

## MATH 170 - 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.  $f(x) = (x^3)^{\sqrt{2-x}}$

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.  $\frac{-1}{4}$

## Power, Product, and Quotient Rules Worksheet

Find the derivative of each function.

1.  $f(x) = 3x^2 + 5x - 2$

2.  $g(x) = -4x^4 + 5x^3 - 2x + 3$

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

4.  $g(x) = 8\sqrt{x^5} - 7x^4 + \frac{5}{\sqrt{x}}$

5.  $f(x) = \frac{x^2 + 7x - 18}{x + 9}$

6.  $f(x) = \frac{x^2 - 5x - 24}{x - 8}$

7.  $f(x) = \frac{x^{-3} + 7\sqrt{x^3} - 4x^2}{2\sqrt{x}}$

8.  $h(x) = \frac{\frac{2}{x^3} + 5x^2 - 8\sqrt{x^7}}{-3\sqrt{x}}$

9.  $s(x) = 2x^{-3} \sec(x)$

10.  $f(x) = 3x^4 e^x$

11.  $f(x) = -7x^3 e^x$

12.  $f(x) = 5x^2 \cos(x)$

13.  $h(x) = 2e^x \sqrt{x}$

14.  $f(x) = 4x^4 - 5x^3 + 2x^2 e^x$

15.  $f(x) = \frac{\tan(x)}{2x^2 + 1}$

16.  $g(x) = \frac{\sin(x)}{e^x + 5}$

17.  $f(x) = \frac{x^2 - 3x + 2}{x + 3}$

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

19.  $h(x) = \frac{2x^4 \cot(x)}{3x^2}$

20.  $f(x) = \frac{\csc(x)}{-4xe^x}$

## Chain Rule Worksheet

Find the derivative of each function.

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

2.  $f(x) = \sqrt{5x^3 - 2x}$

3.  $y = 3 \sin(x - 3)$

4.  $y = -2 \cos(x^2 + 2)$

5.  $g(x) = \sin^2(3x^2)$

6.  $h(x) = \sec^3(x^2 - 5)$

7.  $f(x) = 3x^3 e^{2x-5}$

8.  $g(x) = -5x^2 e^{x^2+3x}$

9.  $y = 3x^2 \sqrt{4x^2 - 5x + 1}$

10.  $h(t) = \frac{2}{3} t^3 \sqrt{3t^3 - 5t}$

11.  $y = \frac{1}{\sqrt[3]{x^3 - 4x^2 + 1}}$

12.  $g(t) = \frac{-3}{\sqrt[4]{2t^3 + 5t - 3}}$

13.  $g(m) = \sin(\cos(m))$

14.  $f(x) = \cos(\tan x)$

15.  $h(x) = \sqrt{x^3 + 2}(x^2 - 1)^4$

16.  $h(m) = \sqrt{m^2 + 1}(m^2 + 1)^3$

17.  $f(t) = \sqrt[3]{\frac{t^2 + 2}{t^2 - 2}}$

18.  $f(t) = \sqrt[4]{\frac{t^3 + 8}{t^3 - 8}}$

19.  $h(x) = (2x + 5)^7 (3x^4 - 8)^5$

20.  $g(n) = (3x^2 - 2)(4x^3 + 1)$

21.  $f(t) = \csc^2(t^3)$

22.  $f(t) = \cot^4(2t^2)$

23.  $h(x) = e^{\sqrt{2x^3 - x^2}}$

24.  $f(x) = e^{\sqrt{4x^2 - 3x}}$

25.  $h(x) = \frac{3x}{\sqrt[3]{5 + 2x^2}}$

26.  $f(s) = \frac{2s^3}{\sqrt[4]{s^2 - 5s}}$

27.  $f(x) = 5^{\sin x^3}$

28.  $f(x) = 2^{e^{4x}}$