

Chain Rule Practice with Logs and Exponentials - Key

1. $y = x^\pi$
Type: u^a
 $y' = \boxed{\pi x^{\pi-1}}$

7. $y = 3^{\sin x}$
Type: a^u
 $y' = \boxed{3^{\sin x} \cdot \ln 3 \cdot \cos x}$

2. $y = x^{1+\sqrt{2}}$
Type: u^a
 $y' = \boxed{(1+\sqrt{2})x^{\sqrt{2}}}$

8. $y = e^{\tan x}$
Type: e^u or a^u
 $y' = \boxed{e^{\tan x} \cdot \sec^2 x}$

3. $y = x^{-\sqrt{2}}$
Type: u^a
 $y' = \boxed{-\sqrt{2}x^{-\sqrt{2}-1}}$

9. $y = \ln^2 x = (\ln x)^2$
Type: $\ln u$
 $y' = 2 \ln x \cdot \frac{1}{x} = \boxed{\frac{2 \ln x}{x}}$

4. $y = x^e$
Type: u^a
 $y' = \boxed{e x^{e-1}}$

10. $y = \frac{1}{\ln x} = (\ln x)^{-1}$
Type: $\ln u$
 $y' = -(\ln x)^{-2} \cdot \frac{1}{x} = \boxed{\frac{-1}{x(\ln x)^2}}$

5. $y = 7^x$
Type: a^u
 $y' = \boxed{7^x \cdot \ln 7}$

6. $y = 10^{-x}$
Type: a^u
 $y' = 10^{-x} \cdot \ln 10 \cdot -1$

$y' = \boxed{-\ln 10 \cdot 10^{-x}}$

$$11. y = x^x \quad \text{Type: } u^v$$

$$\ln y = x \cdot \ln x$$

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

$$\frac{1}{y} \frac{dy}{dx} = 1 + \ln x$$

$$\frac{dy}{dx} = y (1 + \ln x)$$

$$\frac{dy}{dx} = \boxed{x^x (1 + \ln x)}$$

$$14. y = \tan^2 x = (\tan x)^2$$

$$\text{Type: } u^a$$

$$y' = \boxed{2 \tan x \cdot \sec^2 x}$$

$$15. y = \log_8 x^2$$

$$\text{Type: } \log_a u$$

$$y' = \frac{1 \cdot 2x}{x^2 \cdot \ln 8} = \boxed{\frac{2}{x \cdot \ln 8}}$$

$$12. y = (\sin x + 2)^{\sqrt{2}}$$

$$\text{Type: } u^a$$

$$y' = \boxed{\sqrt{2} (\sin x + 2)^{\sqrt{2}-1} \cdot \cos x}$$

$$13. y = x^{\sin x}$$

$$\text{Type: } u^v$$

$$\ln y = \sin x \cdot \ln x$$

$$\frac{1}{y} \frac{dy}{dx} = \sin x \cdot \frac{1}{x} + \ln x \cdot \cos x$$

$$\frac{dy}{dx} = y \left(\frac{\sin x}{x} + \ln x \cdot \cos x \right)$$

$$\frac{dy}{dx} = \boxed{x^{\sin x} \left(\frac{\sin x}{x} + \ln x \cdot \cos x \right)}$$

$$17. y = \log(3x^2 - x)$$

$$\text{Type: } \log_a u$$

$$y' = \frac{1(6x-1)}{(3x^2-x)\ln 10} = \boxed{\frac{6x-1}{(3x^2-x)\ln 10}}$$

$$16. y = \log_5 \sqrt{x}$$

$$\text{Type: } \log_a u$$

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

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

$$18. y = \log \sqrt{1-x^2}$$

Type: $\log_a u$

$$y' = \frac{1}{\sqrt{1-x^2} \cdot \ln 10} \cdot \frac{-2x}{2\sqrt{1-x^2}}$$

$$y' = \boxed{\frac{-x}{(1-x^2)\ln 10}}$$

$$19. y = \log(1/x)$$

Type: $\log_a u$

$$y' = \frac{1}{(1/x)\ln 10} \cdot \frac{-1}{x^2}$$

$$y' = \boxed{\frac{-1}{x \ln 10}}$$

$$20. y = \frac{1}{\log x} = (\log x)^{-1}$$

Type: $\log_a u$

$$y' = -(\log x)^{-2} \cdot \frac{1}{x \cdot \ln 10}$$

$$y' = \boxed{\frac{-1}{x \cdot \ln 10 \cdot (\log x)^2}}$$

$$21. y = \ln 10 \cdot \log x$$

Type: $\log_a u$

$$y' = \frac{\ln 10}{x \cdot \ln 10} = \boxed{\frac{1}{x}}$$

$$22. y = \log_3(2+x\ln 3)$$

Type: $\log_a u$

$$y' = \frac{1 \cdot \ln 3}{(2+x\ln 3)\ln 3} = \boxed{\frac{1}{2+x\ln 3}}$$

$$23. y = \log e^x$$

Type: $\log_a u$

$$y' = \frac{1 \cdot e^x}{e^x \cdot \ln 10} = \boxed{\frac{1}{\ln 10}}$$

$$24. y = \ln 10^x$$

Type: $\ln u$

$$y' = \frac{1}{10^x} \cdot 10^x \cdot \ln 10 = \boxed{\ln 10}$$