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

$y = x^5$

$\frac{dy}{dx} = 5x^4$

A) $y = 5^x$

$y = 5^x$

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

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

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

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

$\frac{dy}{dx} = 5^{\sin x}\cdot \ln 5 \cdot \cos x$

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

$\frac{dy}{dx} = 6^{\arctan(x^3)}\cdot(\ln 6)\cdot\frac{1}{1+(x^3)^2}\cdot 3x^2$

$e = 2.718....$

$\ln_e e = 1$

$\ln_e e = 1$

E) $\boxed{y = e^x}$

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

$\boxed{\frac{dy}{dx} = e^x}$

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

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

$y' = 25e^{5x}$

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

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

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

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

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

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

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

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

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

$y' =$

$y = \log_5(x^3)$

$5^y = x^3$

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

$y' = \frac{1}{x^3 \cdot \ln 5} \cdot 3x^2 = \frac{3x^2}{x^3 \ln 5} = \frac{3}{x \ln 5}$

B) $y = \log_6 \sqrt[3]{x} = \log_6(x^{1/3})$

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

$= \frac{1}{x^{1/3} \cdot \ln 6 \cdot 3 \cdot x^{2/3}} = \boxed{\frac{1}{3x \ln 6}}$

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

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

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

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

$y' = -5(\log_7(x^2))^{-2} \cdot \frac{2x}{x^2 \ln 7} = \frac{-10}{x \ln 7 (\log_7 x^2)^2}$

$y = \ln_e x$

$y = \log_{10} x$

E) $y = \ln(x)$

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

$\boxed{y' = \frac{1}{x}}$

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

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

$y = \ln(x^9)$

$y' = \frac{9}{x}$

$y = \ln(x^{20})$

$y' = \frac{20}{x}$

$y = \ln^4 x$

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

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

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

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

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

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

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

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

$y' = x^3 \cdot \frac{2x}{x^2 \cdot \ln e} + \ln(x^2) \cdot 3x^2 - \frac{1}{\ln(\arcsin x) \cdot \ln e} \cdot \frac{1}{\sqrt{1-x^2}}$

$y' = 2x^2 + 3x^2 \ln(x^2)$