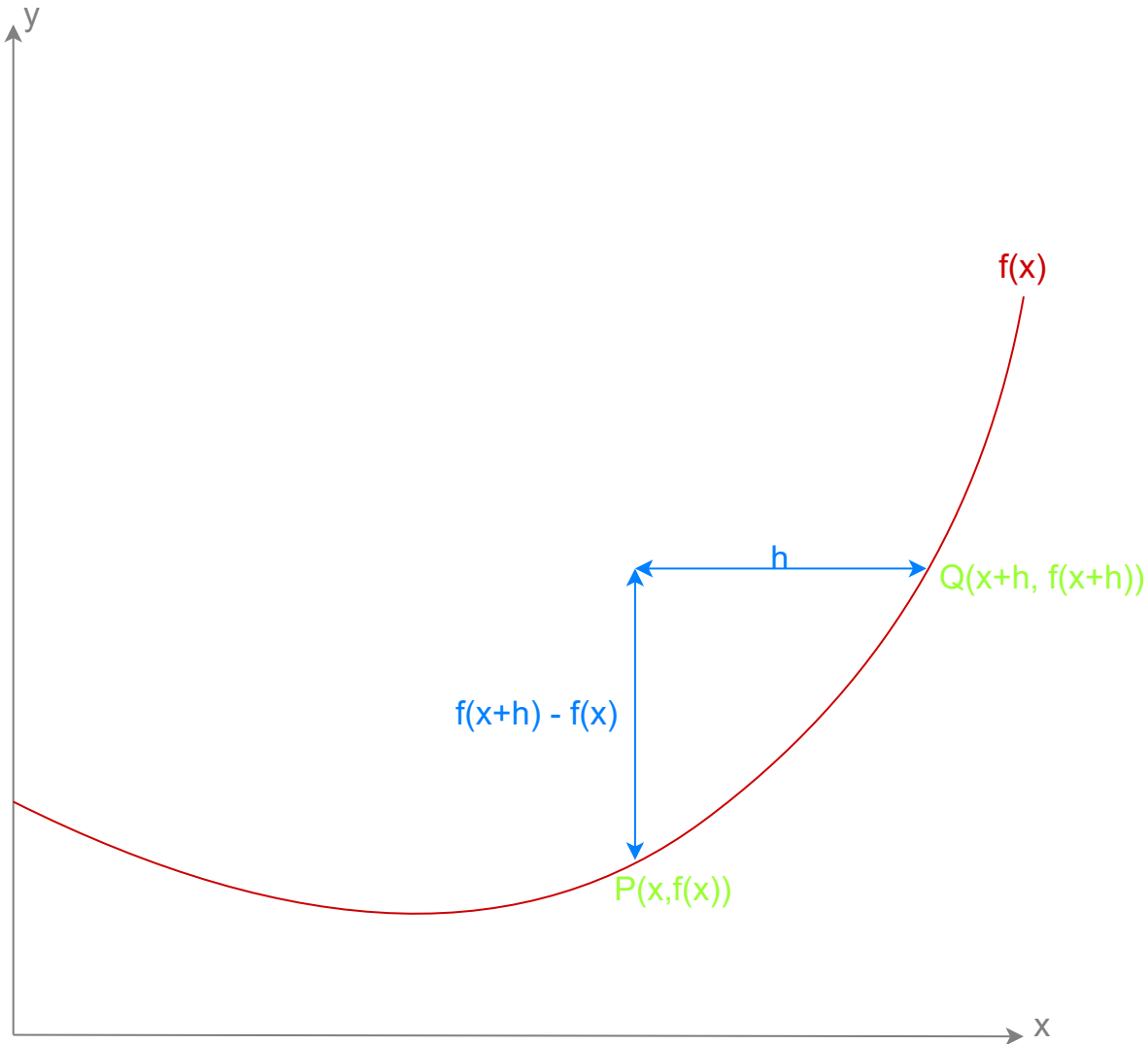# Differentiation

For any equation in the form $y = f(x)$ where $f(x)$ is in the form mx^k, the gradient function, $\frac{dy}{dx} f(x)$ also known as $f'(x)$ is given by the formula mkx^{k-1}.

A proof from first principles

The gradient of the chord formed between **P** and **Q** is $\frac{f(x+h)-f(x)}{h}$.

As $h \to 0$, this gradient more closely approximates teh gradient of the line formed by $f(x)$ at the point **P**.

Therefore, the gradient function $f'(x)$ is equal to:

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