

1-6: Use logarithmic differentiation to find the derivative of the function.

1.  $y = (x+2)^2 (x^4 + 4)^4$

2.  $y = \sqrt{\frac{x-1}{x^4+1}}$

3.  $y = x^x$

4.  $y = x^{\cos x}$

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

6.  $y = \sqrt{x}^x$

## Derivatives Using Implicit

## Derivatives (2)

Day 3

7.  $f(x) = \frac{(3x+2)^6(x^2-1)^5}{\sqrt{2x+1}}$

8.  $y = x^{x+1}$

9.  $f(x) = (2x-3)^x$

10.  $y = (\sin x)^{x+1}$

11.  $y = (2x-5)^{3x+2}$

12.  $f(x) = \sqrt[3]{(3x^2-5)^5} \cdot \frac{(x-3)^4}{(4x+7)^3}$

13.  $\lim_{h \rightarrow 0} \frac{\sqrt{25+h} - 5}{h}$

14.  $f(x) = \begin{cases} x^2 - 5 & x < 3 \\ 2x - 2 & x > 3 \\ 1 & x = 3 \end{cases}$

15.  $g(x) = x^2 e^{5x}$  find  $g'(x)$

Is  $f(x)$  continuous? If not where  $f(x)$  discontinuous and why?

16.  $h(x) = \sec^3(e^{2x})$  find  $h'(x)$

17.  $m(x) = \sqrt{e^x}$  find  $m'(x)$

18.  $\ell(x) = e^{\sqrt{x}}$  find  $\ell'(x)$

**Answers:**

1)  $\frac{dy}{dx} = \left[ \frac{2}{x+2} + \frac{16x^3}{x^4+4} \right] (x+2)^2 (x^4+4)^4$

2)  $\frac{dy}{dx} = \left[ \frac{1}{2(x-1)} - \frac{2x^3}{x^4+1} \right] \sqrt{\frac{x-1}{x^4+1}}$

3)  $\frac{dy}{dx} = [1 + \ln x] x^x$

4)  $\frac{dy}{dx} = \left[ \frac{\cos x}{x} - \sin x \cdot \ln x \right] x^{\cos x}$

5)  $\frac{dy}{dx} = \left[ \frac{\sin x}{x} + \cos x \cdot \ln x \right] x^{\sin x}$

6)  $\frac{dy}{dx} = \left[ \frac{1}{2} + \frac{1}{2} \ln x \right] \sqrt{x}$

7)  $\frac{dy}{dx} = \left[ \frac{18}{3x+2} + \frac{10x}{x^2-1} - \frac{1}{2x+1} \right] \frac{(3x+2)^6 (x^2-1)^5}{\sqrt{2x+1}}$

8)  $\frac{dy}{dx} = \left[ \frac{x+1}{x} + \ln x \right] x^{x+1}$

9)  $\frac{dy}{dx} = \left[ \frac{2x}{2x-3} + \ln(2x-3) \right] (2x-3)^x$

10)  $\frac{dy}{dx} = [\cot x (x+1) + \ln(\sin x)] \sin x^{x+1}$

11)  $\frac{dy}{dx} = \left[ \frac{2(3x+2)}{2x-5} + 3 \ln(2x-5) \right] (2x-5)^{3x+2}$

12)  $\frac{dy}{dx} = \left[ \frac{10x}{3x^2-5} + \frac{4}{x-3} - \frac{12}{4x+7} \right] \frac{\sqrt[3]{(3x^2-5)^5} (x-3)^4}{(4x+7)^3}$

13)  $\frac{1}{10}$

14) Discontinuous at  $x = 3$  because  $\lim_{x \rightarrow 3} f(x) \neq f(3)$

15)  $g'(x) = x e^{5x} (5x + 2)$

16)  $h'(x) = 6e^{2x} \sec^3(e^{2x}) \tan(e^{2x})$

17)  $m'(x) = \frac{e^x}{2\sqrt{e^x}}$

18)  $\ell'(x) = \frac{e^{\sqrt{x}}}{2\sqrt{x}}$