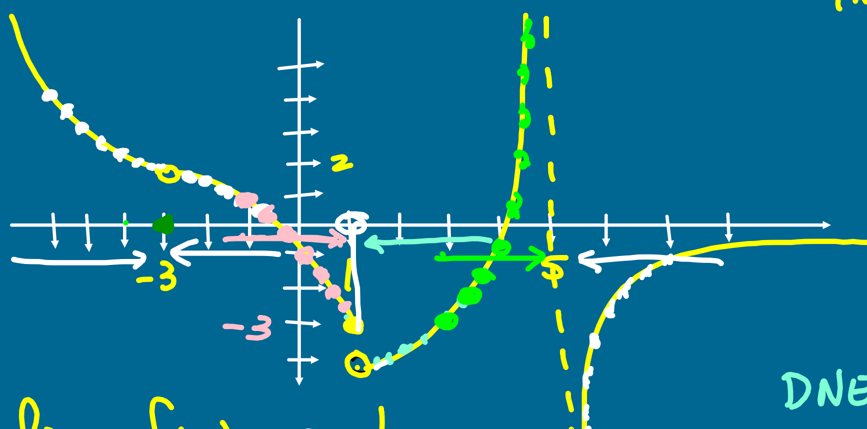
INTRO TO CALCULUS

- LIMITS
- DERIVATIVES
- INTEGRALS



Limits - find what the y-coord is approaching when the x-coord approaches a given number.

DNE = Does not exist

$\lim_{x \to -3^-} f(x) = 2$

$\lim_{x \to -3^+} f(x) = 2$

$\lim_{x \to -3} f(x) = 2$

$f(-3) = \underline{\text{undef.}}$

$\lim_{x \to 1^-} f(x) = -3$

$\lim_{x \to 1^+} f(x) = -4$

$\lim_{x \to 1} f(x) = \text{DNE}$

$f(1) = -3$

$\lim_{x \to 5^-} f(x) = +\infty$

$\lim_{x \to 5^+} f(x) = -\infty$

$\lim_{x \to 5} f(x) = \text{DNE}$

$f(5) = \text{undef.}$

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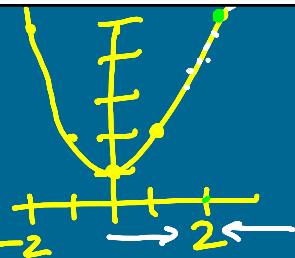
$$\lim_{x \to 2} x^2+1 = 5$$



Limits

1) Sub # in

If $\frac{0}{0}$:

2) Factor or Conjugate

$$\lim_{x \to -4} \frac{x^2-3x}{\sqrt{x+8}} = \frac{16+12}{\sqrt{-4+8}} = \frac{28}{\sqrt{4}} = \frac{28}{2} = 14$$

$$\lim_{x \to 3} \frac{x^2+4x-21}{x^2-3x} = \frac{9+12-21}{9-9} = \frac{0}{0} \leftarrow$$ indeterminate

$$\lim_{x \to 3} \frac{(x+7)\cancel{(x-3)}}{x\cancel{(x-3)}} = \frac{10}{3}$$

$$\lim_{x\to -5} \frac{x^3+125}{x^2-25} = \frac{-125+125}{25-25} = \frac{0}{0}$$

$$\lim_{x\to -5} \frac{\cancel{(x+5)}(x^2-5x+25)}{\cancel{(x+5)}(x-5)} = \frac{25+25+25}{-5-5} = \frac{75}{-10}$$

$$-\frac{15}{2} \text{ OR } -7.5$$

$$\lim_{x\to 64} \frac{\sqrt{x}-8}{x-64}\cdot\frac{(\sqrt{x}+8)}{(\sqrt{x}+8)} \qquad \frac{8-8}{64-64} = \frac{0}{0}$$

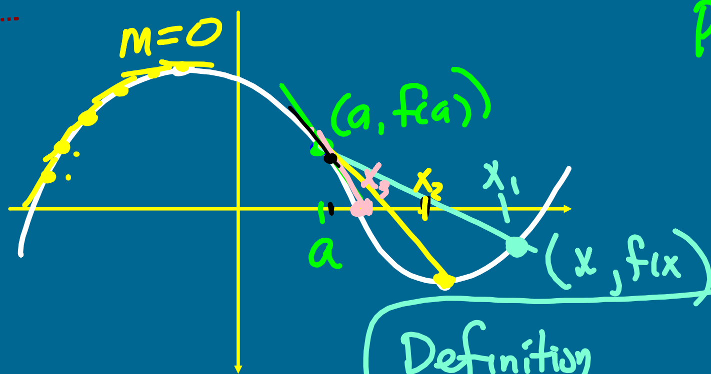
$$= \lim_{x\to 64} \frac{\cancel{x-64}}{\cancel{(x-64)}(\sqrt{x}+8)}$$

$$= \lim_{x\to 64} \frac{1}{\sqrt{x}+8} = \frac{1}{\sqrt{64}+8} = \frac{1}{16}$$

$$\frac{4}{(2+\sqrt{3})}\cdot\frac{(2-\sqrt{3})}{(2-\sqrt{3})}$$

$$\frac{\quad}{4-3}$$

DERIVATIVES



Pretend
$f(x) = x^4 - 3x^3 + 2x^2 + x + 1$

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

Definition of Derivative $\quad \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$

A derivative represents the slope of a line tangent to a curve at a given pt.

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$f(x) = 3x^2+4x-5$

Find $f'(a)$.

Symbols

$f'(x)$.

$\frac{dy}{dx}$

x^2-9

$(x+3)(x-3)$

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

$$\lim_{x\to a} \frac{3x^2+4x-\cancel{5}+(-3a^2-4a+\cancel{5})}{x-a}$$

$$\lim_{x\to a} \frac{(3x^2-3a^2)+(4x-4a)}{x-a}$$

$$\lim_{x\to a} \frac{3\overbrace{(\cancel{x^2-a^2})}^{(x+a)\cancel{(x-a)}} + 4\cancel{(x-a)}}{\cancel{x-a}}$$

$$\lim_{x\to a} 3(x+a)+4 = 3(a+a)+4$$

$$= \boxed{6a+4}$$

$f(x)$	$f'(x)$
$3x^2+4x-5$	$6x+4$
$5x^3-4x^7$	$15x^2-28x^6$
$\frac{1}{x^2}=1x^{-2}$	$\frac{-2}{x^3}$
	$-2x^{-3}$

Power Rule for Derivatives

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

$$f(x) = 5x^7 - \frac{4}{x^6} + \sqrt[3]{x^2} + 8$$

$$f(x) = 5x^7 - 4x^{-6} + x^{2/3} + \cancel{8x^0}$$

$$f'(x) = 35x^6 + 24x^{-7} + \frac{2}{3}x^{-1/3}$$

$$= \boxed{35x^6 + \frac{24}{x^7} + \frac{2}{3x^{1/3}}}$$