4.5 L'Hopital's Rule Fri Oct 28

- Do Now
- Differentiate the numerator and denominator of each fraction separately

• 1) 
$$\frac{x^2 - 4}{x - 2}$$
  
• 2)  $\frac{1 - \sin x}{\cos x}$ 

### **Quiz Review**

• Retakes?

### Indeterminate forms

- An <u>indeterminate form</u> 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:

$$\frac{0}{0} \frac{\infty}{\infty} 0 \cdot \infty \infty \pm \infty \quad 0_{c} \quad \infty_{0}$$

### L'Hopital's Rule

- We can use L'Hopital's Rule to solve difficult limits that are indeterminate forms
- <u>Thm-</u>  $\lim_{x \to c} \frac{f(x)}{g(x)} = \lim_{x \to c} \frac{f'(x)}{g'(x)}$
- We can take the derivative of the numerator and denominator separately, and it will not affect the limit.

# • Evaluate $\lim_{x \to 0} \frac{\sin x}{x}$



# 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<sup>x</sup> 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