

$$\frac{d}{dx} [2^x] = 2^x \cdot \ln 2 \cdot x'$$

$$= 2^x \ln 2$$

$$\frac{d}{dx} [\log_2 x] = \frac{x'}{x \ln 2} = \frac{1}{x \ln 2}$$

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

$$\log_2 8 = 3 \Leftrightarrow 2^3 = 8$$

$$\log_a b = c \Leftrightarrow a^c = b$$

$$[e^x]' = e^x$$

$$[a^u]' = a^u \cdot \ln a \cdot u'$$

$$e^x \cdot \ln e \cdot x'$$

$$[\ln x]' = [\log_e x]'$$

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

$$f(x) = \ln[\sin(5x^3 + 2x)]$$

$$f'(x) = \frac{1}{\sin(5x^3 + 2x)} \cdot [\sin(5x^3 + 2x)]'$$

$$= \frac{1}{\sin(5x^3 + 2x)} \cdot [\cos(5x^3 + 2x)] \cdot (5x^3 + 2x)'$$

$$= \frac{(15x^2 + 2) \cos(5x^3 + 2x)}{\sin(5x^3 + 2x)}$$

$$= (15x^2 + 2) \cot(5x^3 + 2x)$$

$$f(x) = (\sec x) (5^{\sin x})$$

$$\begin{aligned} f'(x) &= (\sec x)' (5^{\sin x}) + (\sec x) (5^{\sin x})' \\ &= (\sec x \tan x) 5^{\sin x} + (\sec x) (5^{\sin x}) \cdot \cos x \cdot \ln 5 \\ &= (\sec x \tan x) \cdot 5^{\sin x} + 5^{\sin x} \cdot \ln 5 \end{aligned}$$

$$f(x) = \frac{(x^2 \ln x)}{(\sin x)} = (\csc x)(x^2 \ln x)$$

$$\begin{aligned} f'(x) &= (\csc x)' (x^2 \ln x) + (\csc x) (x^2 \ln x)' \\ &= (-\csc x \cot x) x^2 \ln x + \csc x [x^2 (\ln x)' + (x^2)' \ln x] \\ &= (-\csc x \cot x) x^2 \ln x + \csc x (x^2 \cdot \frac{1}{x} + 2x \ln x) \\ &= -x^2 \ln x \csc x \cot x + x \csc x + 2x \ln x \csc x \end{aligned}$$

$$f'(x) = \frac{(\sin x)(x^2 \ln x)' - (x^2 \ln x)(\sin x)'}{\sin^2 x}$$

$$= \frac{(\sin x)(2x \ln x + x) - x^2 \ln x \cos x}{\sin^2 x}$$

$$f(x) = \sqrt[3]{\sin^2(\ln(4x^9))}$$

$$= [\sin(\ln(4x^9))]^{2/3}$$

$$f'(x) = \frac{2}{3} [\sin(\ln(4x^9))]^{-1/3} \cdot \cos(\ln(4x^9)) \cdot \frac{1}{4x^8} \cdot 36x^8$$

$$= \frac{6 \cos(\ln(4x^9))}{x \sqrt[3]{\sin(\ln(4x^9))}}$$

$[\ln(f(x))] = \frac{f'(x)}{f(x)}$

$$f(x) = 5^{\sqrt[3]{4 \log_2(3x^2 - 4x)}}$$

$$f'(x) = 5^{\sqrt[3]{4 \log_2(3x^2 - 4x)}} \cdot \ln 5 \cdot \left( \sqrt[3]{4 \log_2(3x^2 - 4x)} \right)'$$

$$= g(x) \cdot \frac{1}{3} (4 \log_2(3x^2 - 4x))^{-2/3} \cdot 4 \cdot (6x - 4) \cdot \frac{1}{(3x^2 - 4x) \ln 2}$$

$$= \frac{5^{\sqrt[3]{4 \log_2(3x^2 - 4x)}} (\ln 5) (24x - 16)}{(9x^2 - 12x) \ln 2 (4 \log_2(3x^2 - 4x))^{2/3}}$$