

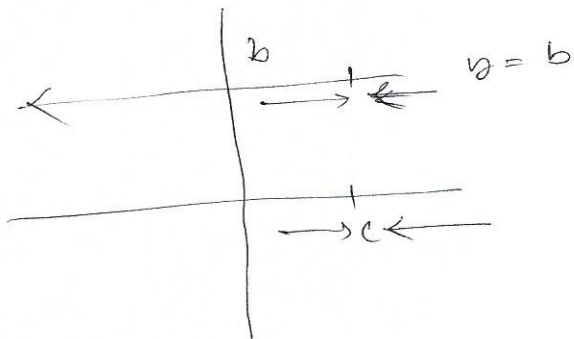
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$\lim_{x \rightarrow c} f(x)$ \longrightarrow y-coordinate

the limit of f as x approaches c is close to c
 \hookrightarrow the value of f approaches
 "get to close to"

12.2 Algebraic of limits.

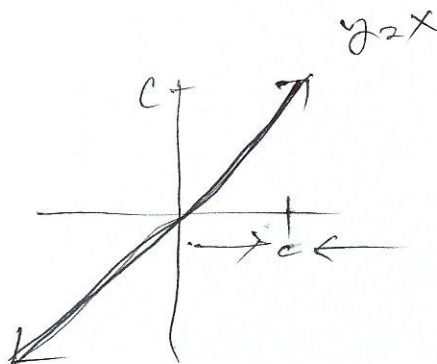
limit of a constant $f(x) = b$ $y = b$



$$\lim_{x \rightarrow c} f(x) = b$$

$$\lim_{x \rightarrow c} b = b$$

limit of x



$$\lim_{x \rightarrow c} f(x) = \lim_{x \rightarrow c} x = c$$

Addition f, g to have limits that exist as $x \rightarrow c$

$$\lim_{x \rightarrow c} [f(x) + g(x)] = \lim_{x \rightarrow c} f(x) + \lim_{x \rightarrow c} g(x)$$

$$\lim_{x \rightarrow c} [f(x) - g(x)] = \lim_{x \rightarrow c} f(x) - \lim_{x \rightarrow c} g(x)$$

$$\lim_{x \rightarrow c} [f(x) g(x)] = \left[\lim_{x \rightarrow c} f(x) \right] \left[\lim_{x \rightarrow c} g(x) \right]$$

ex $\lim_{x \rightarrow -3} (x+4)$

$$\lim_{x \rightarrow -3} x + \lim_{x \rightarrow -3} 4$$

$$-3 + 4$$

$$+1$$

ex $\lim_{x \rightarrow -5} (-4x)$

$$\left(\lim_{x \rightarrow -5} -4 \right) \left(\lim_{x \rightarrow -5} x \right)$$

$$(-4)(-5)$$

$$20$$

Monomial

if $n \geq 1$ is a positive integer

"a" is a constant

$$\lim_{x \rightarrow c} (ax^n) = ac^n$$

$$\underbrace{\left(\lim_{x \rightarrow c} a \right) \left(\lim_{x \rightarrow c} x \right) \left(\lim_{x \rightarrow c} x \right) \dots \left(\lim_{x \rightarrow c} x \right)}_{n \text{ times}}$$

$$\underbrace{a \cdot c \cdot \dots \cdot c}_{n \text{ times}}$$

12.2 Algebra of Limits

$$\lim_{x \rightarrow c} P(x) = P(c)$$

where P is a polynomial

Ex: $\lim_{x \rightarrow 2} 5x^4 - 6x^3 + 3x^2 + 4x - 2$

$$= 5(2)^4 - 6(2)^3 + 3(2)^2 + 4(2) - 2$$

$$= 100 - 50$$

$$= 50.$$

Limit of Quotient

$$\frac{f(x)}{g(x)} = \frac{\lim_{x \rightarrow c} f(x)}{\lim_{x \rightarrow c} g(x)}$$

ex: $\lim_{x \rightarrow 1} \frac{5x^3 - x + 2}{3x + 4}$

$$= \frac{\lim_{x \rightarrow 1} 5x^3 - x + 2}{\lim_{x \rightarrow 1} 3x + 4}$$

$$= \frac{5 \cdot 1^3 - 1 + 2}{7} = \frac{6}{7}$$

$$\lim_{x \rightarrow 3} \frac{x^2 - x - 6}{x^2 - 9}$$

$$\lim_{x \rightarrow 3} \frac{(x-3)(x+2)}{(x-3)(x+3)}$$

$$= \lim_{x \rightarrow 3} \frac{(x+2)}{(x+3)}$$

$$= \frac{5}{6}$$

→ x approaches to 3 but is not equal to 3.

→ x approaches to 0 but is not equal to 0.

$$\text{ex } \lim_{x \rightarrow 0} \frac{5x - \sin x}{x}$$

$$= \lim_{x \rightarrow 0} \frac{5x}{x} - \lim_{x \rightarrow 0} \frac{\sin x}{x}$$

$$= \lim_{x \rightarrow 0} 5 - 1$$

$$= 5 - 1$$

$$= 4$$

$$\text{ex } \lim_{x \rightarrow 2} \frac{x^5 - 2x^2 + 4x - 8}{x^4 - 2x^3 + x - 2}$$

$$\lim_{x \rightarrow 2} \frac{x^2(x-2) + 4(x-2)}{x^3(x-2) + 1(x-2)}$$

$$\lim_{x \rightarrow 2} \frac{(x^2+4)(x-2)}{(x^3+1)(x-2)}$$

$$= \frac{2^2+4}{2^3+1}$$

$$= \frac{8}{9}$$

