

2. Differentiation of Exponential and Logarithmic Functions

Example:

i. $\frac{d}{dx} e^{2x}$

$(e^{2x})' = 1$

ii. $\frac{d}{dx} e^{3x}$

$(e^{3x})' = 3$

iii. $\frac{d}{dx} \ln x$

$(\ln x)' = 1/x$

iv. $\frac{d}{dx} \ln(x+1)$

$(\ln(x+1))' = \frac{1}{x+1}$

v. $\frac{d}{dx} \ln(x^2 + 2x + 1)$

$(\ln(x^2 + 2x + 1))' = \frac{2x+2}{x^2+2x+1}$

Solve the following equations for x :

vi. $2^{x+1} = 8$

$1 + x = \frac{\ln 8}{\ln 2} = 3$

vii. $\frac{1}{x^2} = \frac{2}{e^{2x}}$

$1 + x = \frac{\ln 2 - \ln e^{2x}}{\ln 2} = -2$

Find domains of the following functions:

viii. $\ln\left(\frac{1}{x^2 + 1}\right)$

$(\ln(x+1))'$

Differentiate the following functions and simplify, if it is possible:

ix. $y = e^{2x}$

$(e^{2x})' = 2e^{2x}$

x. $y = \ln\left(\frac{1}{x^2}\right)$

$(\ln(x+1))' = \ln(x+1)$

xi. $y = \ln(x^2 + 2x + 1)$

$\left(\frac{1}{x^2+1}\right)' = -\frac{2x}{x^2+1}$

xii. $y = \ln(x^2 + e^{2x})$

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

xiii. $y = \frac{e^{2x} + e^{4x}}{2}$

$\left(\frac{e^{2x} + e^{4x}}{2}\right)' = \frac{2e^{2x} + 4e^{4x}}{2} = e^{2x} + 2e^{4x}$

xiv. $y = e^{2x}$

$(e^{2x})' = 2e^{2x}$

xv. $y = e^{2x} \sin x$

$(e^{2x} \sin x)' = e^{2x} \cos x + 2e^{2x} \sin x$

xvi. $y = \ln(x^2 + 1)$

$\left(\frac{1}{x^2+1}\right)' = -\frac{2x}{x^2+1}$

xvii. $y = e^{2x} \ln x = \frac{e^{2x}}{x}$

$(2e^{2x})' = 4e^{2x}$

xviii. $y = e^{2x} \ln x$

$(2e^{2x} \ln x)' = 2(2e^{2x} \ln x + e^{2x})$