

Find the Derivative:

1. $f(x) = 3x - 4$

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

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

4. $f(x) = x^2 + 3x - x^{-1} - 1 + x^{-1/2}$

5. $f(t) = 4\sqrt{t} - \frac{1}{4}t^4 + t + 1 + \frac{1}{t}$

6. $f(x) = x^{0.35} + x^{-\pi^2} + x\sqrt{7}$

7. $f(x) = 4x^{5/3} + 6x^{-3/2} - 11x$

8. $f(x) = 2x^{5/4} + 4x^{-2} - 6x$

9. $f(t) = 7t^{-5/14} + 2t^{-6} + 6$

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

11. $f(x) = 6\sqrt{x} - \frac{1}{\sqrt{x}}$

12. $f(x) = \frac{x^2 + 4x^{1/2}}{x^2}$

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

14. $f(y) = 16y^{0.2} + 8y^{-0.8}$

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

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

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

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

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

20. $f(x) = \sqrt{x}(\sqrt{x} - 1)$

21. $f(y) = \frac{y^2 - 1}{y - 1}$

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

23. $f(x) = \frac{x - a}{\sqrt{x} - \sqrt{a}}; \quad a > 0$

24. $y = \frac{x^2 - 2ax + a^2}{x - a}$

25. $y = \frac{x}{x + 1}$

26. $y = \frac{2x^2}{3x + 1}$

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

28. $f(x) = \frac{x^2 - 1}{x^2 + 1}$

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

30. $y = \frac{4x^3 + 3x + 1}{2x^5}$

31. $g(t) = 3t^2 + \frac{6}{t^7}$

32. $g(x) = \frac{x(3 - x)}{2x^2}$

33. $g(x) = \frac{(x - 1)(2x^2 - 1)}{x^3 - 1}$

34. $f(x) = (2 + x^{-1})(x^{3/2} + 1)$

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

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

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

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

39. $f(x) = \frac{x^9 + x^8 + 4x^5 - 7x}{x^4 - 3x^2 + 2x + 1}$

①

$$\#1 \quad f(x) = 3x - 4 \Rightarrow f'(x) = 3$$

$$\#2) \quad f(x) = 2x^3 - 3x^2 - 5 \Rightarrow f'(x) = 6x^2 - 6x$$

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

$$\#4 \quad f(x) = x^2 + 3x - x^{-1} + x^{-1/2} \Rightarrow f'(x) = x + 3 + x^{-2} - \frac{1}{2} x^{-3/2}$$

$$\#5 \quad f(t) = 4\sqrt{t} - \frac{1}{4}t^4 + t + 1 + \frac{1}{t} \Rightarrow f'(t) = \frac{2}{\sqrt{t}} - t^3 + 1 - \frac{1}{t^2}$$

$$\#6 \quad f(x) = x^{.35} + x^{-.2} + x\sqrt{7} \Rightarrow f'(x) = .35x^{-.65} - .2x^{-.2-1} + \sqrt{7}x^{\sqrt{7}-1}$$

$$\#7 \quad f(x) = 4x^{5/3} + 6x^{-3/2} - 11x$$

$$f'(x) = \frac{20}{3}x^{2/3} - 9x^{-5/2} - 11$$

$$\#8 \quad f(x) = 2x^{5/4} + 4x^{-2} - 6x \Rightarrow f'(x) = \frac{5}{2}x^{1/4} - 8x^{-3} - 6$$

$$\#9 \quad f(t) = 7t^{-5/4} + 2t^{-6} + 6 \Rightarrow f'(t) = -\frac{5}{2}t^{-9/4} - 12t^{-7}$$

$$\#10 \quad f(x) = 4\sqrt[4]{x} + 3\sqrt{x} + \sqrt{2}x^{\sqrt{2}}$$

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

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

$$\#11 \quad f(x) = 6\sqrt{x} - \frac{1}{\sqrt{x}} \Rightarrow f'(x) = \frac{3}{\sqrt{x}} + \frac{1}{2x\sqrt{x}}$$

$$\#12 \quad f(x) = \frac{x^2 + 4x^{1/2}}{x^2} = 1 + 4x^{-3/2}$$

$$f'(x) = -6x^{-5/2} = -\frac{6}{x^2\sqrt{x}}$$

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

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

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

#14 $f(y) = 16y^{0.2} + 8y^{-0.8}$
 $f'(y) = 3.2y^{-0.8} - 6.4y^{-1.8}$

#15 $f(x) = (1-2x)(3x+5)$
 $= 3x + 5 - 6x^2 - 10x$
 $= -6x^2 - 7x + 5$
 $f'(x) = -12x - 7$

#16 $f(x) = (2x+1)(3x^2+2)$
 $= 6x^3 + 4x + 3x^2 + 2$
 $f'(x) = 18x^2 + 4 + 6x$

#17 $f(x) = (5x^3 + 3x + 1)(x^2 + 5) = 5x^5 + 25x^3 + 3x^3 + 15x + x^2 + 5$
 $= 5x^5 + 28x^3 + x^2 + 15x + 5$

$f'(x) = 25x^4 + 84x^2 + 2x + 15$

(or) $f'(x) = (15x^2 + 3)(x^2 + 5) + (5x^3 + 3x + 1)(2x)$
 $= 15x^4 + 75x^2 + 3x^2 + 15 + 10x^4 + 6x^2 + 2x$
 $= 15x^4 + 84x^2 + 2x + 15$

#18 $f(x) = (4x-3)^2 = 16x^2 - 24x + 9$
 $f'(x) = 32x - 24$

#19 $f(x) = (x^2 - 2)^2 = x^4 - 4x^2 + 4$
 $f'(x) = 4x^3 - 8x$

#20 $f(x) = \sqrt{x}(\sqrt{x} - 1) = x - \sqrt{x}$
 $f'(x) = 1 - \frac{1}{2\sqrt{x}}$

#21 $f(y) = \frac{y^2 - 1}{y - 1} = \frac{(y-1)(y+1)}{y-1} = y+1$
 $f'(y) = 1$

#22 $f(x) = \frac{x^3 - 6x^2 + 8x}{x^2 - 2x} = \frac{x^2 - 6x + 8}{x - 2} = \frac{(x-2)(x-4)}{x-2}$

$= x - 4$

$f'(x) = 1$

#23 $f(x) = \frac{x-a}{\sqrt{x}-\sqrt{a}} \cdot \frac{\sqrt{x}+\sqrt{a}}{\sqrt{x}+\sqrt{a}} = \frac{(x-a)(\sqrt{x}+\sqrt{a})}{x-a}$ $\left\{ \begin{array}{l} u = x-a \quad N = \sqrt{x}-\sqrt{a} \\ u' = 1 \quad N' = \frac{1}{2\sqrt{x}} \end{array} \right.$

$= \sqrt{x} + \sqrt{a}$

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

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

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

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

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

$$= \frac{1}{2\sqrt{x}}$$

#24 $y = \frac{x^2 - 2ax + a^2}{x-a} = \frac{(x-a)^2}{x-a} = x-a$

$y' = 1$

#25 $y = \frac{x}{x+1} \Rightarrow y' = \frac{x+1-x}{(x+1)^2} = \frac{1}{(x+1)^2}$

#26 $y = \frac{2x^2}{3x+1} \Rightarrow y' = \frac{4x(3x+1) - 6x^2}{(3x+1)^2} = \frac{6x^2 + 4x}{(3x+1)^2}$

#27 $f(x) = \frac{x^3 - 4x^2 + x}{x-2}$

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

$= \frac{3x^3 - 6x^2 - 8x^2 - 10x + x - 2 - x^3 + 4x^2 - x}{(x-2)^2}$

$= \frac{2x^3 - 10x^2 - 10x - 2}{(x-2)^2}$

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

$$\begin{aligned} f'(x) &= \frac{2x(x^2+1) - 2x(x^2-1)}{(x^2+1)^2} \\ &= \frac{2x^3+2x - 2x^3+2x}{(x^2+1)^2} \\ &= \frac{4x}{(x^2+1)^2} \end{aligned}$$

#29 $y = (2\sqrt{x}-1)(4x+1)^{-1}$

$$u = 2\sqrt{x}-1$$

$$v = (4x+1)$$

$$u' = \frac{1}{\sqrt{x}}$$

$$v' = 4$$

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

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

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

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

#30

$$y = \frac{4x^3+3x+1}{2x^5} = 2x^{-2} + \frac{3}{2}x^{-4} + \frac{1}{2}x^{-5}$$

$$y' = -4x^{-3} - 6x^{-5} - \frac{5}{2}x^{-6}$$

$$= -\frac{4}{x^3} - \frac{6}{x^5} - \frac{5}{2x^6}$$

#31

$$g(t) = 3t^2 + \frac{6}{t^2}$$

$$\left(\frac{1}{x^n}\right)' = -\frac{n}{x^{n+1}}$$

$$g'(t) = 6t - \frac{42}{t^3}$$

#32

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

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

#33 $g(x) = \frac{(x-1)(2x^2-1)}{x^3-1}$

(5)

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

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

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

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

$$= \frac{2x^2+6x+1}{(x^2+x+1)^2}$$

#34 $f(x) = (2+x^{-1})(x^{3/2}+1)$

$$= 2x^{3/2}+2+x^{1/2}+x^{-1}$$

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

#35 $f(x) = \frac{x}{1+x^2}$

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

#36 $f(x) = \frac{x+4}{x^2+x+1}$

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

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

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

#37

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

$$= \frac{x^{7/2} + x^{3/2}}{x+1}$$

(6)

$$f'(x) = \frac{\left(\frac{7}{2}x^{5/2} + \frac{3}{2}x^{1/2}\right)(x+1) - x^{7/2} - x^{3/2}}{(x+1)^2}$$

$$= \frac{1}{2} \frac{7x^{7/2} + 7x^{5/2} + 3x^{3/2} + 3x^{1/2} - 2x^{7/2} - 2x^{3/2}}{(x+1)^2}$$

$$= \frac{1}{2} \frac{5x^{7/2} + 7x^{5/2} + x^{3/2} + 3x^{1/2}}{(x+1)^2}$$

#38

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

$$= \frac{(x-2)(x+2)}{x-1} \cdot \frac{(x-1)(x+1)}{x+2}$$

$$= (x-2)(x+1)$$

$$= x^2 - x - 2$$

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

#39

$$f(x) = \frac{x^9 + x^8 + 4x^5 - 7x}{x^4 - 3x^2 + 2x + 1}$$

$$u = x^9 + x^8 + 4x^5 - 7x \quad v = x^4 - 3x^2 + 2x + 1$$

$$u' = 9x^8 + 8x^7 + 20x^4 - 7$$

$$v' = 4x^3 - 6x + 2$$

$$f'(x) = \frac{(9x^8 + 8x^7 + 20x^4 - 7)(x^4 - 3x^2 + 2x + 1) - (4x^3 - 6x + 2)(x^9 + x^8 + 4x^5 - 7x)}{(x^4 - 3x^2 + 2x + 1)^2}$$

$$= \frac{9x^{12} - 27x^{10} + 18x^9 + 9x^8 + 8x^{11} - 24x^9 + 16x^8 + 8x^7 + 20x^8 - 60x^6 - 40x^5 + 20x^4 - 7x^4 + 21x^2 - 10x - 7 - 4x^{12} - 4x^{11} - 16x^8 + 28x^4 + 6x^{10} + 6x^9 + 20x^6 - 42x^2 - 2x^9 - 2x^8 - 8x^5 + 14x}{(x^4 - 3x^2 + 2x + 1)^2}$$

$$= \frac{5x^{12} + 4x^{11} - 21x^{10} - 2x^9 - 27x^8 + 8x^7 - 36x^6 - 48x^5 + 41x^4 - 21x^2 - 7}{(x^4 - 3x^2 + 2x + 1)^2}$$