Calculus Reference Sheet D: Introducing Limits

Limits			
Definition		$\lim_{x \to c} f(x) = L$	
Existence		$\lim_{x \to c} f(x) = L \Leftrightarrow \lim_{x \to c^-} f(x) = \lim_{x \to c^+} f(x)$	
Rules			
Constant		$\lim_{x \to c}[k \times f(x)] = k \times \lim_{x \to c} f(x)$	
Sum	$\lim_{x \to c}[f(x) + g(x)] = \lim_{x \to c} f(x) + \lim_{x \to c} g(x)$	Difference	$\lim_{x \to c}[f(x) - g(x)] = \lim_{x \to c} f(x) - \lim_{x \to c} g(x)$
Product	$\lim_{x \to c}[f(x) \times g(x)] = \lim_{x \to c} f(x) \times \lim_{x \to c} g(x)$	Quotient	$\lim_{x \to c}[f(x) \div g(x)] = \frac{\lim_{x \to c} f(x)}{\lim_{x \to c} g(x)}$, $\lim_{x \to c} g(x) \neq 0$
Power	$\lim_{x \to c}[f(x)^n] = [\lim_{x \to c} f(x)]^n$		
Radical		$\lim_{x \to c} \sqrt[n]{f(x)} = \sqrt[n]{\lim_{x \to c} f(x)}$	
Continuity			
At a point		$f(c) \neq DNE$, $\lim_{x \to c} f(x) = L \Leftrightarrow \lim_{x \to c^-} f(x) = \lim_{x \to c^+} f(x)$, $\lim_{x \to c} f(x) = f(c)$	
Derivatives			
Definition		$\frac{d}{dx}[f(x)] = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$	
Alternative definition		$\frac{d}{dx}[f(x)] = \lim_{x \to c} \frac{f(x) - f(c)}{x - c}$	
Rules			
Constant	$\frac{d}{dx}[c] = 0$	Single variable function	$\frac{d}{dx}[ax] = a$
Sum and difference	$\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$	Power	$\frac{d}{dx}[x^n] = n \times x^{n-1}$ $\frac{d}{dx}[g(x)^n] = n(g(x))^{n-1} \times g'(x)$
Product	$\frac{d}{dx}[f(x) \times g(x)] = f(x) \times g'(x) + g(x) \times f'(x)$	Quotient	$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$, $g(x) \neq 0$
Trigonometry			
Reciprocal identities	$\cot x = \frac{1}{\tan x} = \frac{\cos x}{\sin x}$	Pythagorean identities	$cos^2\theta + sin^2\theta = 1$ $1 + tan^2 x = sec^2 x$ $1 + cot^2 x = csc^2 x$