L'Hospital's Rule **AP Calculus AB April 17, 2020**

When the ratio of two functions tends to $\frac{0}{0}$ or $\frac{\infty}{\infty}$ in the limits, such forms are said to be indeterminant. There are other indeterminant forms such as $\infty - \infty$ which you were learn how to handle in subsequent math courses.

If functions f and g are differentiable on an open interval I, except for perhaps at $x = a$, and if $\lim_{x\to a} f(x) = 0 = \lim_{x\to a} g(x)$, then $\lim_{x\to a} \frac{f(x)}{g(x)} = \lim_{x\to a} \frac{f'(x)}{g'(x)}$. If necessary, rinse and repeat.

The same holds true for limits whose numerator and denominator both approach $\pm$infinity as x approaches a.

Evaluate the limits. Use L'Hospital's Rule only if it applies.

1. $\lim_{x\to 0} \frac{\sin(2x)}{\sin(5x)}$	2. $\lim_{x\to 0} \frac{\sqrt{x+1}-1-x/2}{5x^2}$
3. $\lim_{x\to \infty} \frac{\ln x}{4\sqrt{x}}$	4. Note: $f(1) = 1,\ f'(1) = 2$ and $f''(1) = 3$ $\lim_{x\to 1} \frac{10^x - 3f'(x)}{f(x) - \arctan x}$