

Basic Differentiation

$$\begin{array}{l} 1. \quad f(x) = 6 \\ \quad f'(x) = 0 \end{array}$$

$$\begin{array}{l} 3. \quad f(x) = x \\ \quad f'(x) = 1 \end{array}$$

$$\begin{array}{l} 5. \quad f(x) = x^9 \\ \quad f'(x) = 9x^8 \end{array}$$

$$\begin{array}{l} 7. \quad f(x) = x^{-8} \\ \quad f'(x) = -8x^{-9} = -\frac{8}{x^9} \end{array}$$

$$\begin{array}{l} 9. \quad f(x) = x^{-\frac{7}{3}} \\ \quad f'(x) = -\frac{7}{3}x^{-\frac{10}{3}} = -\frac{7}{3x^{\frac{10}{3}}} \end{array}$$

$$\begin{array}{l} 11. \quad f(x) = 5x^4 \\ \quad f'(x) = 5 \cdot 4x^3 = 20x^3 \end{array}$$

$$\begin{array}{l} 13. \quad f(x) = \frac{6}{x^7} = 6x^{-7} \\ \quad f'(x) = 6 \cdot -7x^{-8} = -\frac{42}{x^8} \end{array}$$

$$\begin{array}{l} 15. \quad f(x) = 7^{5x} \\ \quad f'(x) = 7^{5x} \cdot \ln 7 \cdot 5 \end{array}$$

$$\begin{array}{l} 17. \quad f(x) = 11^{\frac{x}{5}} = 11^{\frac{1}{5}x} \\ \quad f'(x) = 11^{\frac{1}{5}x} \cdot \ln 11 \cdot \frac{1}{5} \end{array}$$

$$\begin{array}{l} 19. \quad f(x) = e^{-7x} \\ \quad f'(x) = e^{-7x} \cdot -7 \end{array}$$

$$\begin{array}{l} 2. \quad f(x) = -7 \\ \quad f'(x) = 0 \end{array}$$

$$\begin{array}{l} 4. \quad f(x) = x^3 \\ \quad f'(x) = 3x^2 \end{array}$$

$$\begin{array}{l} 6. \quad f(x) = x^{-3} \\ \quad f'(x) = -3x^{-4} = -\frac{3}{x^4} \end{array}$$

$$\begin{array}{l} 8. \quad f(x) = x^{\frac{3}{5}} \\ \quad f'(x) = \frac{3}{5}x^{-\frac{2}{5}} = \frac{3}{5x^{\frac{2}{5}}} \end{array}$$

$$\begin{array}{l} 10. \quad f(x) = \frac{1}{x^5} = x^{-5} \\ \quad f'(x) = -5x^{-6} = -\frac{5}{x^6} \end{array}$$

$$\begin{array}{l} 12. \quad f(x) = 7x^{-5} \\ \quad f'(x) = 7 \cdot -5x^{-6} = -\frac{35}{x^6} \end{array}$$

$$\begin{array}{l} 14. \quad f(x) = 4^x \\ \quad f'(x) = 4^x \cdot \ln 4 \end{array}$$

$$\begin{array}{l} 16. \quad f(x) = 9^{-7x} \\ \quad f'(x) = 9^{-7x} \cdot \ln 9 \cdot -7 \end{array}$$

$$\begin{array}{l} 18. \quad f(x) = e^{3x} \\ \quad f'(x) = e^{3x} \cdot 3 \end{array}$$

$$\begin{array}{l} 20. \quad f(x) = e^{-5x} \\ \quad f'(x) = e^{-5x} \cdot -5 \end{array}$$

$$21. \begin{aligned} f(x) &= e^{3x^2} \\ f'(x) &= e^{3x^2} \cdot 6x \end{aligned}$$

$$22. \begin{aligned} f(x) &= e^{x^4} \\ f'(x) &= e^{x^4} \cdot 4x^3 \end{aligned}$$

$$23. \begin{aligned} f(x) &= 11^{3x^3} \\ f'(x) &= 11^{3x^3} \cdot 9x^2 \end{aligned}$$

$$24. \begin{aligned} f(x) &= \ln(2x) \\ f'(x) &= \frac{1}{2x} \cdot 2 = \frac{1}{x} \end{aligned}$$

$$25. \begin{aligned} f(x) &= \ln(4x) \\ f'(x) &= \frac{1}{4x} \cdot 4 = \frac{1}{x} \end{aligned}$$

$$26. \begin{aligned} f(x) &= \ln(x^3) \\ f'(x) &= \frac{1}{x^3} \cdot 3x^2 = \frac{3}{x} \end{aligned}$$

$$27. \begin{aligned} f(x) &= \ln(-7x^5) \\ f'(x) &= \frac{1}{(-7x^5)} \cdot -7 \cdot 5x^4 = \frac{5}{x} \end{aligned}$$

$$28. \begin{aligned} f(x) &= \log_7 x = \frac{\ln x}{\ln 7} = \frac{1}{\ln 7} \cdot \ln x \\ f'(x) &= \frac{1}{\ln 7} \cdot \frac{1}{x} = \frac{1}{x \ln 7} \end{aligned}$$

$$29. \begin{aligned} f(x) &= \log_{11}(3x) = \frac{\ln(3x)}{\ln 11} = \frac{1}{\ln 11} \cdot \ln(3x) \\ f'(x) &= \frac{1}{\ln 11} \cdot \frac{1}{3x} \cdot 3 = \frac{1}{x \ln 11} \end{aligned}$$

$$30. \begin{aligned} f(x) &= \log_2(4x^5) = \frac{\ln(4x^5)}{\ln 2} = \frac{1}{\ln 2} \cdot \ln(4x^5) \\ f'(x) &= \frac{1}{\ln 2} \cdot \frac{1}{4x^5} \cdot 20x^4 = \frac{5}{x \ln 2} \end{aligned}$$

$$31. \begin{aligned} f(x) &= x^3 + 5x^2 - 7x + 2 \\ f'(x) &= 3x^2 + 10x - 7 \end{aligned}$$

$$32. \begin{aligned} f(x) &= 6x^{-7} + 7^{2x} \\ f'(x) &= 6 \cdot -7x^{-8} + 7^{2x} \cdot \ln 7 \cdot 2 \\ f'(x) &= -\frac{42}{x^8} + 7^{2x} \cdot \ln 7 \cdot 2 \end{aligned}$$

$$33. \begin{aligned} f(x) &= \frac{3}{x^{13}} + 5x^3 - 5 + 3^{9x} = 3x^{-13} + 5x^3 - 5 + 3^{9x} \\ f'(x) &= 3 \cdot -13x^{-14} + 5 \cdot 3x^2 + 3^{9x} \cdot \ln 3 \cdot 9 \\ f'(x) &= -\frac{39}{x^{14}} + 15x^2 + 3^{9x} \cdot \ln 3 \cdot 9 \end{aligned}$$

$$34. \begin{aligned} f(x) &= \ln(5x^2) + \log_9(5x) = \ln(5x^2) + \frac{\ln(5x)}{\ln 9} = \ln(5x^2) + \frac{1}{\ln 9} \cdot \ln(5x) \\ f'(x) &= \frac{1}{5x^2} \cdot 10x + \frac{1}{\ln 9} \cdot \frac{1}{5x} \cdot 5 = \frac{2}{x} + \frac{1}{x \ln 9} \end{aligned}$$

$$f(x) = \log_8(3x^3 - 6x + 1) = \frac{\ln(3x^3 - 6x + 1)}{\ln 8} = \frac{1}{\ln 8} \cdot \ln(3x^3 - 6x + 1)$$

$$35. \quad f'(x) = \frac{1}{\ln 8} \cdot \frac{1}{(3x^3 - 6x + 1)} \cdot (9x^2 - 6)$$

$$f(x) = 6^{(3x^2 - 7x + 1)}$$

$$36. \quad f'(x) = 6^{(3x^2 - 7x + 1)} \cdot \ln 6 \cdot (6x - 7)$$

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

$$37. \quad f'(x) = e^{\ln(5x-3)} \cdot \frac{1}{5x-3} \cdot 5$$

$$f(x) = \ln(5^{3x^3 + 7x - e^{2x}})$$

$$38. \quad f'(x) = \frac{1}{(5^{3x^3 + 7x - e^{2x}})} \cdot (5^{3x^3 + 7x - e^{2x}}) \cdot \ln 5 \cdot (9x^2 + 7 - e^{2x} \cdot 2) =$$

$$f'(x) = \ln 5 \cdot (9x^2 + 7 - e^{2x} \cdot 2)$$