https://youtu.be/MjhA1Qz9UZc

3 – A DERIVADA – CÁLCULO DIFERENCIAL

17 EQUAÇÕES QUE MUDARAM O MUNDO – OUTSPOKEN MARKET NA PRÁTICA – LEANDRO GUERRA

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

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

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OUTSPOKEN MARKET NA PRÁTICA

17 Equations That Changed the World
by Ian Stewart

1.	**Pythagoras's Theorem**	$a^2 + b^2 = c^2$	Pythagoras,530 BC
2.	**Logarithms**	$\log xy = \log x + \log y$	John Napier, 1610
3.	**Calculus**	$\frac{df}{dt} = \lim_{h \to 0} \frac{f(t+h) - f(t)}{h}$	Newton, 1668
4.	**Law of Gravity**	$F = G\frac{m_1 m_2}{r^2}$	Newton, 1687
5.	**The Square Root of Minus One**	$i^2 = -1$	Euler, 1750
6.	**Euler's Formula for Polyhedra**	$V - E + F = 2$	Euler, 1751
7.	**Normal Distribution**	$\Phi(x) = \frac{1}{\sqrt{2\pi\rho}} e^{\frac{(x-\mu)^2}{2\rho^2}}$	C.F. Gauss, 1810
8.	**Wave Equation**	$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$	J. d'Almbert, 1746
9.	**Fourier Transform**	$f(\omega) = \int_{\infty}^{\infty} f(x) e^{-2\pi i x \omega} dx$	J. Fourier, 1822
10.	**Navier-Stokes Equation**	$\rho\left(\frac{\partial \mathbf{v}}{\partial t} + \mathbf{v} \cdot \nabla \mathbf{v}\right) = -\nabla p + \nabla \cdot \mathbf{T} + \mathbf{f}$	C. Navier, G. Stokes, 1845
11.	**Maxwell's Equations**	$\nabla \cdot \mathbf{E} = \frac{\rho}{\epsilon_0}$ $\quad \nabla \cdot \mathbf{H} = 0$ $\nabla \times \mathbf{E} = -\frac{1}{c}\frac{\partial \mathbf{H}}{\partial t}$ $\quad \nabla \times \mathbf{H} = \frac{1}{c}\frac{\partial \mathbf{E}}{\partial t}$	J.C. Maxwell, 1865
12.	**Second Law of Thermodynamics**	$dS \geq 0$	L. Boltzmann, 1874
13.	**Relativity**	$E = mc^2$	Einstein, 1905
14.	**Schrodinger's Equation**	$i\hbar \frac{\partial}{\partial t}\Psi = H\Psi$	E. Schrodinger, 1927
15.	**Information Theory**	$H = -\sum p(x) \log p(x)$	C. Shannon, 1949
16.	**Chaos Theory**	$x_{t+1} = kx_t(1 - x_t)$	Robert May, 1975
17.	**Black-Scholes Equation**	$\frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS\frac{\partial V}{\partial S} + \frac{\partial V}{\partial t} - rV = 0$	F. Black, M. Scholes, 1990

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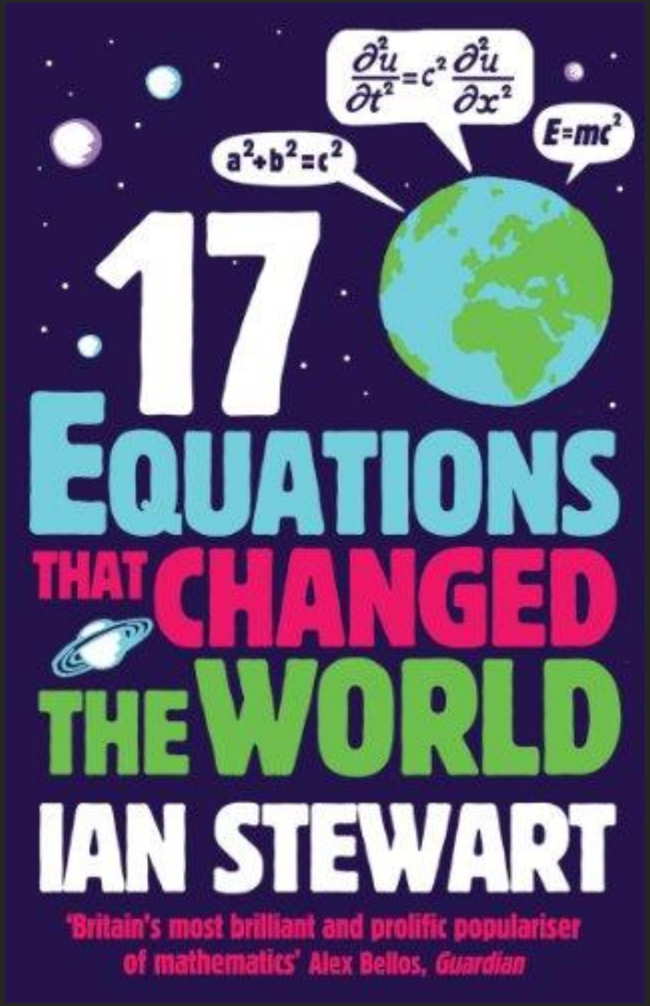
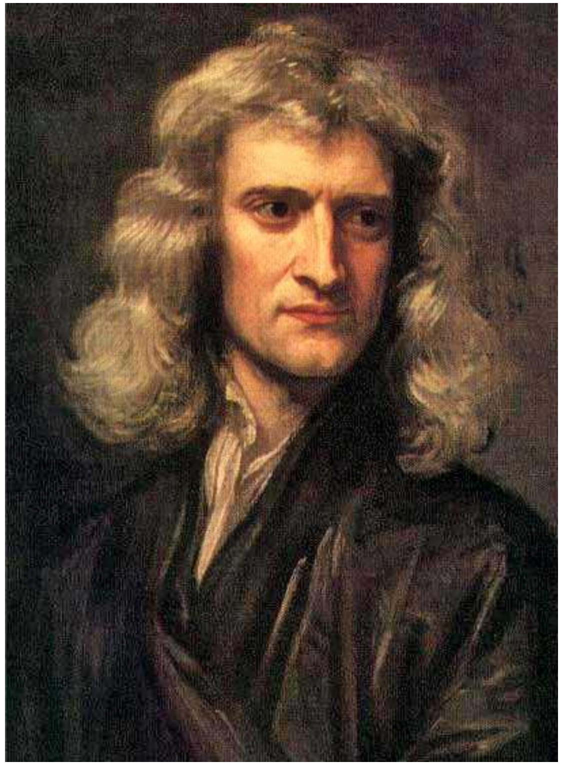

$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$
$a^2+b^2=c^2$
$E=mc^2$
17 EQUATIONS THAT CHANGED THE WORLD
IAN STEWART
'Britain's most brilliant and prolific populariser of mathematics' Alex Bellos, *Guardian*

ISAAC NEWTON OU LEIBNIZ?



Isaac Newton
(1642 -1726)

Gottfried Wilhelm Leibniz
(1646 -1716)

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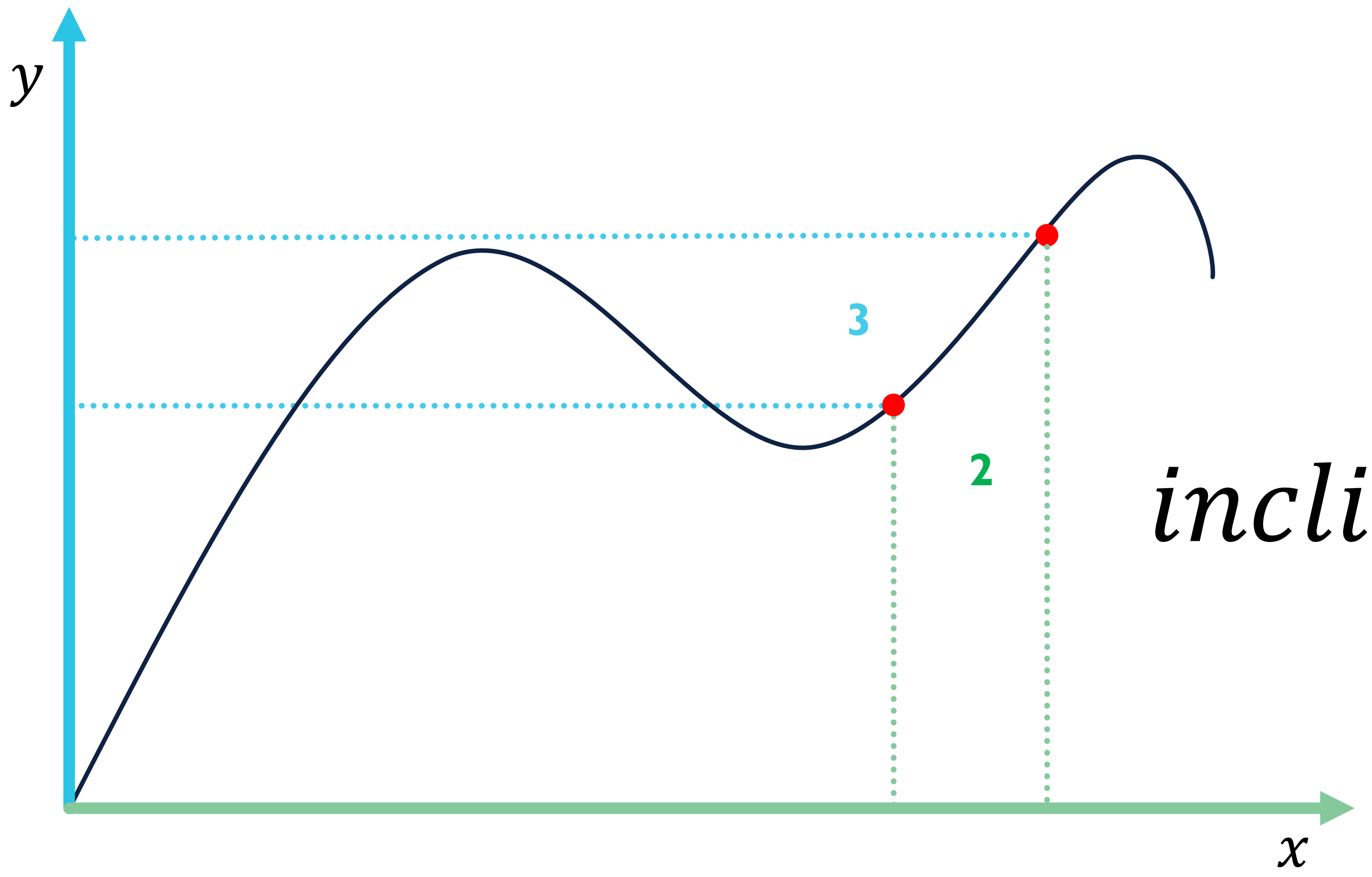
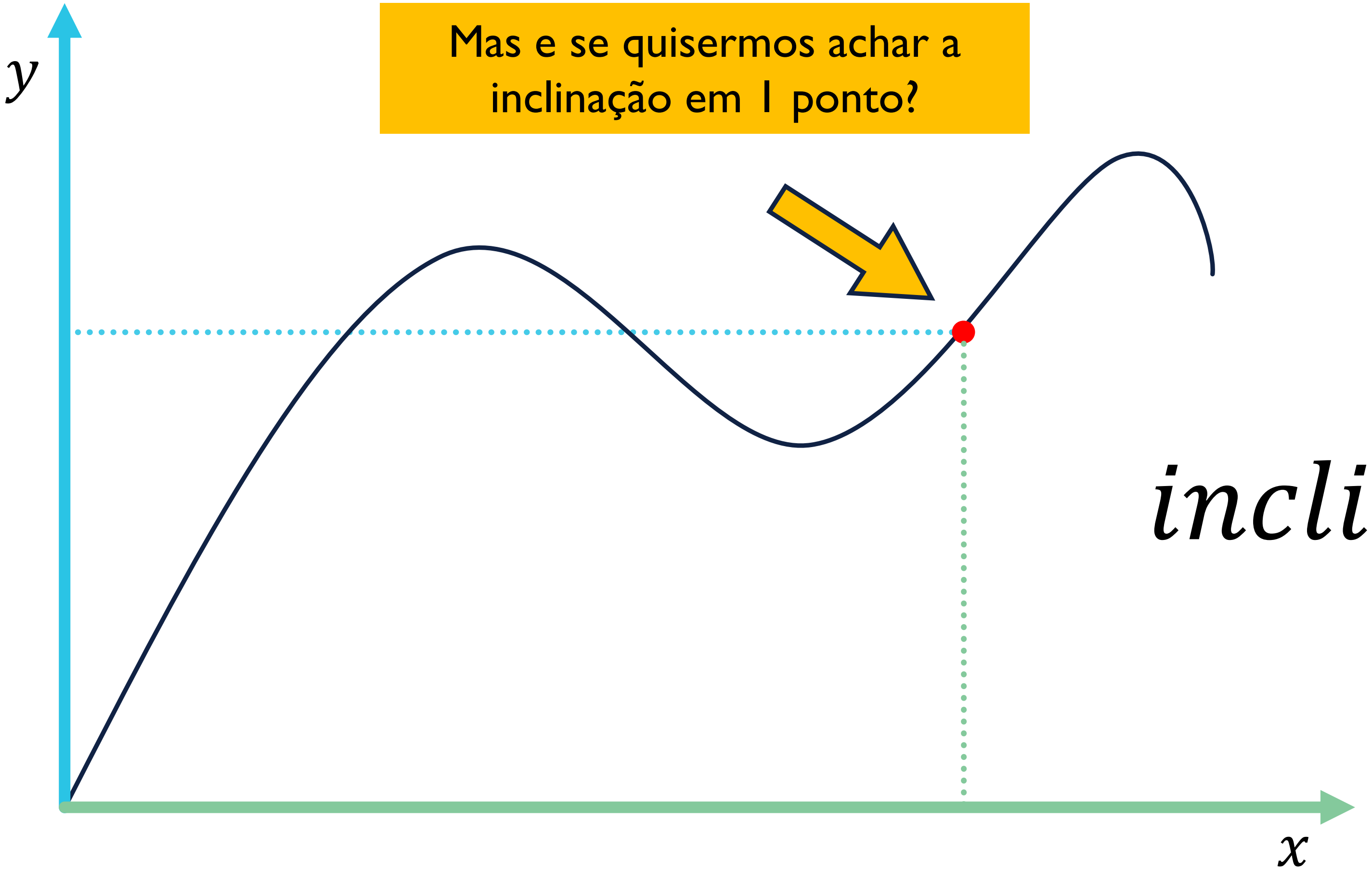
PENSE EM INCLINAÇÃO E TAXA DE VARIAÇÃO



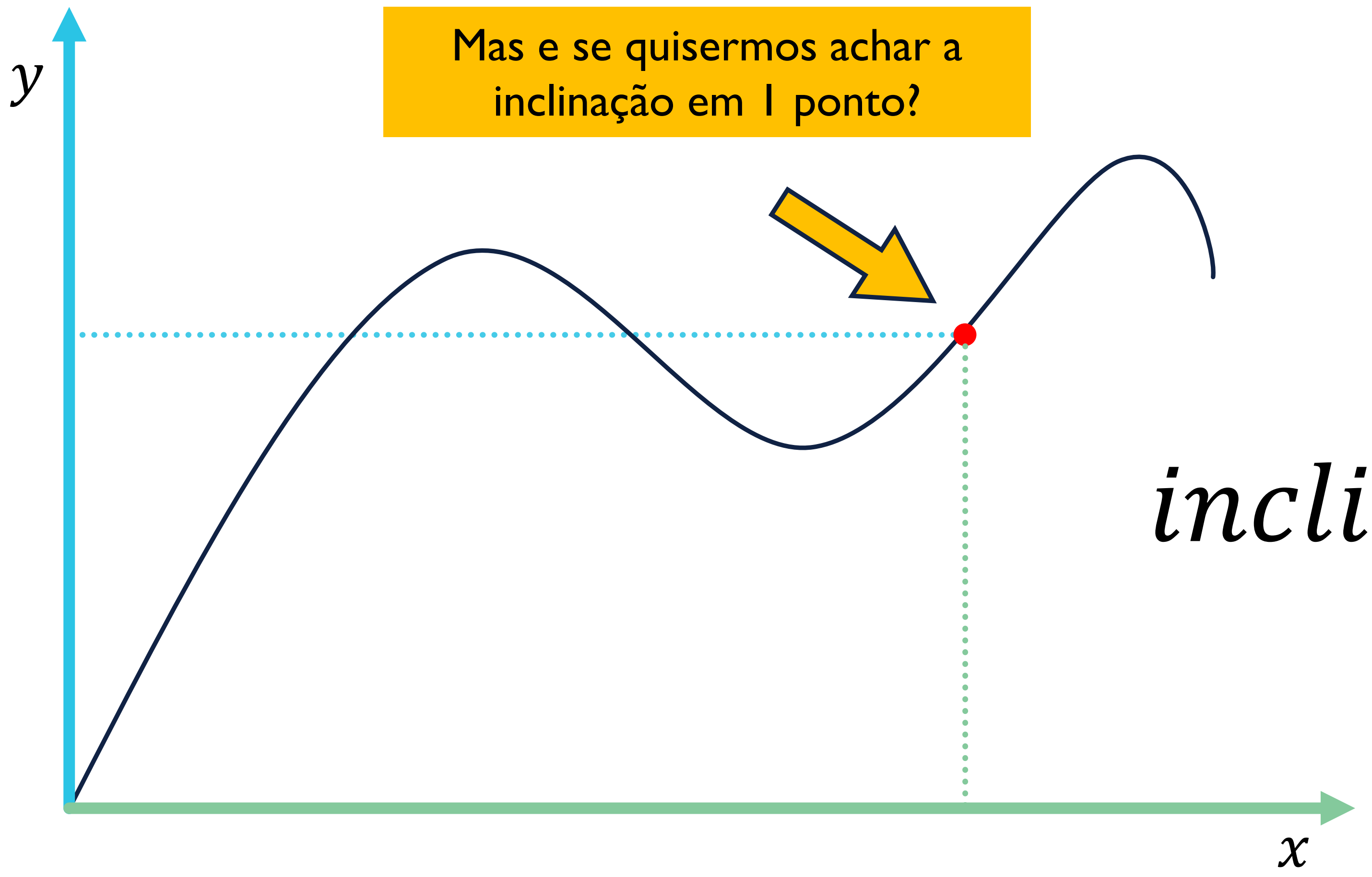
$$inclinaçao = \frac{3}{2} = 1{,}5$$

PENSE EM INCLINAÇÃO E TAXA DE VARIAÇÃO



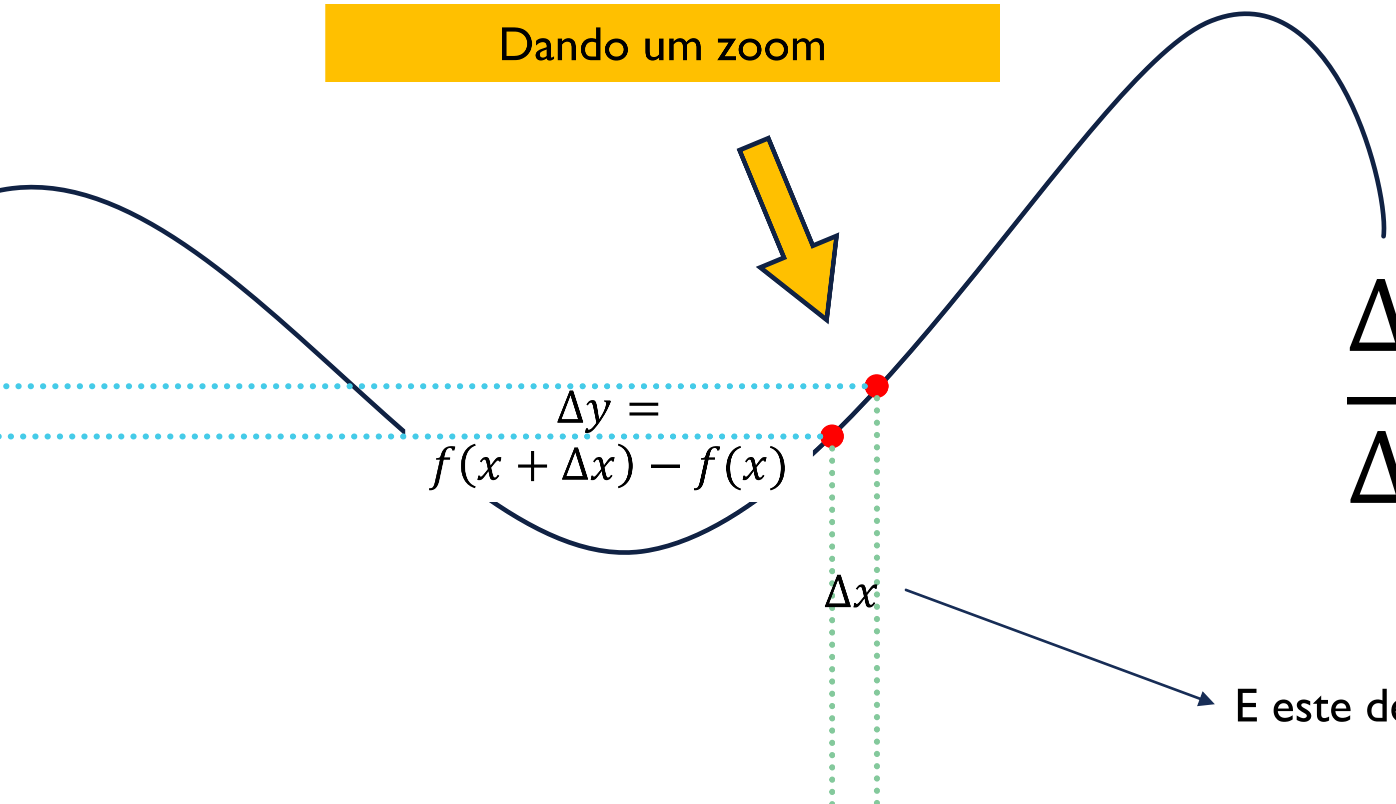
$$inclinaçao = \frac{0}{0} = ?$$

PENSE EM INCLINAÇÃO E TAXA DE VARIAÇÃO



$$inclinaçao = \frac{\Delta y}{\Delta x} = ?$$

PENSE EM INCLINAÇÃO E TAXA DE VARIAÇÃO



$$\frac{\Delta y}{\Delta x} = \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

E este delta x tende a zero

EXEMPLO CLÁSSICO

$$Dado\ f(x) = x^2 \quad \text{qual } f'(x) = x^2?$$

$$\frac{\Delta y}{\Delta x} = f'(x) = \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

$$f'(x) = \frac{(x^2 + 2x \cdot \Delta x + \Delta x^2) - x^2}{\Delta x}$$

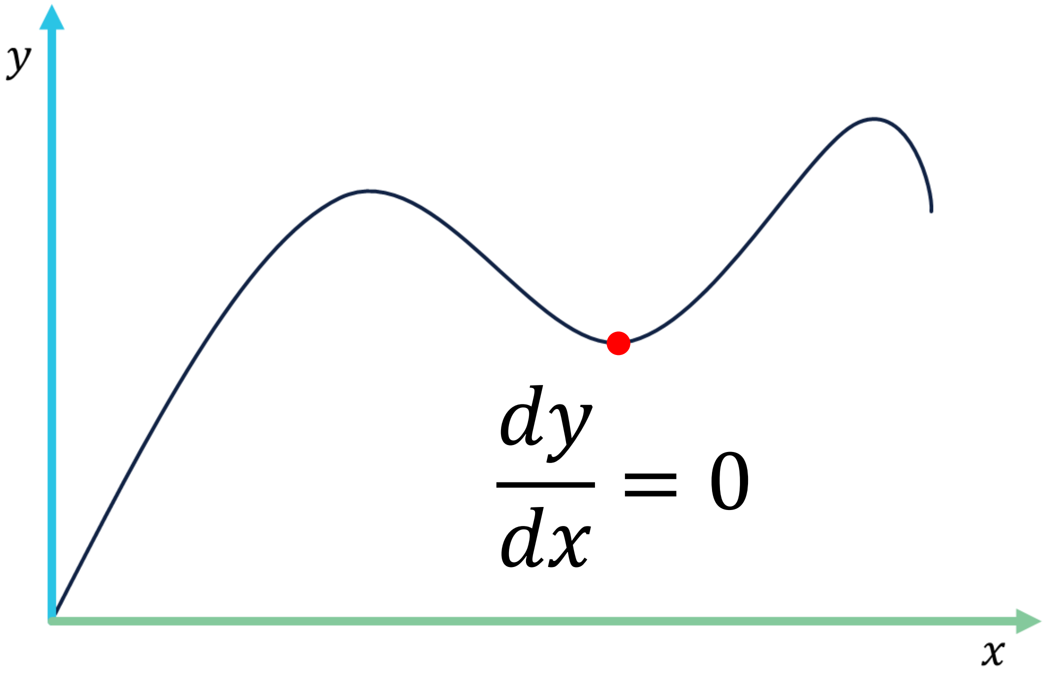
$$f'(x) = \frac{2x \cdot \Delta x + \Delta x^2}{\Delta x}$$

Como o delta x tende a zero

$$f'(x) = 2x \rightarrow \frac{dy}{dx}$$

E PARA O QUE ISSO SERVE?

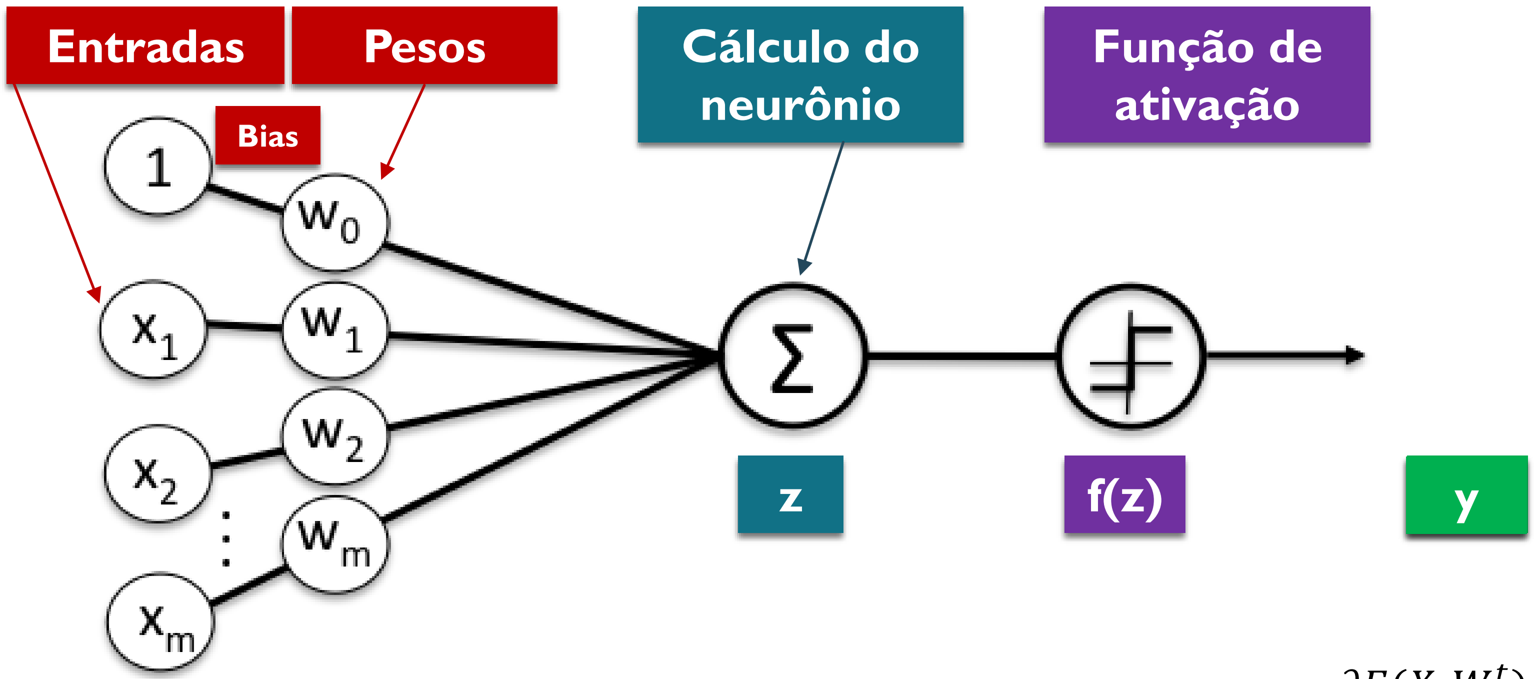
Achar o ponto de mínimo ou máximo de uma função!



$$\frac{dy}{dx} = 0$$

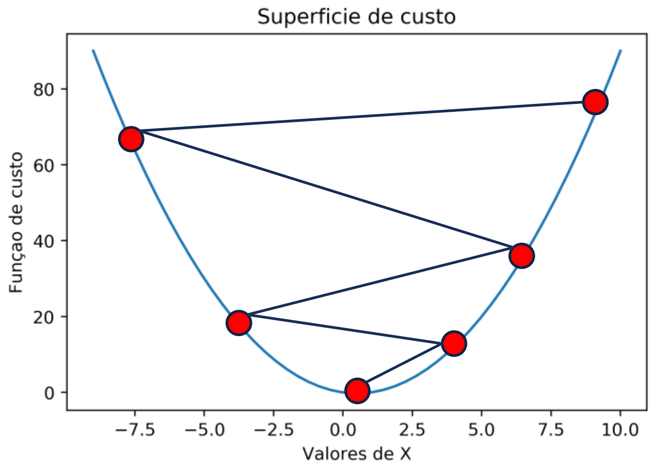
O ponto mínimo é onde a
derivada é igual a zero!
Não existe inclinação!

TREINAMENTO DE MODELOS MATEMÁTICOS!



Y real −

ERRO



$$W^{t+1} = W^t - \alpha \frac{\partial E(X, W^t)}{\partial W}$$

Derivada da Função de Erro

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O MODELO DE BLACK-SCHOLES

$$\frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS\frac{\partial V}{\partial S} + \frac{\partial V}{\partial t} - rV = 0$$

Gamma — Delta — Theta

$r = taxa\ livre\ de\ risco$

$S = preço\ do\ ativo$

$V = preço\ da\ opçao$

$\sigma = volatilidade\ implicita$

OBRIGADO E ATÉ A PRÓXIMA!

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