

Section 1: Differentiating exponentials and logarithms

Crucial points

1. **Don't mix up the derivative of x^n with that of e^x**

Example: Differentiate e^{2x}

✗ **Wrong** $\frac{dy}{dx} = 2xe^{2x-1}$

✓ **Right** $\frac{dy}{dx} = 2e^{2x}$

2. **Don't get the chain rule and product rule mixed up, especially when differentiating log functions**

Example: Differentiate $y = \ln(1+x^2)$

✗ **Wrong** $\frac{dy}{dx} = 2x \ln + \frac{1}{x}(1+x^2)$

✓ **Right** $\frac{dy}{dx} = \frac{1}{1+x^2} \times 2x = \frac{2x}{1+x^2}$

Note that $\ln(1+x^2)$ is **not** a product of 'ln' (which is meaningless) with $(1+x^2)$. It is the composite of the two functions $f(x) = \ln x$ and $g(x) = 1+x^2$. So the chain rule is needed to differentiate this.