

Outcome 1 - The Chain Rule for two functions

Worked Example:

Differentiate $y = (5x - 2)^7$

1. Define the functions.

Let
$$y = u^7$$
 where $u = 5x - 2$

2. Differentiate both functions.

$$\frac{dy}{du} = 7u^6 \qquad \qquad \frac{du}{dx} = 5$$

3. Find $\frac{dy}{dx}$.

$$\frac{dy}{dx} = 7u^6 \times 5 = 35u^6$$

4. Replace u with function of x.

$$\frac{dy}{dx} = 35(5x - 2)^6$$

Questions...

Differentiate each of the following with respect to x.

$$y = (9x - 5)^8$$

$$3 \qquad y = \frac{1}{(4x+7)^3}$$

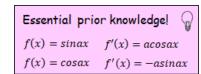
$$4 \quad y = \sin 8x$$

$$y = \cos x^3$$

Key Facts/Formulae:

The chain rule enables us to differentiate a function within a function.

$$f'(\text{outside}) \times f'(\text{inside})$$
E.g. If $y = u$, then $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$



Answers

$$\frac{dy}{dx} = 6(3x+1)$$

$$\frac{dy}{dx} = 72(9x - 5)^7$$

$$\frac{dy}{dx} = -\frac{12}{(4x+7)^4}$$

$$\frac{dy}{dx} = 8\cos 8x$$

$$\frac{dy}{dx} = -3x^2 \sin x^3$$

$$\frac{dy}{dx} = \frac{\sin x}{\cos^2 x}$$