

# 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.  $f(x) = 2x - \frac{1}{\sqrt{x}}$

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.  $f(x) = \sec^2 x \tan x$~~

~~34.  $f(x) = \arcsin(2^x)$~~

~~35.  $f(x) = \tan(\cos x)$~~

36.  $f(x) = [(x^2 - 1)^5 - x]^3$

~~37.  $f(x) = \sec x \sin(3x)$~~

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.  $(f \circ f)'(2)$

Challenge Problems  $\left(\frac{f}{f+g}\right)'(2)$

**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.  $f'(x) = \frac{1}{\sqrt{1 - (2^x)^2}} \cdot 2^x \ln 2$
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.  $-\frac{1}{4}$