

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. $y = \sec x \tan x$

14. $y = \sqrt{1 + \cos x}$

15. Find the derivative of $y = \frac{fg}{h}$, in terms of f, g, h, f', g' , and h' , where f, g , and h are functions of x .

16. Find the rate of change of $y = (4x^3 + 7x^2 + 1)^2$ at $x = -1$.

17. If $f(x) = \sin^3 x$, find $f''(x)$.

18. Find the slope of the line tangent to the curve $y = \cos(2x)$ at the point where $x = \frac{\pi}{6}$.

19. Let $f(x) = \begin{cases} \sin(\pi x), & 0 \leq x \leq 1 \\ ax + b, & 1 < x \leq 2 \end{cases}$. Find the values of a and b such that $f(x)$ is differentiable at $x = 1$.

20. Which of the following functions are NOT differentiable at $x = 0$?

I. $y = \sqrt{4 - x^2}$ II. $y = x^{\frac{2}{3}}$ III. $y = x^{\frac{4}{3}}$ IV. $y = x^{-2}$ V. $y = |\sin(2x)|$

x	f	f'	g	g'
0	2	1	5	-4
1	3	2	3	-3
2	5	3	1	-2
3	10	4	0	-1

6. If $A = f + 2g$, then $A'(3) =$
 (A) -2 (B) 2 (C) 7 (D) 8 (E) 10
7. If $B = f \cdot g$, then $B'(2) =$
 (A) -20 (B) -7 (C) -6 (D) -1 (E) 13
8. If $D = \frac{1}{g}$, then $D'(1) =$
 (A) $-\frac{1}{2}$ (B) $-\frac{1}{3}$ (C) $-\frac{1}{9}$ (D) $\frac{1}{9}$ (E) $\frac{1}{3}$
9. If $H(x) = \sqrt{f(x)}$, then $H'(3) =$
 (A) $\frac{1}{4}$ (B) $\frac{1}{2\sqrt{10}}$ (C) 2 (D) $\frac{2}{\sqrt{10}}$ (E) $4\sqrt{10}$
10. If $K(x) = \left(\frac{f}{g}\right)(x)$, then $K'(0) =$
 (A) $\frac{-13}{25}$ (B) $-\frac{1}{4}$ (C) $\frac{13}{25}$ (D) $\frac{13}{16}$ (E) $\frac{22}{25}$
11. If $M(x) = f(g(x))$, then $M'(1) =$
 (A) -12 (B) -6 (C) 4 (D) 6 (E) 12
12. If $P(x) = f(x^3)$, then $P'(1) =$
 (A) 2 (B) 6 (C) 8 (D) 12 (E) 54
13. If $S(x) = f^{-1}(x)$, then $S'(3) =$
 (A) -2 (B) $-\frac{1}{25}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$ (E) 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. $\sec x(\sec^2 x + \tan^2 x)$

14. $\frac{-\sin x}{2\sqrt{1+\cos x}}$

15. $\frac{f'gh + fg'h - fgh'}{h^2}$

16. $2(4x^3 + 7x^2 + 1)(12x^2 + 14x)\Big|_{x=-1} = -16$

17. $\frac{d}{dx}[3\sin^2 x \cos x] = 3[-\sin^3 x + 2\sin x \cos^2 x] = 3\sin x(2\cos^2 x - \sin^2 x)$

18. $-2\sin(2x)\Big|_{x=\frac{\pi}{6}} = -\sqrt{3}$

19. $\sin \pi = a + b; \pi \cos \pi = a \Rightarrow a = -\pi, b = \pi$

20. II, IV, and V

- 6. B
- 7. B
- 8. E
- 9. D
- 10. C
- 11. A
- 12. B
- 13. D