m^2 = *math minute*

Calculus: *Limit Laws*

Special Limits

$$\lim_{x\to a} c = c \qquad\qquad \lim_{x\to a} x = a$$

Common Limit Laws

1 Sum/Difference Law

$$\lim_{x\to a} f(x) \pm g(x) = \lim_{x\to a} f(x) \pm \lim_{x\to a} g(x) \qquad \lim_{x\to a} 3x^2 + 2x = \lim_{x\to a} 3x^2 + \lim_{x\to a} 2x$$

2 Constant Law: c is a constant

$$\lim_{x\to a} c * f(x) = c * \lim_{x\to a} f(x) \qquad \lim_{x\to a} 3x^2 = 3 * \lim_{x\to a} x^2$$

3 Product Law

$$\lim_{x\to a} f(x) * g(x) = \lim_{x\to a} f(x) * \lim_{x\to a} g(x) \qquad \lim_{x\to a} x\sin(x) = \lim_{x\to a} x * \lim_{x\to a} \sin(x)$$

4 Quotient Law

$$\lim_{x\to a} \frac{f(x)}{g(x)} = \frac{\lim_{x\to a}(x)}{\lim_{x\to a}(x)} \qquad \lim_{x\to a} \frac{x^2+1}{x-1} = \frac{\lim_{x\to a} x^2+1}{\lim_{x\to a} x-1}$$

5 Exponent Law: n is a positive integer

$$\lim_{x\to a} [f(x)]^n = [\lim_{x\to a}(x)]^n \qquad \lim_{x\to a} x^2 = [\lim_{x\to a} x]^2$$

Direct Substitution Property

If $f(x)$ is a polynomial or rational function and a is in the domain of $f(x)$ then,

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

Example: $\lim_{x\to 2} 3x^2 + 2x$

$$\overset{(1)}{=} \lim_{x\to 2} 3x^2 + \lim_{x\to 2} 2x \overset{(2)}{=} 3\lim_{x\to 2} x^2 + 2\lim_{x\to 2} x \overset{(5)}{=} 3[\lim_{x\to 2} x]^2 + 2\lim_{x\to 2} x \overset{(DS)}{=} 3[2]^2 + 2[2] = 16$$