

Differentiate each of the following functions.

1.) $f(x) = (x+3)^{100}(2-x)^5$

9.) $f(x) = \ln\left(\frac{2x+3}{5x-1}\right)$

2.) $f(x) = \log_5(x^2 - \cos x)$

10.) $f(x) = \log_2\left(\sin\left(\frac{1}{x^2-1}\right)\right)$

3.) $f(x) = \frac{\sqrt{x^3 - 5x + 1}}{x^2 - 5}$

11.) $f(x) = x^{10} \ln(x^{10})$

4.) $f(x) = \ln(\cos x)$

12.) $f(x) = \log_9(x^2 - 4x + 4) - \log_9(x - 2)$

5.) $f(x) = x \ln x - x$

13.) $f(x) = \frac{1}{\ln(x^{2009})}$

6.) $f(x) = \frac{\ln(5x^2)}{x^3}$

14.) $f(x) = \frac{\ln(\sin(x))}{\cos(\ln(x))}$

7.) $f(x) = \log_3(7x^3 - 3x^7 + 2)$

15.) $f(x) = \log_2(\sqrt{x^6 - 4x^3 + 100})$

8.) $f(x) = \log_3(x) \cdot \log_x 3$

16.) $f(x) = \log_{11}\left(3x^2 - \frac{1}{x^5}\right)$

Answers

$$1.) \quad f'(x) = 5(x+3)^{99}(2-x)^4(-21x+37) \quad 2.) \quad f'(x) = \frac{1}{\ln 5} \cdot \frac{2x + \sin x}{x^2 - \cos x}$$

$$3.) \quad f'(x) = \frac{3x^2 - 5}{2(x^2 - 5)\sqrt{x^3 - 5x + 1}} - \frac{2x\sqrt{x^3 - 5x + 1}}{(x^2 - 5)^2} \quad 4.) \quad f'(x) = -\tan x \quad 5.) \quad f'(x) = \ln x$$

$$6.) \quad f'(x) = \frac{2}{x^4} - \frac{3 \ln(5x^2)}{x^4} \quad 7.) \quad f'(x) = \frac{21x^2 - 21x^6}{(7x^3 - 3x^7 + 2) \ln 3} \quad 8.) \quad f'(x) = 0$$

$$9.) \quad f'(x) = \frac{2}{2x+3} - \frac{5}{5x-1} = -\frac{17}{(2x+3)(5x-1)} \quad 10.) \quad f'(x) = \frac{-2x \cos\left(\frac{1}{x^2-1}\right)}{(\ln 2)(x^2-1)^2 \left(\sin \frac{1}{x^2-1}\right)}$$

$$11.) \quad f'(x) = 10x^9 + 100x^9 \ln x \quad 12.) \quad f'(x) = \frac{1}{(x-2) \ln 9} \quad 13.) \quad f'(x) = -\frac{1}{2009x \ln^2 x}$$

$$14.) \quad f'(x) = \frac{\frac{\cos x}{\sin x} \cdot \cos(\ln(x)) + \ln(\sin(x)) \cdot \sin(\ln x) \cdot \frac{1}{x}}{\cos^2(\ln x)} \quad 15.) \quad f'(x) = \frac{3x^5 - 6x^2}{(x^6 - 4x^3 + 100) \ln 2}$$

$$16.) \quad f'(x) = \frac{6x + \frac{5}{x^6}}{\left(3x^2 - \frac{1}{x^5}\right) \ln 11}$$