

$$9. \quad g(x) = \frac{4}{x} \quad (2, 2)$$

$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$\lim_{h \rightarrow 0} \frac{\frac{4x}{(x+h)x} + \frac{-4(x+h)}{x(x+h)}}{h}$$

$$\lim_{h \rightarrow 0} \frac{\cancel{4x} - \cancel{4x} - 4h}{x(x+h)} \cdot \frac{1}{h}$$

$$\lim_{h \rightarrow 0} \frac{-4}{x(x+h)} = \boxed{\frac{-4}{x^2}}$$

Slope = -1

11-3 Derivatives

The derivative of a function gives the slope of the tangent line at any point.

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

Ex 1 Find the derivative of

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

$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$\lim_{h \rightarrow 0} \frac{4(x+h)^2 - 5(x+h) - (4x^2 - 5x)}{h}$$

$$\lim_{h \rightarrow 0} \frac{4(x^2 + 2xh + h^2) - 5x - 5h - 4x^2 + 5x}{h}$$

$$\lim_{h \rightarrow 0} \frac{\cancel{4x^2} + 8xh + 4h^2 - \cancel{5x} - 5h - \cancel{4x^2} + \cancel{5x}}{h}$$

$$\lim_{h \rightarrow 0} 8x + 4h - 5$$

$$f'(x) = 8x - 5$$

Ex 2 Find the derivative of $f(x) = 3x^2 - 2x$

$$f'(x) = 6x - 2$$

$$f(x) = 5x^4 + 3x^3 + 7x^2 + 2x - \pi$$

$$f'(x) = 20x^3 + 9x^2 + 14x + 2$$

Ex 3 Find $f'(x)$ for $f(x) = \sqrt{x}$

Then find the slopes of the graph of f at the points (4, 2) and (9, 3).

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

$$\lim_{h \rightarrow 0} \frac{(\sqrt{x+h} - \sqrt{x})(\sqrt{x+h} + \sqrt{x})}{h(\sqrt{x+h} + \sqrt{x})}$$

$$\lim_{h \rightarrow 0} \frac{\cancel{x+h} - \cancel{x}}{h(\sqrt{x+h} + \sqrt{x})}$$

$$\text{Slope} = \frac{1}{4}$$

$$\text{Slope} = \frac{1}{6}$$

$$\lim_{h \rightarrow 0} \frac{1}{\sqrt{x+h} + \sqrt{x}} = \frac{1}{2\sqrt{x}}$$

Practice
p.808
#25-33

Fun time with math