ABSOLUTE VALUES

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -(x) & \text{if } x < 0 \end{cases}$$

Ex

$$|x+4| = \begin{cases} x+4 & \text{if } x+4 \geq 0 \\ -(x+4) & \text{if } x+4 < 0 \end{cases}$$

FACTORING SPECIAL POLYNOMIALS

$$A^2 - B^2 = (A+B)(A-B)$$

$$A^3 - B^3 = (A-B)(A^2+AB+B^2)$$

$$A^3 + B^3 = (A+B)(A^2-AB+B^2)$$

$$\lim_{x\to 0} \frac{\sin x}{x} = 1 \qquad \lim_{x\to 0} \frac{x}{\sin x} = 1$$

$\lim_{x\to a} f(x) = L$ if and only if $\lim_{x\to a^-} f(x) = L = \lim_{x\to a^+} f(x)$

Limits $= \infty$

$\lim_{x\to a^+} f(x) = \infty$ when $\lim_{x\to a^+} \frac{1}{f(x)} = 0$ and $f(x) > 0$ when $x > a$

$\lim_{x\to a^+} f(x) = -\infty$ when $\lim_{x\to a^+} \frac{1}{f(x)} = 0$ and $f(x) < 0$ when $x > a$

Limits at ∞

$$\lim_{x\to\infty} f(x) = \lim_{x\to 0^+} f\left(\tfrac{1}{x}\right)$$

DIVIDE EACH TERM BY THE HIGHEST POWER OF X

LIMIT LAWS FOR USE IN PROOFS

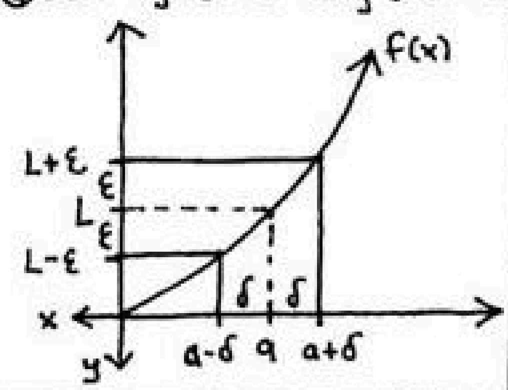
1. $\lim_{x\to a} [f(x)+g(x)] = \lim_{x\to a} f(x) + \lim_{x\to a} g(x)$
2. $\lim_{x\to a} [f(x)-g(x)] = \lim_{x\to a} f(x) - \lim_{x\to a} g(x)$
3. $\lim_{x\to a} [c f(x)] = c \lim_{x\to a} f(x)$
4. $\lim_{x\to a} [f(x)g(x)] = \lim_{x\to a} f(x) \cdot \lim_{x\to a} g(x)$
5. $\lim_{x\to a} \frac{f(x)}{g(x)} = \frac{\lim_{x\to a} f(x)}{\lim_{x\to a} g(x)}$ if $\lim_{x\to a} g(x) \neq 0$

$\varepsilon - \delta$ Notation

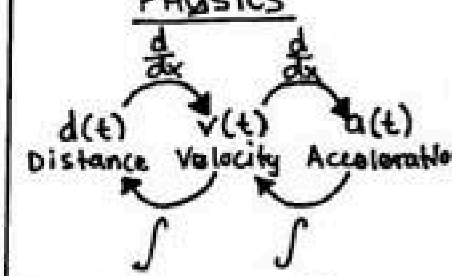
$\lim_{x\to a} f(x) = L$ for any $\varepsilon > 0$ we can find $\delta > 0$ such that whenever

$0 < |x-a| < \delta$ then $|f(x) - L| < \varepsilon$

* Solving for δ any δ smaller than δ_{max} will work



PHYSICS



Ex $d'(t) = v(t) = \int a(t)$

DERIVATIVE BY DEFINITION

$$\lim_{h\to 0} \frac{f(x+h) - f(x)}{h} = f'(x) = \frac{\Delta f(x)}{\Delta x} = \frac{d}{dx} f(x)$$

$$\lim_{x\to a} \frac{f(x) - f(a)}{x-a}$$

* use the first one most

Slope of a line through two points $(x_1,y_1),(x_2,y_2)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Slope-Intercept Form

$y = mx + b$

Point-slope equation of a line through point (a,b) with slope m

$y = m(x-a) + b$ or

$y - b = m(x-a)$

DERIVATION RULES

POWER RULE

$$\frac{d}{dx} x^n = n(x^{n-1})$$

CONSTANT MULTIPLE RULE

$$\frac{d}{dx} K f(x) = K \frac{d}{dx} f(x)$$

SUM RULE

$$\frac{d}{dx}[f(x)+g(x)] = \frac{d}{dx} f(x) + \frac{d}{dx} g(x)$$

CONSTANT

$$\frac{d}{dx} C = 0$$

PRODUCT RULE

$$\frac{d}{dx} f(x)\cdot g(x) = f'(x)g(x) + f(x)g'(x)$$

QUOTIENT RULE

$$\frac{d}{dx} \frac{f(x)}{g(x)} = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

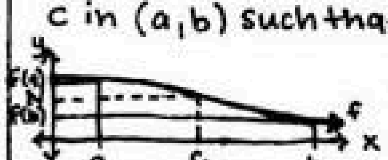
CHAIN RULE

$$\frac{d}{dx} f(g(x)) = f'(g(x)) \cdot g'(x)$$

INTERMEDIATE VALUE THEOREM

Suppose that f is continuous on the closed interval $[a,b]$ and let N be any number strictly between $f(a)$ and $f(b)$.

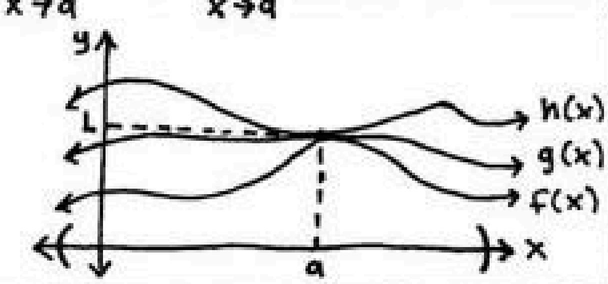
Then there exists a number c in (a,b) such that $f(c) = N$.



SQUEEZE THEOREM

If $f(x) \leq g(x) \leq h(x)$ for all x in an open interval that contains a (except possibly at a) and

$\lim_{x\to a} f(x) = \lim_{x\to a} h(x) = L$ Then $\lim_{x\to a} g(x) = L$



QUADRATIC FORMULA

If $ax^2 + bx + c = 0$ Then

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$