

## Worked Solutions

Pure Maths, Differential Calculus,

sheet PM\_DIF\_EF\_01

### Exponential Functions Q.1

differentiate the function  $y = e^{3x}$

The **Chain Rule** is used when differentiating a 'composite function', which is described as a function of another function.

The derivatives of the functions are linked by the equation:

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

for  $y = e^{3x}$

let  $u$  be the inner function:  $u = 3x$

the outer function is:  $y = e^u$

taking derivatives with respect to  $u$  and  $y$  respectively,

$$\frac{du}{dx} = 3 \quad \text{and} \quad \frac{dy}{du} = e^u$$

substituting these results into the Chain Rule equation,

$$\frac{dy}{dx} = e^u \cdot 3$$

substituting for  $u = 3x$ ,

$$\frac{dy}{dx} = e^{3x} \cdot 3$$

simplifying,

$$\frac{dy}{dx} = 3e^{3x}$$

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