

$$31. \quad f(x) = (2x - 7)(4x + 6) = 8x^2 - 16x - 42$$

$$f'(x) = 16x - 16 = 16(x - 1)$$

$$32. \quad f(x) = (5x^2 + 3x - 2)(4x^4 + 2x^2 + 1)$$

$$f'(x) = (10x + 3)(4x^4 + 2x^2 + 1) + (16x^3 + 4x)(5x^2 + 3x - 2)$$

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

$$33. \quad f'(x) = 2(4x - 5) \cdot 4 \cdot (5x + 3)^3 + 3(5x + 3)^2 \cdot 5 \cdot (4x - 5)^2$$

$$f'(x) = (4x - 5)(5x + 3)^2 [8(5x + 3) + 15(4x - 5)]$$

$$f'(x) = (4x - 5)(5x + 3)^2 [100x - 51]$$

$$f(x) = (5x + 2)^3(7x - 5)^4$$

$$34. \quad f'(x) = 3(5x + 2)^2 \cdot 5 \cdot (7x - 5)^4 + 4(7x - 5)^3 \cdot 7 \cdot (5x + 2)^3$$

$$f'(x) = (5x + 2)^2(7x - 5)^3 [15(7x - 5) + 28(5x + 2)]$$

$$f'(x) = (5x + 2)^2(7x - 5)^3 [245x - 19]$$

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

$$f'(x) = 5(5x^2 + 5)^4 \cdot 10x \cdot (3x^2 - 1)^6 + 6(3x^2 - 1)^5 \cdot 6x \cdot (5x^2 + 5)^5$$

$$35. \quad f'(x) = 2x(5x^2 + 5)^4(3x^2 - 1)^5 [25(3x^2 - 1) + 18(5x^2 + 5)]$$

$$f'(x) = 2x(5x^2 + 5)^4(3x^2 - 1)^5 [165x^2 - 65]$$

$$f'(x) = 2 \cdot 5x(5x^2 + 5)^4(3x^2 - 1)^5 [33x^2 - 13]$$

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

$$f'(x) = 3(3x^4 - 6)^2 \cdot 12x^3 \cdot (5x + 4)^3 + -3(5x + 4)^4 \cdot 5 \cdot (3x^4 - 6)^3$$

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

$$36. \quad f'(x) = 3(5x + 4)^4(3x^4 - 6)^2 [45x^4 + 48x^3 + 30]$$

$$f'(x) = 3(5x + 4)^4 \cdot 3^2(x^4 - 2)^2 \cdot 3 [15x^4 + 16x^3 + 10]$$

$$f'(x) = \frac{3^4(x^4 - 2)^2 [15x^4 + 16x^3 + 10]}{(5x + 4)^4}$$

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

$$f'(x) = -2(4x^2 + 3)^3 \cdot 8x \cdot (x^3 + 1)^4 + -4(x^3 + 1)^5 \cdot 3x^2 \cdot (4x^2 + 3)^2$$

$$37. \quad f'(x) = -4x(4x^2 + 3)^3(x^3 + 1)^5 [4(x^3 + 1) + 3x(4x^2 + 3)]$$

$$f'(x) = -4x(4x^2 + 3)^3(x^3 + 1)^5 [16x^3 + 9x + 4]$$

$$f'(x) = \frac{-4x [16x^3 + 9x + 4]}{(4x^2 + 3)^3(x^3 + 1)^5}$$

$$38. \quad f(x) = \ln(4x^7)$$

$$f'(x) = \frac{1}{4x^7} \cdot 28x^6 = \frac{7}{x}$$

$$39. \quad f(x) = \ln 5x^3$$

$$f'(x) = \frac{1}{5x^3} \cdot 15x^2 = \frac{3}{x}$$

$$40. \quad f(x) = (\ln 6x)^2$$

$$f'(x) = 2(\ln 6x) \cdot \frac{1}{6x} \cdot 6 = \frac{2(\ln 6x)}{x}$$

$$41. \quad f(x) = \ln(6x)^2$$

$$f'(x) = \frac{1}{(6x)^2} \cdot 2(6x) \cdot 6 = \frac{2}{x}$$

$$42. \quad f(x) = (2x+1)\ln x$$

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

$$43. \quad f(x) = \ln x^2 (5x+2)^3$$

$$f'(x) = \frac{1}{x^2} \cdot 2x \cdot (5x+2)^3 + 3(5x+2)^2 \cdot 5 \cdot \ln x^2$$

$$f'(x) = (5x+2)^2 \left[ \frac{2(5x+2)}{x} + 15\ln x^2 \right]$$

$$44. \quad f(x) = \ln \left[ (4x-2)^2 (5x+2)^3 \right]$$

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

$$f'(x) = \frac{1}{\left[ (4x-2)^2 (5x+2)^3 \right]} \cdot (4x-2)(5x+2)^2 \left[ 8(5x+2) + 15(4x-2) \right]$$

$$f'(x) = \frac{[100x-14]}{\left[ (4x-2)(5x+2)^2 \right]} = \frac{2[50x-7]}{\left[ (4x-2)(5x+2)^2 \right]}$$

$$45. \quad f(x) = \ln(3x^4 + 2x^2 - 5)^3$$

$$f'(x) = \frac{1}{(3x^4 + 2x^2 - 5)^3} \cdot 3(3x^4 + 2x^2 - 5)^2 \cdot (12x^3 + 4x)$$

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

$$46. \quad f(x) = 4^{3x+2}$$

$$f'(x) = 4^{3x+2} \cdot \ln 4 \cdot 3$$

$$47. \quad f(x) = 5^{(3x^2+2x-5)} \cdot \ln 5 \cdot (6x+2)$$

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

$$f(x) = 6^{(4x+5)^2(6x-1)}$$

$$48. \quad f'(x) = 6^{(4x+5)^2(6x-1)} \cdot \ln 6 \cdot [2(4x+5)(6x-1) + 6(4x+5)^2]$$

$$f'(x) = 6^{(4x+5)^2(6x-1)} \cdot \ln 6 \cdot 2 \cdot (4x+5)[18x+14]$$

$$f'(x) = 6^{(4x+5)^2(6x-1)} \cdot \ln 6 \cdot 2 \cdot (4x+5) \cdot 2 \cdot [9x+7]$$

$$f(x) = 4^{(5x^2-2x+1)^3}$$

$$49. \quad f'(x) = 4^{(5x^2-2x+1)^3} \cdot \ln 4 \cdot 3(5x^2-2x+1)^2 \cdot (10x-2)$$

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

$$50. \quad f(x) = e^{(6x^3-5x)}$$

$$f'(x) = e^{(6x^3-5x)} \cdot (18x^2-5)$$

$$f(x) = 5^{(2x+3)} \ln(2x+3)$$

$$51. \quad f'(x) = 5^{(2x+3)} \cdot \ln 5 \cdot 2 \cdot \ln(2x+3) + \frac{1}{(2x+3)} \cdot 2 \cdot 5^{(2x+3)}$$

$$f'(x) = 5^{(2x+3)} \cdot 2 \cdot \left[ \ln 5 \cdot \ln(2x+3) + \frac{1}{(2x+3)} \right]$$

$$f(x) = \ln(5x-3)^2 e^{(3x-5)}$$

$$52. \quad f'(x) = \frac{1}{(5x-3)^2} \cdot 2(5x-3) \cdot 5 \cdot e^{(3x-5)} + e^{(3x-5)} \cdot 3 \cdot \ln(5x-3)^2$$

$$f'(x) = e^{(3x-5)} \left[ \frac{10}{(5x-3)} + 3 \cdot \ln(5x-3)^2 \right]$$

53.

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

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

$$f'(x) = (3x+2)(5x-1)^2 (x+6) [6(5x-1)(x+6) + 15(3x+2)(x+6) + 2(3x+2)(5x-1)]$$

$$f(x) = \frac{(5x+2)^2}{(4x+1)}$$

$$54. \quad f'(x) = \frac{2(5x+2) \cdot 5 \cdot (4x+1) - 4(5x+2)^2}{[(4x+1)]^2}$$

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

$$f'(x) = \frac{2(5x+2)[10x+1]}{[(4x+1)]^2}$$

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

$$55. \quad f'(x) = \frac{4(5x^3 + 2x - 5)^3 \cdot (15x^2 + 2) \cdot (4x^2 + 3)^2 - 2(4x^2 + 3) \cdot 8x \cdot (5x^3 + 2x - 5)^4}{[(4x^2 + 3)^2]^2}$$

$$f'(x) = \frac{4(5x^3 + 2x - 5)^3 (4x^2 + 3)[(15x^2 + 2)(4x^2 + 3) - 4x(5x^3 + 2x - 5)]}{(4x^2 + 3)^4}$$

$$f'(x) = \frac{4(5x^3 + 2x - 5)^3 [40x^4 + 43x^2 + 20x + 6]}{(4x^2 + 3)^3}$$

$$f(x) = \frac{\ln(5x-2)^3}{5^{5x-1}}$$

$$56. \quad f'(x) = \frac{\frac{1}{(5x-2)^3} \cdot 3(5x-2)^2 \cdot 5 \cdot 5^{5x-1} - 5^{5x-1} \cdot \ln 5 \cdot 5 \cdot \ln(5x-2)^3}{[5^{5x-1}]^2}$$

$$f'(x) = \frac{5^{5x-1} \cdot 5 \cdot \left[ \frac{3}{(5x-2)} - \ln 5 \cdot \ln(5x-2)^3 \right]}{[5^{5x-1}]^2} = \frac{5 \cdot \left[ \frac{3}{(5x-2)} - \ln 5 \cdot \ln(5x-2)^3 \right]}{5^{5x-1}}$$

$$f(x) = \frac{3^{x^3+2x}}{e^{\ln x}}$$

$$f'(x) = \frac{3^{x^3+2x} \cdot \ln 3 \cdot (3x^2 + 2) \cdot e^{\ln x} - e^{\ln x} \cdot \frac{1}{x} \cdot 3^{x^3+2x}}{[e^{\ln x}]^2}$$

57.

$$f'(x) = e^{\ln x} \cdot 3^{x^3+2x} \cdot \frac{\left[ \ln 3 \cdot (3x^2 + 2) - \frac{1}{x} \right]}{[e^{\ln x}]^2}$$

$$f'(x) = 3^{x^3+2x} \cdot \frac{\left[ \ln 3 \cdot (3x^2 + 2) - \frac{1}{x} \right]}{e^{\ln x}}$$

$$f(x) = \frac{e^{(4x^2-7x)}}{\sqrt[4]{6x^3-7x+1}} = e^{(4x^2-7x)} \cdot (6x^3-7x+1)^{-\frac{1}{4}}$$

$$f'(x) = e^{(4x^2-7x)} \cdot (8x-7) \cdot (6x^3-7x+1)^{-\frac{1}{4}} + \frac{-1}{4} (6x^3-7x+1)^{-\frac{5}{4}} \cdot (18x^2-7) \cdot e^{(4x^2-7x)}$$

58.

$$f'(x) = e^{(4x^2-7x)} \cdot (6x^3-7x+1)^{-\frac{5}{4}} \left[ (8x-7)(6x^3-7x+1) - \frac{1}{4}(18x^2-7) \right]$$

$$f'(x) = \frac{e^{(4x^2-7x)}}{(6x^3-7x+1)^{\frac{5}{4}}} \cdot \left[ (8x-7)(6x^3-7x+1) - \frac{1}{4}(18x^2-7) \right]$$

$$f(x) = \frac{\log_4(x^2+5x-1)}{\ln^2(x^3-5)}$$

59.

$$f'(x) = \frac{\frac{1}{(x^2+5x-1)\ln 4} \cdot (2x+5) \cdot \ln^2(x^3-5) - 2\ln(x^3-5) \cdot \frac{1}{(x^3-5)} \cdot 3x^2 \cdot \log_4(x^2+5x-1)}{[\ln^2(x^3-5)]^2}$$

$$f(x) = \log_7(4x-3)^5 \sqrt[3]{\ln(x^3-5)} = \log_7(4x-3)^5 (\ln(x^3-5))^{\frac{1}{3}}$$

$$60. f'(x) = \frac{1}{(4x-3)^5 \cdot \ln 7} \cdot 5(4x-3)^4 \cdot 4 \cdot (\ln(x^3-5))^{\frac{1}{3}} + \frac{1}{3} (\ln(x^3-5))^{\frac{-2}{3}} \cdot \frac{1}{(x^3-5)} \cdot 3x^2 \cdot \log_7(4x-3)^5$$

$$f'(x) = \frac{1}{(4x-3) \cdot \ln 7} \cdot 5 \cdot 4 \cdot (\ln(x^3-5))^{\frac{1}{3}} + (\ln(x^3-5))^{\frac{-2}{3}} \cdot \frac{1}{(x^3-5)} \cdot x^2 \cdot \log_7(4x-3)^5$$