3.1 Exercises

In Exercises 1–34, find the derivative of the function f by using the rules of differentiation.

1. $f(x) = -3$
2. $f(x) = 365$
3. $f(x) = x^5$
4. $f(x) = x^7$
5. $f(x) = x^{3.1}$
6. $f(x) = x^{0.8}$
7. $f(x) = 3x^2$
8. $f(x) = -2x^3$
9. $f(r) = \pi r^2$
10. $f(r) = \frac{4}{3}\pi r^3$
11. $f(x) = 9x^{1/3}$
12. $f(x) = \frac{5}{4}x^{4/5}$
13. $f(x) = 3\sqrt{x}$
14. $f(u) = \frac{2}{\sqrt{u}}$
15. $f(x) = 7x^{-12}$
16. $f(x) = 0.3x^{-1.2}$
17. $f(x) = 5x^2 - 3x + 7$
18. $f(x) = x^3 - 3x^2 + 1$
19. $f(x) = -x^3 + 2x^2 - 6$
20. $f(x) = (1 + 2x^2)^2 + 2x^3$
21. $f(x) = 0.03x^2 - 0.4x + 10$
22. $f(x) = 0.002x^3 - 0.05x^2 + 0.1x - 20$
23. $f(x) = \frac{2x^3 - 4x^2 + 3}{x}$
24. $f(x) = \frac{x^3 + 2x^2 + x - 1}{x}$
25. $f(x) = 4x^4 - 3x^{5/2} + 2$
26. $f(x) = 5x^{4/3} - \frac{2}{3}x^{3/2} + x^2 - 3x + 1$
27. $f(x) = 5x^{-1} + 4x^{-2}$
28. $f(x) = -\frac{1}{3}(x^{-3} - x^6)$
29. $f(t) = \frac{4}{t^4} - \frac{3}{t^3} + \frac{2}{t}$
30. $f(x) = \frac{5}{x^3} - \frac{2}{x^2} - \frac{1}{x} + 200$
31. $f(x) = 3x - 5\sqrt{x}$
32. $f(t) = 2t^2 + \sqrt{t^3}$
33. $f(x) = \frac{2}{x^2} - \frac{3}{x^{1/3}}$
34. $f(x) = \frac{3}{x^3} + \frac{4}{\sqrt{x}} + 1$
35. Let $f(x) = 2x^3 - 4x$. Find:
    a. $f'(-2)$ b. $f'(0)$ c. $f'(2)$
36. Let $f(x) = 4x^{5/4} + 2x^{3/2} + x$. Find:
    a. $f'(4)$ b. $f'(16)$

In Exercises 37–40, find each limit by evaluating the derivative of a suitable function at an appropriate point.
Hint: Look at the definition of the derivative.

37. $\lim_{h \to 0} \frac{(1 + h)^3 - 1}{h}$
38. $\lim_{x \to 1} \frac{x^5 - 1}{x - 1}$
    Hint: Let $h = x - 1$.
39. $\lim_{h \to 0} \frac{3(2 + h)^2 - (2 + h) - 10}{h}$
40. $\lim_{t \to 0} \frac{1 - (1 + t)^2}{t(1 + t)^2}$

In Exercises 41–44, find the slope and an equation of the tangent line to the graph of the function f at the specified point.

41. $f(x) = 2x^2 - 3x + 4; (2, 6)$
42. $f(x) = -\frac{5}{3}x^2 + 2x + 2; \left(-1, -\frac{5}{3}\right)$
43. $f(x) = x^4 - 3x^3 + 2x^2 - x + 1; (2, -1)$
44. $f(x) = \sqrt{x} + \frac{1}{\sqrt{x}}; \left(4, \frac{5}{2}\right)$
45. Let $f(x) = x^3$.
    a. Find the point on the graph of f where the tangent line is horizontal.
    b. Sketch the graph of f and draw the horizontal tangent line.