What you'll Learn About
How to take the derivative of exponential and logarithmic functions

A) $y = 5^x$

$y = 5^x$

$y' = 5^x \ln(5) \cdot 1$

(original) (ln base) $\frac{d}{dx}$(power)

B) $y = 7^{x^2}$

$y = 7^{x^2}$

$y' = 7^{x^2} \cdot \ln 7 \cdot 2x$

C) $y = 5^{\sin x}$

$y = 5^{\sin x}$

$y' = 5^{\sin x} \cdot \ln 5 \cdot \cos x$

D) $y = 6^{\arctan x^3}$

$y = 6^{\arctan(x^3)}$

$y' = 6^{\arctan(x^3)} \cdot \ln 6 \cdot \left(\frac{1}{1+(x^3)^2} \cdot 3x^2\right)$

E) $y = e^x$

$y = e^x$

$y' = e^x \cdot \ln e \cdot 1 = e^x$

F) $y = 5e^{5x}$

$y = 5(e^{5x})$

$y' = 5e^{5x} \ln e \cdot 5 = 25e^x$

G) $y = (5e)^{5x}$

$y = (5e)^{5x}$

$y' = (5e)^{5x} \cdot \ln(5e) \cdot 5$

H) $y = e^{\frac{-3}{4}x}$

$y = e^{-3/4 x}$

$y' = e^{-3/4 x} \cdot \ln e \cdot -\frac{3}{4}$

I) $y = x^3 e^{4x} - x^4 e^{2x}$

$y = (x^3 e^{4x}) - (x^4 e^{2x})$

$y' = x^3(e^{4x} \cdot \ln e \cdot 4) + e^{4x}(3x^2) - \left[x^4(e^{2x} \ln e \cdot 2) + e^{2x} \cdot 4x^3\right]$

B) ~~$y = 7^{x^2}$~~

$y' = \frac{-3}{4e^{3/4 x}}$

$\frac{1}{3x\ln 6}$

A) $y = \log_5(x^3)$

$y = \log_5(x^3)$

$y' = \frac{3x^2}{(x^3)\ln 5} = \frac{3}{x\ln 5}$

B) $y = \log_6 \sqrt[3]{x}$

$y = \log_6(x^{1/3})$

$y' = \frac{1}{x^{1/3}\cdot\ln 6}\cdot\frac{1}{3}x^{-2/3} = \frac{1}{3x^{2/3}x^{1/3}\ln 6}$

$\frac{-1}{x\ln 5}$

C) $y = \log_5\left(\frac{4}{x}\right)$

$y = \log_5(4x^{-1})$

$y' = \frac{1}{(4x^{-1})\ln 5}\cdot -4x^{-2}$

$\frac{-x}{x^2\ln 5}$ ←

D) $y = \frac{5}{\log_7(x^2)}$

$y = 5(\log_7(x^2))^{-1}$

$y' = -5(\log_7(x^2))^{-2}\cdot\frac{1}{x^2\ln 7}\cdot 2x$

E) $y = \ln x$

$y = \ln x$

$\frac{dy}{dx} = \frac{1}{x\cdot\ln e} = \frac{1}{x}$

F) $y = \ln(x^4)$

$y = \ln(x^4)$

$y' = \frac{1}{x^4\cdot\ln e}\cdot 4x^3 = \frac{4}{x}$

$y = \ln^4 x$ ←

G) $y = (\ln x)^4$

$y = (\ln x)^4$

$y' = 4(\ln x)^3\cdot\frac{1}{x}$

H) $y = \ln\left(\frac{5}{x}\right) = \ln(5x^{-1})$

$y' = \frac{1}{(5x^{-1})\ln e}\cdot -5x^{-2} = \frac{-x}{x^2} = \frac{-1}{x}$

I) $y = x^3\ln(x^2) - \ln(\ln(\arcsin x))$

$y = (x^3\ln(x^2)) - \ln(\ln(\arcsin x))$

$y' = \left[x^3\left(\frac{1}{x^2\ln e}\cdot 2x\right) + \ln(x^2)\cdot 3x^2\right] -$

$2x^2 + 3x^2\ln(x^2) - \left(\frac{1}{\ln\arcsin x\cdot\ln e}\cdot\frac{1}{\arcsin x\ln e}\cdot\frac{1}{\sqrt{1-x^2}}\right)$