

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) (base) $\frac{d}{dx}(\text{power})$

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

$y = 5^{\sin x}$

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

E) $y = e^x$

$y = e^x$

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

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

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

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

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

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

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

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

$y = 7^{x^2}$

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

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

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

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

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

$y = 5e^{5x}$

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

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

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

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

~~B)~~ $y = x^{-\frac{3}{4}}$

$y' = -\frac{3}{4} x^{-\frac{3}{4}-1} = -\frac{3}{4} x^{-\frac{7}{4}}$

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

$$\frac{-x}{x^2 \ln 5}$$

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

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

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

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

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

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

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

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

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

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

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

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