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. $f(x)=(2x+1)\left(3x^2+2\right)$

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

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

19. $f(x)=\left(x^2-2\right)^2$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

#9 $f(t) = 7t^{-5/14} + 2t^{-6} + 6 \Rightarrow f'(t) = -\frac{5}{2}t^{-19/14} - 12t^{-7}$

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

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

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

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

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

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

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

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

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

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

$f'(y) = 3.2y^{-.8} - 6.4y^{-1.8}$

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

$= x - 4$

$f'(x) = 1$

#23 $f(x) = \dfrac{x - a}{\sqrt{x} - \sqrt{a}} \cdot \dfrac{\sqrt{x} + \sqrt{a}}{\sqrt{x} + \sqrt{a}} = \dfrac{(x-a)(\sqrt{x} + \sqrt{a})}{x - a}$

$u = x - a \quad v = \sqrt{x} - \sqrt{a}$

$u' = 1 \quad v' = \frac{1}{2\sqrt{x}}$

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

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

(or)

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

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

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

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

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

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

$y' = 1$

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

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

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

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

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

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

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

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

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

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

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

$u = 2\sqrt{x}-1 \qquad v = (4x+1)$

$u' = \frac{1}{\sqrt{x}} \qquad v^{-1} = 4$

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

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

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

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

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

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

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

$$g'(t) = 6t - \frac{42}{t^8}$$

#32 $g(x) = \frac{x(3-x)}{2x^2} = \frac{3x-x^2}{2x^2} = \frac{3}{2}\frac{1}{x} - \frac{1}{2}$ $\qquad \frac{3x}{2x^2} - \frac{x^2}{2x^2}$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

#38 $f(x) = \dfrac{x^2-4}{x-1} \dfrac{x^2-1}{x+2}$

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

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

$= x^2 - x - 2$

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

#39 $f(x) = \dfrac{x^9 + x^8 + 4x^5 - 7x}{x^4 - 3x^2 + 2x + 1}$ $\quad u = x^9 + x^8 + 4x^5 - 7x \quad N = x^4 - 3x^2 + 2x + 1$

$u' = 9x^8 + 8x^7 + 20x^4 - 7 \quad N' = 4x^3 - 6x + 2$

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

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

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