ABSOLUTE VALUES

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

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

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 ∞

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

Divide each term by the highest power of x

LIMIT LAWS [illegible]

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 $\lim_{x\to a} [f(x) g(x)] = \lim_{x\to a} f(x) \cdot \lim_{x\to a} g(x)$

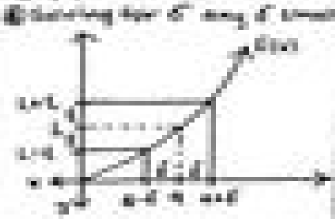
⑤ $\lim_{x\to a} \frac{f(x)}{g(x)} = \frac{\lim_{x\to a} f(x)}{\lim_{x\to a} g(x)}$ if $\lim_{x\to a} g(x) \neq 0$

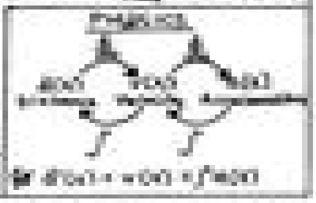
$\varepsilon - \delta$ Notation

$\lim_{x\to a} f(x) = L$ for any $\varepsilon > 0$ we can find $\delta > 0$ [illegible]

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

[illegible]





DERIVATIVE BY DEFINITION

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

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

[illegible]

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

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

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

CHAIN RULE: $\frac{d}{dx} f(g(x)) = f'(g(x)) g'(x)$

INTERMEDIATE VALUE THEOREM

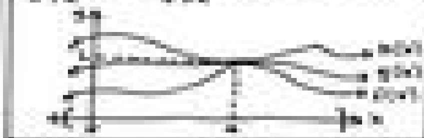
Suppose that f is continuous on the closed interval $[a, b]$ and let N be any number strictly between $f(a)$ and $f(b)$.

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 which 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

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