

Question 1

Let

$$f(x) = \ln(x^2 + 1) \cdot e^{3x}$$

- (a) Differentiate $f(x)$ using the product rule and the chain rule.
- (b) Simplify your answer.

Question 1 - Solution

We are given:

$$f(x) = \ln(x^2 + 1) \cdot e^{3x}$$

(a) Differentiate Using Product Rule:

Let:

$$u(x) = \ln(x^2 + 1), \quad v(x) = e^{3x}$$

Then:

$$u'(x) = \frac{1}{x^2 + 1} \cdot 2x = \frac{2x}{x^2 + 1}, \quad v'(x) = 3e^{3x}$$

Now apply the product rule:

$$f'(x) = u'(x)v(x) + u(x)v'(x) = \frac{2x}{x^2 + 1} \cdot e^{3x} + \ln(x^2 + 1) \cdot 3e^{3x}$$

(b) Final Simplified Answer:

Factor out e^{3x} :

$$f'(x) = e^{3x} \left(\frac{2x}{x^2 + 1} + 3 \ln(x^2 + 1) \right)$$

$$\boxed{f'(x) = e^{3x} \left(\frac{2x}{x^2 + 1} + 3 \ln(x^2 + 1) \right)}$$