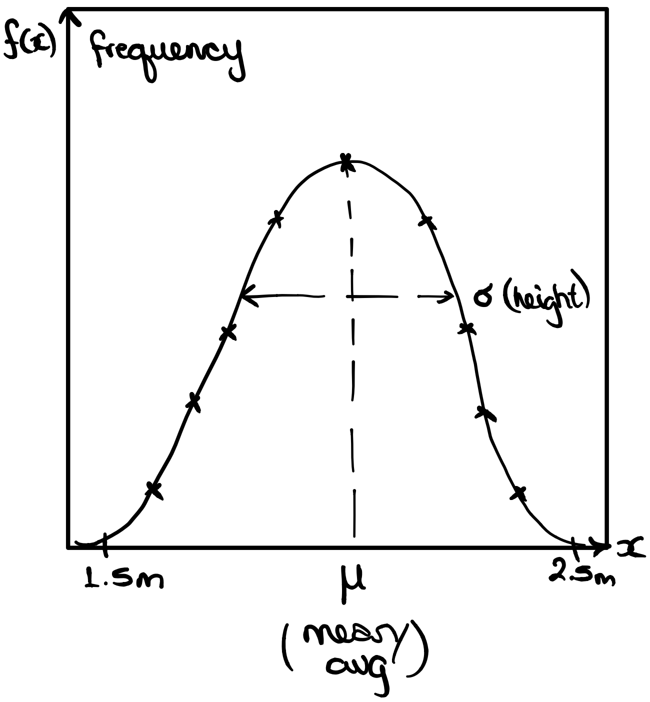
The Newton-Raphson method can be used to solve equations.



By solving the equation – a model for the distribution can be produced; often working with a model is more desirable than working with the raw data points.

Newton-Raphson produces a degree of error; and the parameter values are subject to a goodness of fit.

$$f(x) = x^3 - 2x + 2.$$

NEWTON-RAPHSON ITERATION TABLE.

i	x_i	$y(x_i)$	$\frac{\partial y(x_i)}{\partial x}$
0	-2	-2	10
1	-1.8	-0.23	7.7
2	-1.77	-0.005	7.4
3	-1.769	-2.3E-6	

Example: solving for y=0 in

$$f(x) = x^3 - 2x + 2.$$

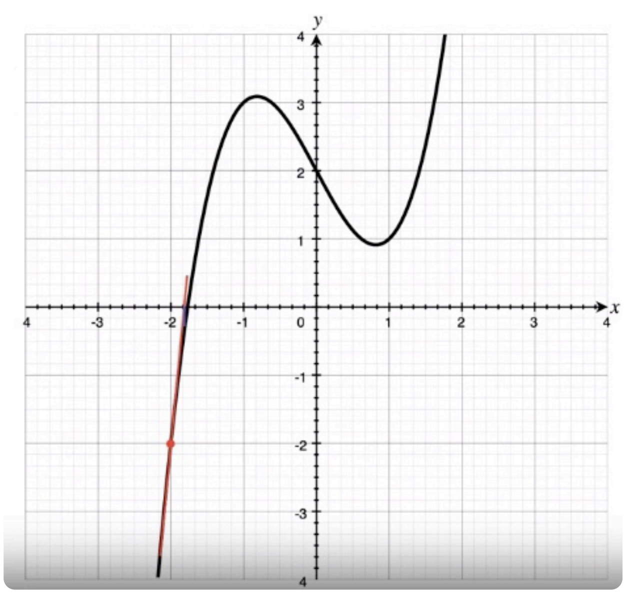
① $\frac{\partial f}{\partial x} = 3x^2 - 2$, linearise the function

② $g_1(-2) = 10$, compute the gradient

③ $x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$, estimate the parameters which will solve the equation.

$$-1.8 = -2 - \frac{(-2)}{10}$$

④ $-0.23 = f(-1.8)$, evaluate the new function.

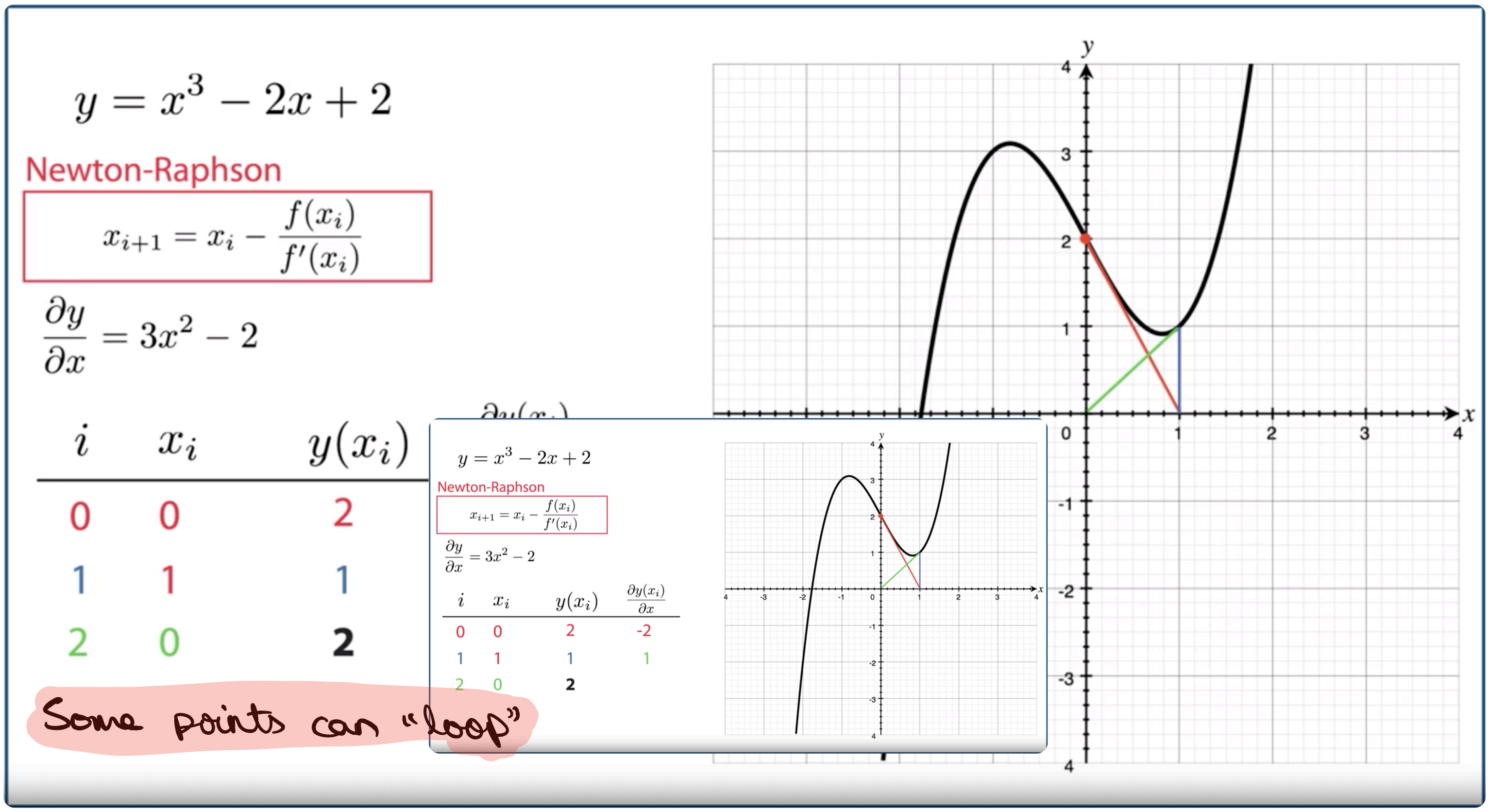


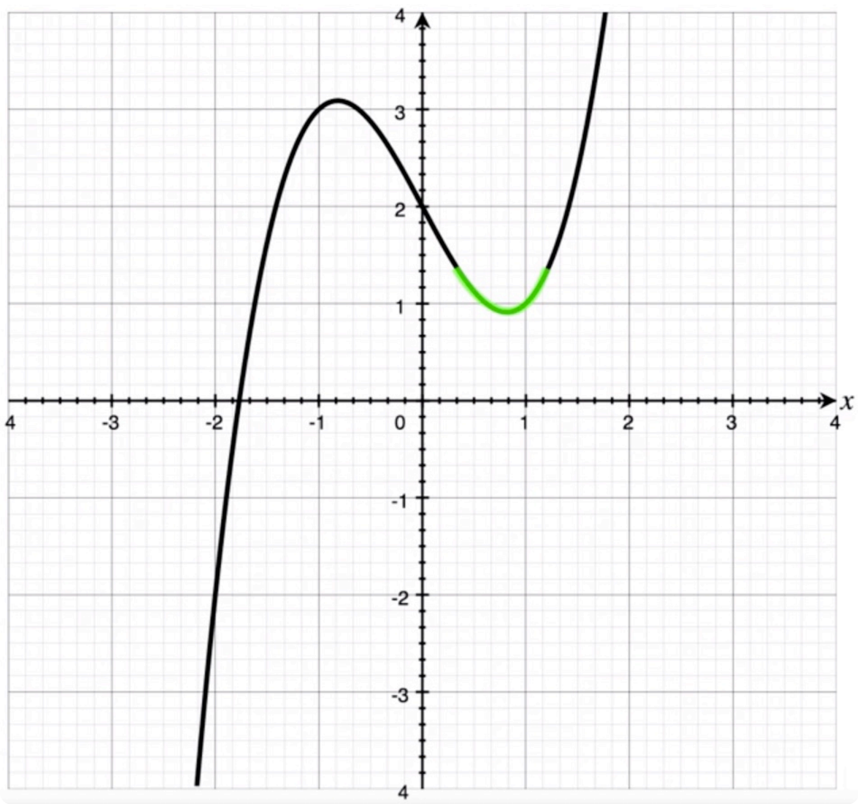
$$f(x) = x^3 - 2x + 2.$$

(*) The key requirements of the Newton-Raphson method for solving an equation is: (1) the ability to evaluate the function, and (2) the ability to derivate the func.

Complex functions with massive datasets are often too complex to be solved analytically - or be graphed out.

An Algorthimic corner case in Newton-Raphson.





Secondly, when estimating/iterating with Newton-Raphson near a minima/maxima the division by the gradient will produce an inflated jump to the next estimate. Zero also is problematic.

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$

In a multivariate context newton-raphson requires a contour plot.

Newton - Raphson works by linearisation.

Assuming the root is nearby a certain point — like $(x_0 + \delta x)$.

$$f(x_0+\delta x) = f(x_0) + f'(x_0)\delta x$$

$= 0$, the jump slightly over will be the root.

By rearranging this equation; and assuming $f(x_0+\delta x)$ is 0.

$$f(x_0+\delta x) = f(x_0) + f'(x_0)\delta x$$
$$0 = f(x_0) + f'(x_0)\delta x$$
$$f'(x_0)\delta x = -f(x_0)$$
$$\delta x = -\frac{f(x_0)}{f'(x_0)}$$

∘ the delta to shift for the next Newton-Raphson estimation.

Hence, $x_{i+1} = x_i - \dfrac{f(x_i)}{f'(x_i)}$.