### **Worked Solutions**

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

The Chain Rule Q. 7

The given function is:

$$y = \left(3x^{-3} - 2x\right)^{1/2}$$
.

We will use the chain rule:

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

where  $u = 3x^{-3} - 2x$ .

## Step 1: Define $\boldsymbol{u}$ and differentiate it with respect to $\boldsymbol{x}$ :

$$u = 3x^{-3} - 2x$$
.

Differentiate u with respect to x:

$$rac{du}{dx} = rac{d}{dx}(3x^{-3}) - rac{d}{dx}(2x).$$
 
$$rac{du}{dx} = -9x^{-4} - 2.$$

### Step 2: Differentiate y with respect to u:

$$y = u^{1/2}$$
.

$$rac{dy}{du}=rac{1}{2}u^{-1/2}.$$

#### Step 3: Combine using the chain rule:

$$rac{dy}{dx} = rac{dy}{du} \cdot rac{du}{dx}.$$

Substitute the expressions for  $\frac{dy}{du}$  and  $\frac{du}{dx}$ :

$$rac{dy}{dx} = rac{1}{2}u^{-1/2} \cdot (-9x^{-4} - 2).$$

# Step 4: Substitute $u=3x^{-3}-2x$ :

$$rac{dy}{dx} = rac{1}{2}(3x^{-3} - 2x)^{-1/2} \cdot (-9x^{-4} - 2).$$