C12 - 1.0 - Limits Properties Review

Limit: *What y is approaching**.

$\lim_{x\to a^-} f(x)$ Left hand limit (LHL)
$\lim_{x\to a^+} f(x)$ Right hand limit (RHL)

Limit Exists if and only if:

$$LHL = RHL$$
$$\lim_{x\to a^-} f(x) = \lim_{x\to a^+} f(x)$$
$$\lim_{x\to a} f(x) = Exists$$

Limit Does Not Exists if :

$$LHL \neq RHL$$
$$\lim_{x\to a^+} f(x) \neq \lim_{x\to a^-} f(x)$$
$$\lim_{x\to a} f(x) = Does\ not\ Exists$$

Continuous : *Limit exists and equals the value of the function. Obviously*!

$\lim_{x\to a^+} f(x) = \lim_{x\to a^-} f(x) = f(a)$ OR $\lim_{x\to a} f(x) = f(a)$

Differentiable :
LH Derivative equals RH Derivative

Given

$\lim_{x\to c} f(x) = L$ *The Limit of* $f(x)$, *as x approaches c, equals L*

$\lim_{x\to c} g(x) = M$ *The Limit of* $g(x)$, *as x approaches c, equals M*

Examples

$\lim_{x\to 2} 3x = 6$

$\lim_{x\to 2} x^2 = 4$

Sum Rule	$\lim_{x\to c} \big(f(x) + g(x)\big) = L + M$	$\lim_{x\to 2} 3x + x^2 = 6 + 4 = 10$
Difference Rule	$\lim_{x\to c} \big(f(x) - g(x)\big) = L - M$	$\lim_{x\to 2} 3x + x^2 = 6 - 4 = 2$
Constant Rule	$\lim_{x\to c} \big(k \times g(x)\big) = k \times M$	$\lim_{x\to 2} 5x^2 = 5 \times 4 = 20$
Product Rule	$\lim_{x\to c} \big(f(x) \times g(x)\big) = L \times M$	$\lim_{x\to 2} 3x \times x^2 = 6 \times 4 = 24$
Quotient Rule	$\lim_{x\to c} \frac{f(x)}{g(x)} = \frac{L}{M}$	$\lim_{x\to 2} \frac{3x}{x^2} = \frac{6}{4}$
Power Rule	$\lim_{x\to c} \big(f(x)\big)^{\frac{m}{n}} = L^{\frac{m}{n}}$	$\lim_{x\to 2} (3x)^{\frac{1}{2}} = 6^{\frac{1}{2}}$

Separate Limits

$\lim_{x\to c} f(x) + g(x) =$

$\lim_{x\to c} f(x) + \lim_{x\to c} g(x)$