

Worked Solutions

Pure Maths, Differential Calculus,

sheet PM-DIFF-CR-01

The Chain Rule Q. 5

Function

$$y = (2x^2 - x + 3)^3$$

Here, we identify the inner function u and the outer function y :

- Inner function: $u = 2x^2 - x + 3$
- Outer function: $y = u^3$

The Chain Rule states:

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

Step 1: Compute $\frac{du}{dx}$

$$u = 2x^2 - x + 3$$

differentiating with respect to x :

$$\frac{du}{dx} = 4x - 1$$

Step 2: Compute $\frac{dy}{du}$

$$y = u^3$$

differentiating with respect to u :

$$\frac{dy}{du} = 3u^2$$

Step 3: Combine using the Chain Rule

$$\begin{aligned}\frac{dy}{dx} &= \frac{dy}{du} \cdot \frac{du}{dx} \\ &= 3u^2 \cdot (4x - 1)\end{aligned}$$

substituting for $u = 2x^2 - x + 3$

Final Answer

$$\frac{dy}{dx} = 3(2x^2 - x + 3)^2(4x - 1)$$