

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\#21/ f(x) = \frac{x^3 - 6x^2 + 8x}{x^2 - 2x} = \frac{x^2 - 6x + 8}{x - 2} = \frac{(x-2)(x-4)}{x-2}$$

$$= x - 4$$

$$f'(x) = 1$$

$$\#22/ f(x) = \frac{x-a}{\sqrt{x}-\sqrt{a}} \cdot \frac{\sqrt{x}+\sqrt{a}}{\sqrt{x}+\sqrt{a}} = \frac{(x-a)(\sqrt{x}+\sqrt{a})}{x-a} \quad \left\{ \begin{array}{l} u = x-a \quad v = \sqrt{x}-\sqrt{a} \\ u' = 1 \quad v' = \frac{1}{2\sqrt{x}} \end{array} \right.$$

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

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

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

$$\#23/ y = \frac{x^2 - 2ax + a^2}{x-a} = \frac{(x-a)^2}{x-a} = x-a$$

$$y' = 1$$

$$\#24/ y = \frac{x}{x+1} \Rightarrow y' = \frac{x+1-x}{(x+1)^2} = \frac{1}{(x+1)^2}$$

$$\#25/ y = \frac{2x^2}{3x+1} \Rightarrow y' = \frac{4x(3x+1) - 6x^2}{(3x+1)^2} = \frac{6x^2 + 4x}{(3x+1)^2}$$

$$\#26/ f(x) = \frac{x^3 - 4x^2 + x}{x-2}$$

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

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

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



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

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

#28

$$\begin{aligned} y &= \frac{4x^3+3x+1}{2x^5} = 2x^{-2} + \frac{3}{2}x^{-4} + \frac{1}{2}x^{-5} \\ y' &= -4x^{-3} - 6x^{-5} - \frac{5}{2}x^{-6} \\ &= -\frac{4}{x^3} - \frac{6}{x^5} - \frac{5}{2x^6} \end{aligned}$$

#29

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

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

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

#30

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$u = x^9 + x^8 + 4x^5 - 7x$   $v = x^4 - 3x^2 + 2x + 1$   
 $u' = 9x^8 + 8x^7 + 20x^4 - 7$

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

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

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