## Indeterminate Forms

- Given two functions f and g.
- Let a be a point where the limits of these functions at a are 0 or $\pm\infty$
- The limits of algebraic combinations of these functions at a may or may not exist and are called indeterminate forms.

<u>Indeterminate Quotients</u>

- If $\lim_{x\to a} f(x)=0$ and $\lim_{x\to a} g(x)=0$, then $\lim_{x\to a}\frac{f(x)}{g(x)}$ is of type $\frac{0}{0}$
- If $\lim_{x\to a} f(x)=\pm\infty$ and $\lim_{x\to a} g(x)=\pm\infty$, then $\lim_{x\to a}\frac{f(x)}{g(x)}$ is of type $\frac{\infty}{\infty}$

<u>Indeterminate Products:</u>

- If $\lim_{x\to a} f(x)=0$ and $\lim_{x\to a} g(x)=\pm\infty$, then $\lim_{x\to a}[f(x).g(x)]$ is of type $0\cdot\infty$

<u>Indeterminate Differences:</u>

- If $\lim_{x\to a} f(x)=\lim_{x\to a} g(x)=\pm\infty$, then $\lim_{x\to a}[f(x)-g(x)]$ is of type $\infty-\infty$

<u>Indeterminate Powers:</u>

- If $\lim_{x\to a} f(x)=0$ and $\lim_{x\to a} g(x)=0$, then $\lim_{x\to a}[f(x)]^{g(x)}$ is of type $0^0$
- If $\lim_{x\to a} f(x)=\pm\infty$ and $\lim_{x\to a} g(x)=0$, then $\lim_{x\to a}[f(x)]^{g(x)}$ is of type $\infty^0$
- If $\lim_{x\to a} f(x)=1$ and $\lim_{x\to a} g(x)=\pm\infty$, then $\lim_{x\to a}[f(x)]^{g(x)}$ is of type $1^\infty$

## L'Hospital's Rule

Let f and g be differentiable functions, and $g'(x)\neq 0$ near a (except possibly at a)

Suppose that: $\lim_{x\to a}\frac{f(x)}{g(x)}$ is of indeterminate form $\frac{0}{0}$ or $\frac{\infty}{\infty}$

Then if $\lim_{x\to a}\frac{f'(x)}{g'(x)}$ exists or is $\pm\infty$, $\lim_{x\to a}\frac{f(x)}{g(x)} = \lim_{x\to a}\frac{f'(x)}{g'(x)}$