

Find the Derivative:

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

2. $f(x) = (4x - 3)^2$

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

4. $f(x) = x^2\sqrt{1 - x^2}$

5. $f(x) = \frac{x}{\sqrt[3]{x^2 + 4}}$

6. $y = \left(\frac{3x - 1}{x^2 + 3}\right)^2$

7. $f(t) = \sin^3 4t$

8. $y = 3(4 - 9x)^4$

9. $y = \sqrt[3]{6x^2 + 1}$

10. $y = \left(\frac{1}{x - 3}\right)^2$

11. $y = \frac{1}{\sqrt{x + 2}}$

12. $f(x) = x^3(x - 4)^5$

13. $f(x) = \frac{x}{\sqrt{x^2 + 1}}$

14. $g(t) = \sqrt{\frac{1}{t^2 - 2}}$

15. $y = \frac{1}{2}x^2\sqrt{16 - x^2}$

16. $f(x) = \left(\frac{x^2}{x^3 + 2}\right)^2$

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

18. $h(x) = \sin 2x \cos 2x$

19. $f(x) = \frac{\cot x}{\sin x}$

20. $f(\theta) = \tan^2 5\theta$

21. $f(x) = \sqrt{x} + \frac{1}{4}\sin(2x)^2$

22. $y = \sin(\tan 2x)$

23. $y = \cos(1 - 2x)^2$

24. $h(t) = 2\cot^2(\pi t + 2)$

25. $y = \sin \sqrt[3]{x} + \sqrt[3]{\sin x}$

26. $y = \cos \sqrt{\sin(\tan \pi x)}$

27. $f(x) = \left((x^2 + 3)^5 + x\right)^2$

28. $f(x) = (2x + 5)^2 \cdot (x^4 - 3)^3 \cdot (x^2 - 5x + 2)^6$

29. $f(x) = \frac{(3x^2 - 1)^4 \cdot (5 - 8x)^3}{(x^3 - 2x + 1)^2}$

30. $y = \sec\left(\frac{x^2 + 1}{x^4 + 2}\right)^3$

$$1- f(x) = (x^2 - 2)^2$$

$$f'(x) = 4x(x^2 - 2)$$

$$2- f(x) = (4x - 3)^2 \quad f'(x) = 8(4x - 3)$$

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

$$f'(x) = (4x + 1)^{-2} \left(\frac{1}{\sqrt{x}} (4x + 1) - 4(2\sqrt{x} - 1) \right)$$

$$= \frac{4x + 1 - 8x + 4\sqrt{x}}{\sqrt{x} (4x + 1)^2}$$

$$= \frac{1 - 4x + 4\sqrt{x}}{\sqrt{x} (4x + 1)^2}$$

$$4- f(x) = x^2 \sqrt{1 - x^2}$$

$$f'(x) = 2x \sqrt{1 - x^2} - \frac{x^3}{\sqrt{1 - x^2}}$$

$$= \frac{2x - 2x^3 - x^3}{\sqrt{1 - x^2}}$$

$$= \frac{2x - 3x^3}{\sqrt{1 - x^2}}$$

$$5- f(x) = \frac{x}{\sqrt[3]{x^2 + 4}} = x(x^2 + 4)^{-1/3}$$

$$f'(x) = \frac{1}{(x^2 + 4)^{4/3}} \left(x^2 + 4 - \frac{2}{3}x^2 \right)$$

$$= \frac{x^2 + 12}{3(x^2 + 4)^{4/3}}$$

#6 $y = \left(\frac{3x-1}{x^2+3} \right)^2$

$$y' = 2 \left(\frac{3x-1}{x^2+3} \right) \frac{3x^2+9-6x^2+2x}{(x^2+3)^2}$$

$$= \frac{2(3x-1)(-3x^2+2x+9)}{(x^2+3)^3}$$

#7 $f(t) = \sin^3 4t$

$$f'(t) = 12 \sin^2 4t \cos 4t$$

#8 $y = 3(4-9x)^4$

$$y' = -108(4-9x)^3$$

#9 $y = \sqrt[3]{6x^2+1}$

$$y' = \frac{4x}{(6x^2+1)^{2/3}}$$

#10 $y = \left(\frac{1}{x-3} \right)^2$

$$y' = \frac{-2}{(x-3)^3}$$

#11 $y = \frac{1}{\sqrt{x+2}}$

$$y' = \frac{1}{2(x+2)^{3/2}}$$

#12 $f(x) = x^3(x-4)^5$

$$f'(x) = x^2(x-4)^4 (3(x-4) + 5x)$$

$$= x^2(x-4)^4 (8x-12)$$

#13 $f(x) = \frac{x}{\sqrt{x^2+1}} = x(x^2+1)^{-1/2}$

$$f'(x) = \frac{1}{(x^2+1)^{3/2}} (x^2+1 - x^2) = \frac{1}{(x^2+1)^{3/2}}$$

$$\#14 \quad g(t) = \sqrt{\frac{1}{t^2-2}} = \frac{1}{(t^2-2)^{1/2}}$$

$$g'(t) = \frac{t}{(t^2-2)^{3/2}}$$

$$\#15 \quad y = \frac{1}{2}x^2\sqrt{16-x^2}$$

$$\begin{aligned} y' &= \frac{1}{2} \frac{x}{\sqrt{16-x^2}} (16-x^2 - \frac{1}{2}x^2) \\ &= \frac{x(8-x^2)}{\sqrt{16-x^2}} \end{aligned}$$

$$\#16 \quad f(x) = \left(\frac{x^2}{x^3+2}\right)^2 = x^4(x^3+2)^{-2}$$

$$f'(x) = \frac{x^3}{(x^3+2)^3} (4x^3+8 - 6x^6)$$

$$\#17 \quad f(x) = \left(\frac{3x^2-2}{2x+3}\right)^3 = (3x^2-2)^3 (2x+3)^{-3}$$

$$\begin{aligned} f'(x) &= \frac{(3x^2-2)^2}{(2x+3)^4} (18x(2x+3) - 6(3x^2-2)) \\ &= \frac{(3x^2-2)^2(18x^2+54x+12)}{(2x+3)^4} \end{aligned}$$

$$\#18 \quad h(x) = \sin 2x \cos 2x$$

$$= \frac{1}{2} \sin 4x$$

$$h'(x) = 2 \cos 4x$$

$$\#19 \quad f(x) = \frac{\cot x}{\sin x}$$

$$f'(x) = \frac{-\csc^2 x \sin x - \cot x \cot x}{\sin^2 x}$$

$$= \frac{-\csc x - \sin x}{\sin^2 x} = -\frac{1 + \sin^2 x}{\sin^3 x}$$

$$\#20 \quad f(\theta) = \tan^2 5\theta$$

$$f'(\theta) = 10 \tan 5\theta \sec^2 5\theta$$

$$\#21 \quad f(x) = \sqrt{x} + \frac{1}{4} \sin(2x)^2$$

$$f'(x) = \frac{1}{2\sqrt{x}} + 2x \cos(2x)^2$$

$$\#22 \quad y = \sin(\tan 2x)$$

$$y' = 2 \sec^2 2x \cos(\tan 2x)$$

$$\#23 \quad y = \cos(1-2x)^2$$

$$y' = +4x(1-2x) \sin(1-2x)^2$$

$$\#24 \quad h(t) = 2 \cot^2(\pi t + 2)$$

$$h'(t) = -4\pi \cot(\pi t + 2) \csc^2(\pi t + 2)$$

$$\#25 \quad y = \sin \sqrt[3]{x} + \sqrt[3]{\sin x}$$

$$y' = \frac{1}{3x^{2/3}} \cos \sqrt[3]{x} + \frac{1}{3} \frac{\cos x}{(\sin x)^{2/3}}$$

$$\#26 \quad y = \cos \sqrt{\sin(\tan \pi x)}$$

$$y' = \frac{-\pi \sec^2 \pi x \cos(\tan \pi x)}{2\sqrt{\sin(\tan \pi x)}} \sin \sqrt{\sin(\tan \pi x)}$$

$$\#27 \quad f(x) = ((x^2+3)^5 + x)^2$$

$$f'(x) = 2((x^2+3)^5 + x)(10x(x^2+3)^4 + 1)$$

#28 $f(x) = (2x+5)^2 (x^4-3)^3 (x^2-5x+2)^6$

$$f'(x) = (2x+5)(x^4-3)^2 (x^2-5x+2)^5 \left[4(x^4-3)(x^2-5x+2) + 12x^3(2x+5)(x^2-5x+2) + 6(2x-5)(2x+5)(x^4-3) \right]$$

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

x^6	x^5	x^4	x^3	x^2	x^1	x^0
4	-20	8	120	-12	60	-24
24	-120	48		72		450
24	60	300				
		-150				

$$= (2x+5)(x^4-3)^2 (x^2-5x+2)^5 (52x^6 - 80x^5 + 206x^4 + 12x^3 - 60x^2 + 60x + 426)$$

#28 $f(x) = \frac{(3x^2-1)^4 (5-8x)^3}{(x^3-2x+1)^2}$

$$f'(x) = \frac{(3x^2-1)^3 (5-8x)^2}{(x^3-2x+1)^3} \left[24x(5-8x)(x^3-2x+1) - 24(3x^2-1)(x^3-2x+1) - (6x^2-4)(3x^2-1)(5-8x) \right]$$

$$= \frac{(3x^2-1)^3 (5-8x)^2}{(x^3-2x+1)^3} (-18x^4 + 18x^2 - 4)$$

x^5	x^4	x^3	x^2	x^1	x^0
-192	120	384	-240	120	24
-72	-90	144	-192	-48	-20
144		24	-72	32	
		-144	90		

$$= \frac{(3x^2-1)^3 (5-8x)^2 (-120x^5 + 30x^4 + 408x^3 - 414x^2 + 104x + 4)}{(x^3-2x+1)^3}$$

#30 $y = \sec\left(\frac{x^2+1}{x^4+2}\right)^3$

$$y' = 3\left(\frac{x^2+1}{x^4+2}\right)^2 \left(\frac{2x^5+4x-4x^5-4x^3}{(x^4+2)^2}\right) \sec\left(\frac{x^2+1}{x^4+2}\right)^3 \tan\left(\frac{x^2+1}{x^4+2}\right)^3$$

$$= \frac{3(x^2+1)^2(4x-2x^5-4x^3)}{(x^4+2)^4} \sec\left(\frac{x^2+1}{x^4+2}\right)^3 \tan\left(\frac{x^2+1}{x^4+2}\right)^3$$