Calculus

Write your questions and thoughts here!

11.1 L'Hôpital's Rule

Name:____________________________

Notes

Recall: Special Trig Limits $\lim_{x\to0}\frac{\sin x}{x}=1$ and $\lim_{x\to0}\frac{1-\cos x}{x}=0$

Recall: When evaluating limits, first try direct substitution! $\lim_{x\to3}\frac{2x-5}{x}=\frac{2(3)-5}{3}=\frac{6-5}{3}=\frac{1}{3}$

Example 1: $\lim_{x\to2}\frac{x^2-7x+10}{x-2}=\frac{(2)^2-7(2)+10}{(2)-2}=\frac{4-14+10}{0}=\frac{0}{0}$

$=\lim_{x\to2}\frac{(x-2)(x-5)}{x-2}=\lim_{x\to2}(x-5)=(2)-5=-3$

L'Hôpital's Rule:

Suppose $f(a)=0$ and $g(a)=0$ and $\lim_{x\to0}\frac{f(x)}{g(x)}=\frac{0}{0}$ or $\frac{\pm\infty}{\pm\infty}$. L'Hopital's Rule allows you to apply the following:

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

Evaluate each limit. Use L'Hôpital's when possible.

2. $\lim_{x\to2}\frac{x-2}{3x^3-6x^2+x-2}=\frac{0}{0}$

$=\lim_{x\to2}\frac{1}{9x^2-12x+1}$

$=\frac{1}{9(2)^2-12(2)+1}$

$=\frac{1}{9(4)-24+1}$

$=\frac{1}{36-23}$

$=\frac{1}{13}$

3. $\lim_{x\to0}\frac{\sin(6x)}{x}=\frac{0}{0}$

$=\lim_{x\to0}6\cos(6x)$

$=6\cos[6(\ )]$

$=6\cos(0)$

$=6\cdot1$

$=6$

4. $\lim_{x\to0}\frac{1-\cos(x)}{x^2}=\frac{1-1}{0}=\frac{0}{0}$

$=\lim_{x\to0}\frac{0-(-\sin(x))}{2x}$

$=\lim_{x\to0}\frac{\sin(x)}{2x}=\frac{0}{0}$

$=\lim_{x\to0}\frac{\cos(x)}{2}$

$=\frac{\cos(0)}{2}$

$=\frac{1}{2}$

L'HÔPITAL'S IS NOT THE QUOTIENT RULE!!

5. $\frac{d}{dx}\frac{\sin(6x)}{x}=\frac{[\sin(6x)]'\cdot x-\sin(6x)\cdot x'}{x^2}$

$=\frac{6\cdot\cos(6x)\cdot x-\sin(6x)\cdot1}{x^2}$

$=\frac{6x\cos(6x)-\sin(6x)}{x^2}$

Now summarize what you learned!