

Derivatives of Ln & Exponential Functions

Directions: Find the derivative of each of the following functions.

1. $y = \ln(x^2)$
 $y = 2 \ln x$
 $y' = \frac{2}{x}$

2. $y = \ln\left(\frac{1}{x}\right)$
 $y = \ln 1 - \ln x$
 $y = -\ln x$
 $y' = -\frac{1}{x}$

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

4. $y = \ln(2 - \cos x)$
 $y' = \frac{\sin x}{2 - \cos x}$

5. $y = (\ln x)^2$
 $y' = 2 \ln x \cdot \frac{1}{x}$
 $y' = \frac{2}{x} \ln x$

6. $y = \ln\left(\frac{10}{x}\right)$
 $y = \ln 10 - \ln x$
 $y = -\ln x$
 $y' = -\frac{1}{x}$

7. $y = \ln(2x^2 + 2)$
 $y' = \frac{4x}{2x^2 + 2}$

$y' = \frac{2x}{x^2 + 1}$

8. $y = \ln(x^2 + 1)$
 $y' = \frac{2x}{x^2 + 1}$

9. $y = \ln(\ln x)$
 $y' = \frac{1}{\ln x} \cdot \frac{1}{x}$
 $y' = \frac{1}{x \ln x}$

10. $y = x \ln x - x$
 $y' = (x)\left(\frac{1}{x}\right) + (\ln x)(1) - 1$
 $y' = 1 - \ln x - 1$
 $y' = -\ln x$

11. $y = \ln \frac{x+2}{x-2}$
 $y = \ln(x+2) - \ln(x-2)$
 $y' = \frac{1}{x+2} - \frac{1}{x-2}$

12. $y = \ln[7x(x-3)(x-2)]$
 $y = \ln 7x + \ln(x-3) + \ln(x-2)$
 $y' = \frac{1}{x} + \frac{1}{x-3} + \frac{1}{x-2}$

13. $y = \ln \sqrt{\frac{4x+1}{5x-3}}$
 $y = \frac{1}{2} (\ln(4x+1) - \ln(5x-3))$
 $y' = \frac{1}{2} \left(\frac{4}{4x+1} - \frac{5}{5x-3} \right)$

14. $y = \ln \frac{x^2}{(x-5)^3}$
 $y = \ln x^2 - \ln(x-5)^3$
 $y = 2 \ln x - 3 \ln(x-5)$
 $y' = \frac{2}{x} - \frac{3}{x-5}$

15. $y = \ln \left(\frac{x-3}{x+2} \right)^2$
 $y = 2(\ln(x-3) - \ln(x+2))$
 $y' = 2 \left(\frac{1}{x-3} - \frac{1}{x+2} \right)$

16. $y = 2e^x$
 $y' = 2e^x$

17. $y = e^{2x}$
 $y' = 2e^{2x}$

18. $y = e^{-x}$
 $y' = -e^{-x}$

19. $y = e^{\frac{2x}{3}}$
 $y' = \frac{2}{3} e^{\frac{2x}{3}}$

20. $y = e^{-\frac{x}{4}}$
 $y' = -\frac{1}{4} e^{-\frac{x}{4}}$

21. $y = xe^2 - e^x$
 $y' = (x)(0) + (e^2)(1) - e^x$
 $y' = e^2 - e^x$

22. $y = x^2 e^x - x e^x$
 $y = x e^x (x-1)$
 $y' = (x e^x)(1) + (x-1)[(x)(e^x) + (e^x)(1)]$
 $y' = e^x (x + x(x-1) + x-1)$

23. $y = e^{\sqrt{x}}$
 $y' = e^{\sqrt{x}} (x^{-1/2})$
 $y' = \frac{1}{2\sqrt{x}} e^{\sqrt{x}}$

24. $y = e^{\sin x}$
 $y' = \cos x e^{\sin x}$

25. $y = e^{x^3} \ln(x^2)$
 $y' = (e^{x^3})\left(\frac{2}{x}\right) + (\ln x^2)(3x^2 e^{x^3})$
 $y' = e^{x^3} \left(\frac{2}{x} + 3x^2 \ln x^2 \right)$

26. $y = \frac{e^{3x}}{\ln e^{4x^2}} = \frac{e^{3x}}{4x^2}$
 $y' = \frac{(4x^2)(3e^{3x}) - (e^{3x})(8x)}{(4x^2)^2}$
 $y' = \frac{xe^{3x}(12x-8)}{16x^4}$

27. $y = \frac{e^{2x}}{(x^2)(2e^{2x})x^2} = \frac{e^{2x}}{2x^4}$
 $y' = \frac{(x^2)(2e^{2x})x^2 - (e^{2x})(2x)}{x^8}$
 $y' = \frac{2xe^{2x}(x-1)}{x^4} = \frac{2e^{2x}(x-1)}{x^3}$

28. $y = \sin(e^{2x})$
 $y' = \cos(e^{2x}) \cdot 2e^{2x}$
 $y' = 2e^{2x} \cos(e^{2x})$

29. $y = (2x)e^{2x+3}$
 $y' = (2x)(2e^{2x+3}) + (e^{2x+3})(2)$
 $y' = 2e^{2x+3}(8x^2+1)$

30. $y = (e^{x^2} + x)^3$

$y' = 3(e^{x^2} + x)^2 (2xe^{x^2} + 1)$