

**U3H3** Find the derivative.

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

2.  $f(x) = (3x^2 + 4x + 5)^{10}$

3.  $f(x) = \sqrt{2x \cos x}$

4.  $f(x) = \sec x$

5.  $f(x) = \sec(3x + 4)$

6.  $f(x) = (3x + 4)^5(2x + 1)^4$

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

8.  $f(x) = e^{-x}$

9.  $f(x) = \sin(2x + 4)e^{3x-4}$

10.  $f(x) = (x^3 - 1)^{100}$

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

12.  $f(x) = \left(\frac{x-2}{2x+1}\right)^9$

13.  $f(x) = (2x + 1)^5(x^3 - x + 1)^4$

14.  $f(x) = e^{\sin(3x)}$

15.  $y = (x^3 - 4)^4$

$$16. f(x) = \sqrt[3]{x^2 + x}$$

$$17. y = \sqrt{(3x+1)^3}$$

$$18. y = (\sqrt{x} + 1)^2$$

$$19. f(x) = \left(x + \frac{1}{x}\right)^2$$

$$20. f(x) = \frac{1}{\sqrt{2x^3 - 7x^2}}$$

$$21. y = (1-x)(3x^2 - 5)^5$$

$$22. y = (x^2 - 5x)^6 (2x - 5)^{-1}$$

$$23. y = \left(\frac{7 - 2x^5}{5x^2 - 8}\right)^2$$

$$24. f(x) = \sqrt{\frac{x^2 + 9}{x + 3}}$$

$$25. f(x) = \sqrt{4 - \sqrt{x^2 - 5}}$$

$$26. f(x) = \sin(3x^2 - 4)$$

$$27. f(x) = \cot^2(4x)$$

$$28. f(x) = \frac{-\csc(9x)}{4x}$$

$$29. f(x) = \sin^2(4x) + \cos^2(4x)$$

U3H3 Find the derivative.

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

$$f'(x) = 2(2x+3) \cdot 2 \\ = 4(2x+3)$$

2.  $f(x) = (3x^2 + 4x + 5)^{10}$

$$f'(x) = 10(3x^2 + 4x + 5)^9 \cdot (6x+4)$$

3.  $f(x) = \sqrt{2x \cos x} = (2x \cos x)^{1/2}$

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

4.  $f(x) = \sec x$

$$f'(x) = \sec x \tan x$$

5.  $f(x) = \sec(3x+4)$

$$f'(x) = \sec(3x+4) \tan(3x+4) \cdot 3 \\ = 3 \sec(3x+4) \tan(3x+4)$$

6.  $f(x) = (3x+4)^5 (2x+1)^4$

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

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

$$f'(x) = (4x+5)^{5/2} \cdot \frac{7}{2} (2x-3)^{5/2} \cdot 2 \\ + (2x-3)^{7/2} \cdot \frac{5}{2} (4x+5)^{3/2} \cdot 4$$

8.  $f(x) = e^{-x}$

$$f'(x) = -e^{-x}$$

9.  $f(x) = \sin(2x+4)e^{3x-4}$

$$f'(x) = \sin(2x+4) \cdot e^{3x-4} \cdot 3 \\ + e^{3x-4} \cdot \cos(2x+4) \cdot 2$$

10.  $f(x) = (x^3 - 1)^{100}$

$$f'(x) = 100(x^3 - 1)^{99} \cdot 3x^2$$

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

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

12.  $f(x) = \left(\frac{x-2}{2x+1}\right)^9$

$$f'(x) = 9 \left(\frac{x-2}{2x+1}\right)^8 \cdot \frac{(2x+1) \cdot 1 - (x-2)(2)}{(2x+1)^2}$$

13.  $f(x) = (2x+1)^5 (x^3 - x + 1)^4$

$$f'(x) = (2x+1)^5 \cdot 4(x^3 - x + 1)^3 \cdot (3x^2 - 1) \\ + (x^3 - x + 1)^4 \cdot 5(2x+1)^4 \cdot (2)$$

14.  $f(x) = e^{\sin(3x)}$

$$f'(x) = e^{\sin 3x} \cdot \cos 3x \cdot 3$$

15.  $y = (x^3 - 4)^4$

$$y' = 4(x^3 - 4)^3 \cdot 3x^2$$

$$16. f(x) = \sqrt[3]{x^2+x} = (x^2+x)^{1/3}$$

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

$$17. y = \sqrt{(3x+1)^3} = (3x+1)^{3/2}$$

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

$$18. y = (\sqrt{x}+1)^2$$

$$y' = 2(\sqrt{x}+1)^1 \cdot \left(\frac{1}{2}x^{-1/2}\right)$$

$$19. f(x) = \left(x + \frac{1}{x}\right)^2$$

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

$$20. f(x) = \frac{1}{\sqrt{2x^3-7x^2}} = (2x^3-7x^2)^{-1/2}$$

$$f'(x) = -\frac{1}{2} (2x^3-7x^2)^{-3/2} \cdot (6x^2-14x)$$

$$21. y = (1-x)(3x^2-5)^5$$

$$y' = (1-x) \cdot 5(3x^2-5)^4 \cdot 6x + (3x^2-5)^5 \cdot -1$$

$$22. y = (x^2-5x)^6 (2x-5)^{-1}$$

$$y' = (x^2-5x)^6 \cdot -1(2x-5)^{-2} \cdot 2$$

$$+ (2x-5)^{-1} \cdot 6(x^2-5x)^5 \cdot (2x-5)$$

$$23. y = \left(\frac{7-2x^5}{5x^2-8}\right)^2$$

$$y' = 2\left(\frac{7-2x^5}{5x^2-8}\right)^1 \cdot \frac{(5x^2-8)(-10x^4) - (7-2x^5)(10x)}{(5x^2-8)^2}$$

$$24. f(x) = \sqrt{\frac{x^2+9}{x+3}} = \left(\frac{x^2+9}{x+3}\right)^{1/2}$$

$$f'(x) = \frac{1}{2} \left(\frac{x^2+9}{x+3}\right)^{-1/2} \cdot \left(\frac{(x+3)(2x) - (x^2+9)(1)}{(x+3)^2}\right)$$

$$25. f(x) = \sqrt{4-\sqrt{x^2-5}} = (4-(x^2-5)^{1/2})^{1/2}$$

$$f'(x) = \frac{1}{2} (4-(x^2-5)^{1/2})^{-1/2} \cdot \left(-\frac{1}{2}(x^2-5)^{-1/2}\right) \cdot 2x$$

$$26. f(x) = \sin(3x^2-4)$$

$$f'(x) = \cos(3x^2-4) \cdot 6x$$

$$27. f(x) = \cot^2(4x) = (\cot(4x))^2$$

$$f'(x) = 2(\cot(4x))^1 \cdot -\csc^2(4x) \cdot 4$$

$$28. f(x) = \frac{-\csc(9x)}{4x}$$

$$f'(x) = \frac{(4x)(\csc(9x)\cot(9x) \cdot -9) + \csc(9x) \cdot 4}{(4x)^2}$$

$$29. f(x) = \sin^2(4x) + \cos^2(4x) = 1$$

$$f'(x) = 0$$