

Extra Practice—Derivative Rules for Natural Logs and Exponentials

Differentiate the following functions.

a. $f(x) = \ln(2x^3)$ b. $f(x) = e^{x^7}$ c. $f(x) = \ln(11x^7)$

d. $f(x) = e^{x^2+x^3}$ e. $f(x) = \log_e(7x^{-2})$ f. $f(x) = e^{-x}$

g. $f(x) = \ln(e^x + x^3)$ h. $f(x) = \ln(e^x x^3)$ i. $f(x) = \ln\left(\frac{x^2 + 1}{x^3 - x}\right)$

ANSWERS:

a. $f'(x) = \frac{6x^2}{2x^3} = \frac{3}{x}$

Alternatively write $f(x) = \ln 2 + 3 \ln x$ so that $f'(x) = 3 \frac{1}{x}$.

b. $f'(x) = 7x^6 e^{x^7}$

c. $f'(x) = \frac{7}{x}$

d. $f'(x) = (2x + 3x^2)e^{x^2+x^3}$

e. Write $f(x) = \log_e 7 - 2 \log_e x$ so that $f'(x) = -\frac{2}{x}$.

f. $f'(x) = -e^{-x}$

g. $f'(x) = \frac{e^x + 3x^2}{e^x + x^3}$

h. Write $f(x) = \ln e^x + \frac{3}{\ln x}$ so that $f'(x) = 1 + \frac{3}{x}$.

i. Write $f(x) = \ln(x^2 + 1) - \ln(x^3 - x)$ so that $f'(x) = \frac{2x}{x^2 + 1} - \frac{3x^2 - 1}{x^3 - x}$.