Worked Solutions

Pure Maths, Differential Calculus, sheet PM-DIFF-CR-01

The Chain Rule Q. 1

Differentiate $y = (2x + 1)^2$

inner function: $u = 2x + 1$

outer function: $y = u^2$

differentiating the outer function:

$$y = u^2 \Rightarrow \frac{dy}{du} = 2u$$

differentiating the inner function:

$$u = 2x + 1 \Rightarrow \frac{du}{dx} = 2$$

using the Chain Rule: $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$

substituting for $\frac{dy}{du} = 2u$ and $\frac{du}{dx} = 2$

$$\frac{dy}{dx} = 2u \cdot 2$$

substituting for: $u = 2x + 1$

$$\frac{dy}{dx} = 2(2x + 1) \cdot 2$$

expanding gives the answer:

$$\frac{dy}{dx} = 4(2x + 1)$$