Section 8.2:

L'Hopital's Rule

When working with limits and evaluauating them, there are 6 expressions which are considered to have an indeterminate form (that is - we cannot assign a value to the expression without further investigation.)

They are: $\frac{0}{0}$ $\frac{\infty}{\infty}$ $0 \bullet \infty$ 1^{∞} $\infty - \infty$ ∞^{0} 0^{∞}

So far, you have had to use graphs/tables to decide what the limit is because we have not had the skills (or I have not taught you the skills) to work them out algebraically. Now that you can find a derivative, however, we can use L'Hopital's Rule!!!

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

Let's try some!

$$\lim_{x\to 2}\left(\frac{3x^2-7x+2}{x-2}\right)$$

$$\lim_{x\to -3}\left(\frac{x+3}{\sqrt{x^2-5}-2}\right)$$

$$\lim_{x\to -2}\left(\frac{x^3+x^2-8x-12}{x^3+8x^2+20x+16}\right)$$

How about some e's, ln's and trig???

$$\lim_{x\to 1}\left(\frac{\ln x - x + 1}{x^4 - x}\right)$$

$$\lim_{x\to 0}\left(\frac{e^x + x - 1}{1 - e^{-x}}\right)$$

$$\lim_{x\to 0}\left(\frac{x^2\sin x + \cos x - 1}{x}\right)$$

L'Hopital's Rule for $\pm\frac{\infty}{\infty}$

$$\lim_{x\to\infty}\frac{3x^2-1}{2x^2+1}$$

$$\lim_{x\to\infty}\frac{4x^2-5x+2}{e^{5x}+\ln x}$$

L'Hopital's Rule in the form $\infty - \infty$

$$\lim_{x \to \frac{\pi}{2}} \left[\sec x - \tan x \right]$$

$$\lim_{x \to 0} \left[\frac{1}{e^x - 1} - \frac{1}{x} \right]$$

L'Hopital's Rule in the form 1^∞ 0^∞ ∞^0

$$\lim_{x\to\infty} x^{1/x}$$

$$\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^x$$