Logarithms Rule … Set 1

Differentiation - Logs and Exponentials

Differentiate each function with respect to x.

1) $y = 4^{4x^4}$

2) $y = 4^{-5x^3}$

3) $y = \log_3 3x^2$

4) $y = \log_2 4x^2$

5) $y = \log_3 (3x^5 + 5)^5$

6) $y = \log_5 (-5x^3 - 2)^3$

7) $y = (4^{x^3} + 2)^3$

8) $y = 3^{(x^4+1)^3}$

9) $y = 3^{\cos 3x^4}$

10) $y = \log_5 \tan 4x^4$

Logarithms Rule … Set 1

Answers

Differentiate each function with respect to x.

1) $y = 4^{4x^4}$

$$\frac{dy}{dx} = 4^{4x^4} \ln 4 \cdot 16x^3$$
$$= x^3 \cdot 4^{4x^4+2} \ln 4$$

2) $y = 4^{-5x^3}$

$$\frac{dy}{dx} = 4^{-5x^3} \ln 4 \cdot -15x^2$$
$$= -\frac{15x^2 \ln 4}{4^{5x^3}}$$

3) $y = \log_3 3x^2$

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

4) $y = \log_2 4x^2$

$$\frac{dy}{dx} = \frac{1}{4x^2 \ln 2} \cdot 8x$$
$$= \frac{2}{x \ln 2}$$

5) $y = \log_3 (3x^5 + 5)^5$

$$\frac{dy}{dx} = \frac{1}{(3x^5+5)^5 \ln 3} \cdot 5(3x^5+5)^4 \cdot 15x^4$$
$$= \frac{75x^4}{\ln 3 \cdot (3x^5+5)}$$

6) $y = \log_5 (-5x^3 - 2)^3$

$$\frac{dy}{dx} = \frac{1}{(-5x^3-2)^3 \ln 5} \cdot 3(-5x^3-2)^2 \cdot -15x^2$$
$$= -\frac{45x^2}{\ln 5 \cdot (-5x^3-2)}$$

7) $y = (4^{x^3} + 2)^3$

$$\frac{dy}{dx} = 3(4^{x^3}+2)^2 \cdot 4^{x^3} \ln 4 \cdot 3x^2$$
$$= 9x^2(4^{x^3}+2)^2 \cdot 4^{x^3} \ln 4$$

8) $y = 3^{(x^4+1)^3}$

$$\frac{dy}{dx} = 3^{(x^4+1)^3} \ln 3 \cdot 3(x^4+1)^2 \cdot 4x^3$$
$$= 4x^3 \cdot 3^{(x^4+1)^3+1} \cdot (x^4+1)^2 \ln 3$$

9) $y = 3^{\cos 3x^4}$

$$\frac{dy}{dx} = 3^{\cos 3x^4} \ln 3 \cdot -1 \sin 3x^4 \cdot 12x^3$$
$$= -4x^3 \cdot 3^{\cos 3x^4+1} \sin 3x^4 \cdot \ln 3$$

10) $y = \log_5 \tan 4x^4$

$$\frac{dy}{dx} = \frac{1}{\tan 4x^4 \cdot \ln 5} \cdot \sec^2 4x^4 \cdot 16x^3$$
$$= \frac{16x^3 \cdot \sec^2 4x^4}{\tan 4x^4 \cdot \ln 5}$$