

Question 4

Let

$$f(x) = (x^2 + 3x) \cdot e^x$$

- (a) Use the product rule to differentiate $f(x)$.
- (b) Factor and simplify your final expression.

Question 4 - Solution

We are given:

$$f(x) = (x^2 + 3x) \cdot e^x$$

Let:

$$u(x) = x^2 + 3x, \quad v(x) = e^x$$

By the product rule:

$$f'(x) = u'(x)v(x) + u(x)v'(x)$$

Differentiate each part:

$$u'(x) = 2x + 3, \quad v'(x) = e^x$$

Now plug into the formula:

$$f'(x) = (2x + 3)e^x + (x^2 + 3x)e^x$$

Factor out e^x :

$$f'(x) = e^x [(2x + 3) + (x^2 + 3x)]$$

Simplify inside the brackets:

$$(2x + 3) + (x^2 + 3x) = x^2 + 5x + 3$$

Final Answer:

$$\boxed{f'(x) = e^x(x^2 + 5x + 3)}$$