

3.3 Exercises

In Exercises 1–48, find the derivative of each function.

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

2. $f(x) = (1 - x)^4$

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

4. $f(t) = 2(t^3 - 1)^5$

5. $f(x) = (2x - x^2)^3$

6. $f(x) = 3(x^3 - x)^4$

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

8. $f(t) = \frac{1}{2}(2t^2 + t)^{-3}$

9. $f(x) = (x^2 - 4)^{5/2}$

10. $f(t) = (3t^2 - 2t + 1)^{3/2}$

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

12. $f(t) = \sqrt{3t^2 - t}$

13. $f(x) = \sqrt[3]{1 - x^2}$

14. $f(x) = \sqrt{2x^2 - 2x + 3}$

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

16. $f(x) = \frac{2}{(x^2 - 1)^4}$

17. $f(t) = \frac{1}{\sqrt{2t - 4}}$

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

19. $y = \frac{1}{(4x^4 + x)^{3/2}}$

20. $f(t) = \frac{4}{\sqrt[3]{2t^2 + t}}$

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

22. $f(t) = (5t^3 + 2t^2 - t + 4)^{-3}$

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

24. $f(t) = (2t - 1)^4 + (2t + 1)^4$

25. $f(t) = (t^{-1} - t^{-2})^3$

26. $f(v) = (v^{-3} + 4v^{-2})^3$

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

28. $f(u) = (2u + 1)^{3/2} + (u^2 - 1)^{-3/2}$

29. $f(x) = 2x^2(3 - 4x)^4$

30. $h(t) = t^2(3t + 4)^3$

31. $f(x) = (x - 1)^2(2x + 1)^4$

32. $g(u) = \sqrt{u + 1}(1 - 2u^2)^8$

33. $f(x) = \left(\frac{x + 3}{x - 2}\right)^3$

34. $f(x) = \left(\frac{x + 1}{x - 1}\right)^5$

35. $s(t) = \left(\frac{t}{2t + 1}\right)^{3/2}$

36. $g(s) = \left(s^2 + \frac{1}{s}\right)^{3/2}$

37. $g(u) = \sqrt{\frac{u + 1}{3u + 2}}$

38. $g(x) = \sqrt{\frac{2x + 1}{2x - 1}}$

39. $f(x) = \frac{x^2}{(x^2 - 1)^4}$

40. $g(u) = \frac{2u^2}{(u^2 + u)^3}$

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

42. $g(t) = \frac{(2t - 1)^2}{(3t + 2)^4}$

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

44. $f(t) = \frac{4t^2}{\sqrt{2t^2 + 2t - 1}}$

45. $g(t) = \frac{\sqrt{t + 1}}{\sqrt{t^2 + 1}}$

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

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

48. $g(t) = (2t + 3)^2(3t^2 - 1)^{-3}$

In Exercises 49–54, find $\frac{dy}{du}$, $\frac{du}{dx}$, and $\frac{dy}{dx}$.

49. $y = u^{4/3}$ and $u = 3x^2 - 1$

50. $y = \sqrt{u}$ and $u = 7x - 2x^2$

51. $y = u^{-2/3}$ and $u = 2x^3 - x + 1$

52. $y = 2u^2 + 1$ and $u = x^2 + 1$

53. $y = \sqrt{u} + \frac{1}{\sqrt{u}}$ and $u = x^3 - x$

54. $y = \frac{1}{u}$ and $u = \sqrt{x} + 1$

55. If $g(x) = f(2x + 1)$, what is $g'(x)$?

56. If $h(x) = f(-x^3)$, what is $h'(x)$?

57. Suppose $F(x) = g(f(x))$ and $f(2) = 3$, $f'(2) = -3$, $g(3) = 5$, and $g'(3) = 4$. Find $F'(2)$.

58. Suppose $h = f \circ g$. Find $h'(0)$ given that $f(0) = 6$, $f'(5) = -2$, $g(0) = 5$, and $g'(0) = 3$.

59. Suppose $F(x) = f(x^2 + 1)$. Find $F'(1)$ if $f'(2) = 3$.

60. Let $F(x) = f(f(x))$. Does it follow that $F'(x) = [f'(x)]^2$?
Hint: Let $f(x) = x^2$.