# Differentiation from first principles

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

Differentiate $f(x) = 2x^2 + 3x$ from 1st Principles

① $f(x+h) = 2(x+h)^2 + 3(x+h)$

$= 2[x^2 + 2xh + h^2] + 3x + 3h$

$= 2x^2 + 4xh + 2h^2 + 3x + 3h$

② $\frac{f(x+h) - f(x)}{h} = \frac{2x^2 + 4xh + 2h^2 + 3x + 3h - 2x^2 - 3x}{h}$

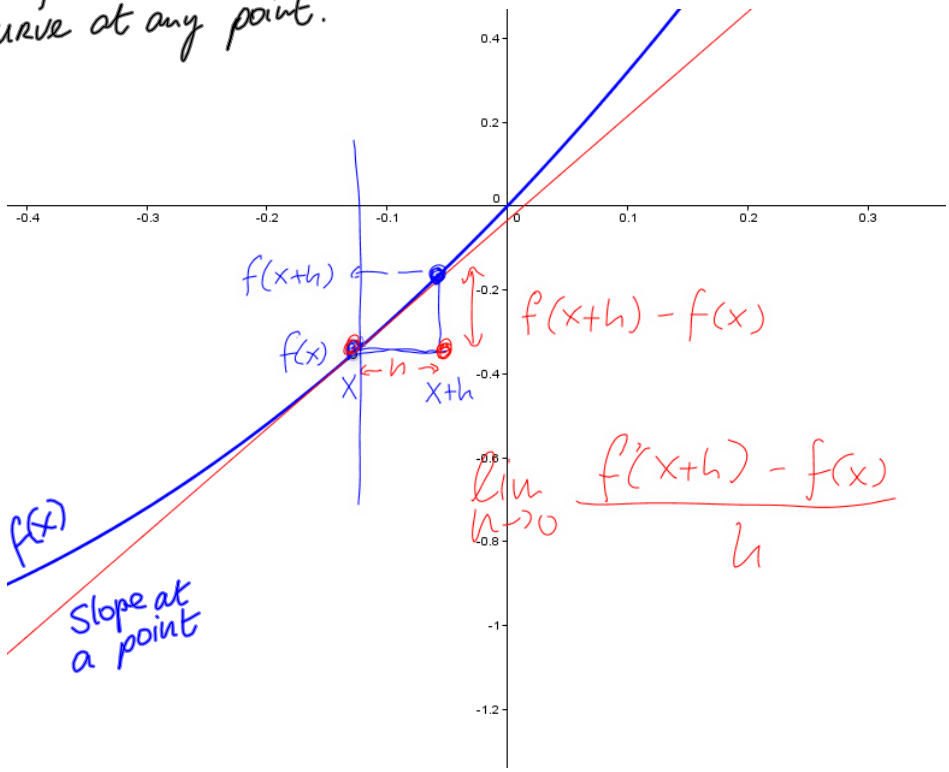
$= 4x + 2h + 3$

③ $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = 4x + 2(0) + 3 = 4x + 3$

Differentiation is concerned with division of changing related terms.

This can be used to find the slope of a line.

Differentiation allows us to find the slope of a curve at any point.




HW Questions

Differentiate from first principles:

① $f(x) = 2x + 1$

② $f(x) = 4x^2 + 3x + 2$