

Exponential and Logarithmic Derivatives Worksheet

This worksheet is arranged in order of increasing difficulty.

For problems 1-8, find the derivative of the given function:

1. $f(x) = \ln(x)$

2. $f(x) = e^x$

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

4. $f(x) = \log_{10}(x)$

5. $f(x) = 8^x - \log_6(x)$

6. $f(x) = \log_4(x) + 16^x$

7. $f(x) = 4e^x - 4^x$

8. $f(x) = 6 \ln(x)$

For problems 9-13, find the derivative of the function at the given point:

9. $f(x) = 2e^x - x$, at $x = 1$

10. $f(x) = x^3 - 5x$, at $x = 2$

11. $f(x) = \ln(x) - 3^x$, at $x = 3$

12. $f(x) = 6 \cdot 5^x + \log_{10}(x)$, at $x = 2$

13. $f(x) = 10 \cdot e^x + 7x$, at $x = 0$

For problems 14-28, find the derivative of the given function

14. $f(x) = e^{-3x}$

15. $f(x) = -e^{3x^2}$

16. $f(x) = \frac{5x}{e^x}$

17. $f(x) = \frac{3x^3}{e^x}$

18. $f(x) = x^3 \ln(x)$

19. $f(x) = \log_7(3x)$

20. $f(x) = \log_3(x^2 + 1)$

21. $f(x) = \frac{\log_{10}(x)}{x}$

22. $f(x) = \frac{e^{2x}}{x}$

23. $f(x) = \frac{(e^x)^4}{x^2}$

24. $f(x) = x^2 \ln(x^2 + 3x)$

25. $f(x) = x^3 \cdot 8^x$

26. $f(x) = \frac{(2x)^2}{e^{2x}}$

27. $f(x) = x^5 \log_2(x^2)$

28. $f(x) = \frac{e^{2x}}{x^2}$

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Key

This worksheet is arranged in order of increasing difficulty.

For problems 1-8, find the derivative of the given function:

1. $f(x) = \ln(x) \Rightarrow f'(x) = \frac{1}{x}$
2. $f(x) = e^x \Rightarrow f'(x) = e^x$
3. $f(x) = 2^x \Rightarrow f'(x) = 2^x \cdot \ln(2) \cdot (1)$
4. $f(x) = \log_{10}(x) \Rightarrow f'(x) = \frac{1}{\ln(10)} \cdot \frac{1}{x}$
5. $f(x) = 8^x - \log_6(x) \Rightarrow f'(x) = [8^x \cdot \ln(8) \cdot (1)] - [\frac{1}{\ln(6)} \cdot \frac{1}{x}]$
6. $f(x) = \log_4(x) + 16^x \Rightarrow f'(x) = \frac{1}{\ln(4)} \cdot \frac{1}{x} + 16^x \cdot \ln(16) \cdot (1)$
7. $f(x) = 4e^x - 4^x \Rightarrow f'(x) = 4e^x - 4^x \cdot \ln(4) \cdot (1)$
8. $f(x) = 6 \ln(x) \Rightarrow f'(x) = 6 \cdot \frac{1}{x}$

For problems 9-13, find the derivative of the function at the given point:

9. $f(x) = 2e^x - x$, at $x=1 \Rightarrow f'(x) = 2e^x - 1 \Rightarrow f'(1) = 2e^1 - 1$
10. $f(x) = x^3 - 5x$, at $x=2 \Rightarrow f'(x) = 3x^2 - 5 \Rightarrow f'(2) = 12 - 5 = 7$
11. $f(x) = \ln(x) - 3^x$, at $x=3 \Rightarrow f'(x) = \frac{1}{x} - 3^x \cdot \ln(3) \cdot (1) \Rightarrow f'(3) = \frac{1}{3} - 27 \cdot \ln(3)$
12. $f(x) = 6 \cdot 5^x + \log_{10}(x)$, at $x=2 \Rightarrow f'(x) = 6 \cdot 5^x \cdot \ln(5) \cdot (1) + \frac{1}{\ln(10)} \cdot \frac{1}{x} \Rightarrow f'(2) = 150 \cdot \ln(5) + \frac{1}{\ln(10)} \cdot \frac{1}{2}$
13. $f(x) = 10 \cdot e^x + 7x$, at $x=0 \Rightarrow f'(x) = 10e^x + 7 \Rightarrow f'(0) = 10e^0 + 7 = 10 + 7 = 17$

For problems 14-28, find the derivative of the given function

14. $f(x) = e^{-3x} \rightarrow f'(x) = e^{-3x} \cdot \ln(e) \cdot (-3)$
15. $f(x) = -e^{3x^2} \rightarrow f'(x) = -e^{3x^2} \cdot \ln(e) \cdot (6x)$
16. $f(x) = \frac{5x}{e^x} \rightarrow f'(x) = \frac{e^x \cdot (5) - 5x \cdot e^x}{(e^x)^2}$
17. $f(x) = \frac{3x^3}{e^x} \rightarrow f'(x) = \frac{e^x \cdot 9x^2 - 3x^3 \cdot e^x}{(e^x)^2}$
18. $f(x) = x^3 \ln(x) \rightarrow f'(x) = 3x^2 \cdot \ln(x) + x^3 \cdot \frac{1}{x}$
19. $f(x) = \log_7(3x) \rightarrow f'(x) = \frac{1}{\ln(7)} \cdot \frac{1}{3x} \cdot 3$
20. $f(x) = \log_3(x^2 + 1) \rightarrow f'(x) = \frac{1}{\ln(3)} \cdot \frac{1}{(x^2 + 1)} \cdot (2x)$
21. $f(x) = \frac{\log_{10}(x)}{x} \rightarrow f'(x) = \frac{x \cdot \frac{1}{\ln(10)} \cdot \frac{1}{x} - \log_{10}(x) \cdot (1)}{x^2}$
22. $f(x) = \frac{e^{2x}}{x} \rightarrow f'(x) = \frac{x \cdot e^{2x} \cdot (2) - e^{2x} \cdot (1)}{x^2}$
23. $f(x) = \frac{(e^x)^4}{x^2} \rightarrow f'(x) = \frac{x^2 \cdot 4 \cdot (e^x)^3 \cdot e^x - (e^x)^4 \cdot (2x)}{[x^2]^2}$
24. $f(x) = x^2 \ln(x^2 + 3x) \rightarrow f'(x) = 2x \cdot \ln(x^2 + 3x) + x^2 \cdot \frac{1}{(x^2 + 3x)} \cdot (2x + 3)$
25. $f(x) = x^3 \cdot 8^x \rightarrow f'(x) = 3x^2 \cdot 8^x + x^3 \cdot 8^x \cdot \ln(8) \cdot (1)$
26. $f(x) = \frac{(2x)^2 \cdot e^{2x} \cdot 8x}{e^{2x}} = \frac{4x^2 \cdot 8x}{(e^{2x})^2} = \frac{32x^3}{(e^{2x})^2}$
27. $f(x) = x^5 \log_2(x^2)$
28. $f(x) = \frac{e^{2x}}{x^2} \rightarrow f'(x) = \frac{5x^4 \cdot \log_2(x^2) + x^5 \cdot \frac{1}{\ln(2)} \cdot \frac{1}{x^2} \cdot 2x}{x^2}$
 \downarrow
 $f'(x) = \frac{x^2 \cdot e^{2x} \cdot 2 - e^{2x} \cdot (2x)}{[x^2]^2}$