

## MATH 171 - Derivative Worksheet

*Differentiate these for fun, or practice, whichever you need. The given answers are not simplified.*

- |   |   |  |
|---|---|--|
| 1. $f(x) = 4x^5 - 5x^4$                           | 2. $f(x) = e^x \sin x$                    | 3. $f(x) = (x^4 + 3x)^{-1}$                            |
| 4. $f(x) = 3x^2(x^3 + 1)^7$                       | 5. $f(x) = \cos^4 x - 2x^2$               | 6. $f(x) = \frac{x}{1 + x^2}$                          |
| 7. $f(x) = \frac{x^2 - 1}{x}$                     | 8. $f(x) = (3x^2)(x^{\frac{1}{2}})$       | 9. $f(x) = \ln(xe^{7x})$                               |
| 10. $f(x) = \frac{2x^4 + 3x^2 - 1}{x^2}$          | 11. $f(x) = (x^3)^{\sqrt[5]{2-x}}$        | 12. $f(x) = 2x - \frac{4}{\sqrt{x}}$                   |
| 13. $f(x) = \frac{4(3x-1)^2}{x^2 + 7^x}$          | 14. $f(x) = \sqrt{x^2 + 8}$               | 15. $f(x) = \frac{x}{\sqrt{1 - (\ln x)^2}}$            |
| 16. $f(x) = \frac{6}{(3x^2 - \pi)^4}$             | 17. $f(x) = \frac{(3x^2 - \pi x)^4}{6}$   | 18. $f(x) = \frac{x}{(x^2 + \sqrt{3x})^5}$             |
| 19. $f(x) = (xe^x)^\pi$                           | 20. $f(x) = [\arctan(2x)]^{10}$           | 21. $f(x) = (e^{2x} + e)^{\frac{1}{2}}$                |
| 22. $f(x) = (x^6 + 1)^5(4x + 7)^3$                | 23. $f(x) = (7x + \sqrt{x^2 + 3})^6$      | 24. $f(x) = \frac{\frac{1}{x} + \frac{1}{x^2}}{x - 1}$ |
| 25. $f(x) = \sqrt[3]{x^2} - \frac{1}{\sqrt{x^3}}$ | 26. $f(x) = \sqrt{\frac{2x + 5}{7x - 9}}$ | 27. $f(x) = \frac{\sin x}{\cos x}$                     |
| 28. $f(x) = e^x(x^2 + 3)(x^3 + 4)$                | 29. $f(x) = \frac{5x^2 - 7x}{x^2 + 2}$    | 30. $f(x) = [\ln(5x^2 + 9)]^3$                         |
| 31. $f(x) = \ln(5x^2 + 9)^3$                      | 32. $f(x) = \cot(6x)$                     | 33. $f(x) = \sec^2 x \cdot \tan x$                     |
| 34. $f(x) = \arcsin(2^x)$                         | 35. $f(x) = \tan(\cos x)$                 | 36. $f(x) = [(x^2 - 1)^5 - x]^3$                       |
| 37. $f(x) = \sec x \cdot \sin(3x)$                | 38. $f(x) = \frac{(x-1)^3}{x(x+3)^4}$     | 39. $f(x) = \log_5(3x^2 + 4x)$                         |

In problems 40 – 42, find  $\frac{dy}{dx}$ . Assume  $y$  is a differentiable function of  $x$ .

- |                    |                          |                                   |
|--------------------|--------------------------|-----------------------------------|
| 40. $3y = xe^{5y}$ | 41. $xy + y^2 + x^3 = 7$ | 42. $\frac{\sin y}{y^2 + 1} = 3x$ |
|--------------------|--------------------------|-----------------------------------|

If  $f$  and  $g$  are differentiable functions such that  $f(2) = 3$ ,  $f'(2) = -1$ ,  $f'(3) = 7$ ,  $g(2) = -5$  and  $g'(2) = 2$ , find the numbers indicated in problems 43 – 48.

- |                     |                       |  |
|---------------------|-----------------------|--|
| 43. $(g - f)'(2)$   | 44. $(fg)'(2)$        | 45. $\left(\frac{f}{g}\right)'(2)$     |
| 46. $(5f + 3g)'(2)$ | 47. $(f \circ f)'(2)$ | 48. $\left(\frac{f}{f + g}\right)'(2)$ |

**Answers:** Absolutely not simplified ... you should simplify more.

1.  $f'(x) = 20x^4 - 20x^3$
2.  $f'(x) = e^x \cos x + (\sin x)e^x$
3.  $f'(x) = -1(x^4 + 3x)^{-2}(4x^3 + 3)$
4.  $f'(x) = 3x^2 \cdot 7(x^3 + 1)^6(3x^2) + (x^3 + 1)^7 \cdot 6x$
5.  $f'(x) = 4(\cos x)^3(-\sin x) - 4x$
6.  $f'(x) = \frac{(1+x^2)(1) - x(2x)}{(1+x^2)^2}$
7.  $f'(x) = 1 + x^{-2}$  (*Simplify f first.*)
8.  $f'(x) = 3 \cdot \frac{5}{2} x^{\frac{3}{2}}$  (*Simplify f first.*)
9.  $f'(x) = \frac{1}{x} + 7$  (*Simplify f first.*)
10.  $f'(x) = 4x + 0 + 2x^{-3}$  (*Simplify f first.*)
11.  $f'(x) = x^3 \cdot \frac{1}{5}(2-x)^{-\frac{4}{5}}(-1) + (2-x)^{\frac{1}{5}}(3x^2)$
12.  $f'(x) = 2 + 2x^{-\frac{3}{2}}$
13.  $f'(x) = \frac{(x^2 + 7x)[4 \cdot 2(3x - 1)(3)] - 4(3x - 1)^2(2x + 7x \ln 7)}{(x^2 + 7x)^2}$
14.  $f'(x) = \frac{1}{2}(x^2 + 8)^{-\frac{1}{2}}(2x)$
15.  $f'(x) = \frac{(1 - (\ln x)^2)^{\frac{1}{2}}(1 - x \cdot \frac{1}{2}(1 - (\ln x)^2)^{-\frac{1}{2}}(-2(\ln x) \cdot \frac{1}{x}))}{1 - (\ln x)^2}$
16.  $f'(x) = -24(3x^2 - \pi)^{-5}(6x)$
17.  $f'(x) = \frac{1}{6}[4(3x^2 - \pi x)^3(6x - \pi)]$
18.  $f'(x) = \frac{(x^2 + \sqrt{3x})^5(1) - x[5(x^2 + \sqrt{3x})^4(2x + \frac{1}{2}(3x)^{-\frac{1}{2}} \cdot 3)]}{(x^2 + \sqrt{3x})^{10}}$
19.  $f'(x) = \pi(xe^x)^{(\pi-1)}[xe^x + e^x]$
20.  $f'(x) = 10[\arctan(2x)]^9 \cdot \frac{1}{1 + (2x)^2} \cdot 2$
21.  $f'(x) = \frac{1}{2}(e^{2x} + e)^{-\frac{1}{2}}(e^{2x} \cdot 2 + 0)$
22.  $f'(x) = (x^6 + 1)^5[3(4x + 7)^2(4)] + (4x + 7)^3[5(x^6 + 1)^4(6x^5)]$
23.  $f'(x) = 6(7x + \sqrt{x^2 + 3})^5(7 + \frac{1}{2}(x^2 + 3)^{-\frac{1}{2}} \cdot 2x)$
24.  $f'(x) = \frac{(x-1)(-x^{-2} - 2x^{-3}) - (x^{-1} + x^{-2})(1)}{(x-1)^2}$
25.  $f'(x) = \frac{2}{3}x^{-\frac{1}{3}} + \frac{3}{2}x^{-\frac{5}{2}}$
26.  $f'(x) = \frac{1}{2}\left(\frac{2x+5}{7x-9}\right)^{-\frac{1}{2}} \left[\frac{(7x-9)(2) - (2x+5)(7)}{(7x-9)^2}\right]$
27.  $f'(x) = \sec^2 x$
28.  $f'(x) = [e^x(x^2 + 3)](3x^2) + (x^3 + 4)[e^x(2x) + (x^2 + 3)e^x]$
29.  $f'(x) = \frac{(x^2 + 2)(10x - 7) - (5x^2 - 7x)(2x)}{(x^2 + 2)^2}$
30.  $f'(x) = 3[\ln(5x^2 + 9)]^2 \cdot \frac{1}{5x^2 + 9}(10x + 0)$
31.  $f'(x) = \frac{1}{(5x^2 + 9)^3} \cdot [3(5x^2 + 9)^2(10x + 0)]$
32.  $f'(x) = -\csc^2(6x) \cdot 6$
33.  $f'(x) = \sec^2 x(\sec^2 x) + \tan x[2 \cdot \sec x(\sec x \tan x)]$
34.  $f'(x) = \frac{1}{\sqrt{1 - (2x)^2}} \cdot 2^x \ln 2$
35.  $f'(x) = (\sec^2(\cos x))(-\sin x)$
36.  $f'(x) = 3[(x^2 - 1)^5 - x]^2(5(x^2 - 1)^4 \cdot 2x - 1)$
37.  $f'(x) = \sec x(\cos(3x) \cdot 3) + \sin(3x)(\sec x \tan x)$
38.  $f'(x) = \frac{x(x+3)^4[3(x-1)^2(1)] - (x-1)^3[x \cdot 4(x+3)^3(1) + (x+3)^4(1)]}{x^2(x+3)^8}$
39.  $f'(x) = \frac{1}{(3x^2 + 4x) \cdot \ln 5} \cdot (6x + 4)$
40.  $\frac{dy}{dx} = \frac{e^{5y}}{3 - 5xe^{5y}}$
41.  $\frac{dy}{dx} = \frac{-3x^2 - y}{x + 2y}$
42.  $\frac{dy}{dx} = \frac{3(y^2 + 1)^2}{(y^2 + 1)(\cos y) - 2y \sin y}$
43. 3
44. 11
45.  $\frac{-1}{25}$
46. 1
47. -7
48.  $\frac{-1}{4}$