

Result

$$y = a^x + C \quad \Leftrightarrow \quad y' = \ln(a)a^x$$

Proof

$$\begin{aligned} y + C &= a^x \\ \Leftrightarrow y' &= y(x \ln(a))' \\ &= y \ln(a) \\ &= \ln(a)a^x \end{aligned}$$

Concepts

Differentiate

Definition

The differentiate of a function f with respect a variable which it acts upon x is defined as

$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

and is written as f'

It may also be thought of as the instantaneous rate of change of f with respect to x

Techniques

Logarithmic differentiation

Procedure For a function

$$y = f(x)$$

where $f(x)$ contains complex powers, products or quantents.

1. Take the natural logarithm of both sides
2. Simply $\ln f(x)$ using logarithm laws(power to product, product to sum and quotient to difference)
3. differentiate both sides with respect to x
4. Solve for y'

$$y' = y \underbrace{(\ln(fx))}_{\text{simplified}}$$