EXERCISES 2

In Exercises 1–4, perform the indicated operations on the resulting expressions if the given changes are made in the indicated examples of this section.

1. In Example 1(b), change the sign in the first parentheses from + to − and then perform the addition.
2. In Example 2(b), change the sign before $6.2j$ from − to +, and then perform the multiplication.
3. In Example 3(a), change the sign in the denominator from + to − and then simplify.
4. In Example 3(b), change the sign in the second denominator from + to − and then simplify.

In Exercises 5–38, perform the indicated operations, expressing all answers in the form $a + bj$.

5. $(3 - 7j) + (2 - j)$
6. $(-4 - j) + (-7 - 4j)$
7. $(7j - 6) - (19 - 3j)$
8. $(5.4 - 3.4j) - (2.9j + 5.5)$
9. $0.23 - (0.46 - 0.19j) + 0.67j$
10. $(7 - j) - (4 - 4j) - (j - 6)$
11. $(12j - 21) - (15 - 18j) - 9j$
12. $(0.062j - 0.073) - 0.030j - (0.121 - 0.051j)$
13. $(7 - j)(7j)$
14. $(-2.2j)(1.5j - 4.0)$
15. $(4 - j)(5 + 2j)$
16. $(8j - 5)(7 + 4j)$
17. $(\sqrt{-18}\sqrt{-4})(3j)$
18. $\sqrt{-6}\sqrt{-12}\sqrt{30}$
19. $7j^3 - 7\sqrt{-9}$
20. $6j - 5j^2\sqrt{-63}$
21. $j\sqrt{-7} - j^6\sqrt{112} + 3j$
22. $j^2\sqrt{-7} - \sqrt{-28} + 8j^3$
23. $(3 - 7j)^2$
24. $(8j + 20)^2$
25. $(1 - j)^3$
26. $(1 + j)(1 - j)^2$
27. $\dfrac{6j}{2 - 5j}$
28. $\dfrac{0.25}{3 - \sqrt{-1}}$
29. $\dfrac{1 - j}{3j}$
30. $\dfrac{12 + 10j}{6 - 8j}$
31. $\dfrac{j\sqrt{2} - 5}{j\sqrt{2} + 3}$
32. $\dfrac{j^5 - j^3}{3 + j}$
33. $\dfrac{j^2 - j}{2j - j^8}$
34. $\dfrac{3}{2j} - \dfrac{5}{j - 6}$
35. $\dfrac{4j}{1 - j} - \dfrac{j + 8}{2 + 3j}$
36. $\dfrac{(6j + 5)(2 - 4j)}{(5 - j)(4j + 1)}$
37. $(4j^5 - 5j^4 + 2j^3 - 3j^2)^2$
38. $(2j^2 - 3j^3 + 2j^4 - 2j^5)^6$

In Exercises 39–42, evaluate each expression on a calculator. Express answers in the form $a + bj$.

39. $(3j^9 - 5j^3)(4j^6 - 6j^8)$
40. $(5j - 4j^2 + 3j^7)(2j^{12} - j^{13})$
41. $\dfrac{(2 - j^3)^4}{(j^8 - j^6)^3} + j$
42. $(1 + j)^{-3}(2 - j)^{-2}$

In Exercises 43–56, solve the given problems.

43. Show that $-1 - j$ is a solution to the equation $x^2 + 2x + 2 = 0$.
44. Show that $1 - j\sqrt{3}$ is a solution to the equation $x^2 + 4 = 2x$.
45. What is the sum of the solutions for the equation $x^2 - 4x + 13 = 0$?
46. What is the product of the solutions to the equation in Exercise 45?
47. Multiply $-3 + j$ by its conjugate.
48. Divide $2 - 3j$ by its conjugate.
49. Write the reciprocal of $3 - j$ in rectangular form.
50. Write the reciprocal of $2 + 5j$ in rectangular form.
51. Write $j^{-2} + j^{-3}$ in rectangular form.
52. Solve for x: $(x + 2j)^2 = 5 + 12j$
53. Solve for x: $(x + 3j)^2 = 7 - 24j$
54. For $\dfrac{3}{5} + \dfrac{4}{5}j$, find: (a) the conjugate; (b) the reciprocal.
55. If $f(x) = x + \dfrac{1}{x}$, find $f(1 + 3j)$.
56. When finding the current in a certain electric circuit, the expression $(s + 1 + 4j)(s + 1 - 4j)$ occurs. Simplify this expression.

In Exercises 57–60, solve the given problems. Refer to Example 4.

57. If $I = 0.835 - 0.427j$ amperes and $Z = 250 + 170j$ ohms, find the complex-number representation for E.
58. If $E = 5.70 - 3.65j$ mV and $I = 0.360 - 0.525j$ μA, find the complex-number representation for Z.
59. If $E = 85 + 74j$ volts and $Z = 2500 - 1200j$ ohms, find the complex-number representation for I.
60. In an alternating-current circuit, two impedances Z_1 and Z_2 have a total impedance Z_T of $Z_T = \dfrac{Z_1 Z_2}{Z_1 + Z_2}$. Find Z_T for $Z_1 = 3.2 + 4.8j$ mΩ and $Z_2 = 4.8 - 6.4j$ mΩ.

In Exercises 61–64, answer or explain as indicated.

61. What type of number is the result of (a) adding a complex number to its conjugate and (b) subtracting a complex number from its conjugate?
62. (W) If the reciprocal of $a + bj$ equals $a - bj$, what condition must a and b satisfy?
63. (W) Explain why the product of a complex number and its conjugate is real and nonnegative.
64. (W) Explain how to show that the reciprocal of the imaginary unit is the negative of the imaginary unit.

Answers to Practice Exercises

1. $-3 - j$ 2. $41 - 57j$ 3. $\dfrac{-11 - 41j}{53}$