

real, complex
 real, complex 9. complex,
 imaginary 10. complex,
 imaginary 11. complex
 complex 13. real, complex
 real, complex 15. complex,
 imaginary 16. complex,
 imaginary 17. $5i$ 18. $6i$

$\sqrt{10}$ 20. $i\sqrt{15}$
 $2i\sqrt{2}$ 22. $10i\sqrt{5}$
 $-3i\sqrt{2}$ 24. $-4i\sqrt{5}$
 -13 26. -17 27. $-2\sqrt{6}$
 $-5\sqrt{3}$ 29. $\sqrt{3}$ 30. $\sqrt{10}$

$\sqrt{3}$ 32. $i\sqrt{2}$ 33. $\frac{1}{2}$
 $\sqrt{2}$ 35. -2 36. -3
 $3 + i\sqrt{6}$ 38. $-3 + i\sqrt{2}$
 $-2i\sqrt{2}$ 40. $10 - i\sqrt{2}$

$\frac{1}{8} + \frac{\sqrt{2}}{8}i$
 $\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i$ 43. $7 - i$
 $+ 4i$ 45. 2 46. 1
 $-10i$ 48. $-10 + i$

$13 + 5i$ 50. $-3 + 2i$
 $-i$ 52. $-2 + 16i$
 $14 + 2i$ 54. $17 + i$
 $-12i$ 56. $3 + 4i$

$8 - 6i$ 58. $-24 - 10i$
 3 60. 52 61. 7 62. 18
 $5i$ 64. $53i$ 65. $12 + 9i$
 $120 - 35i$ 67. $20 + 15i$
 $9 - 60i$ 69. i 70. i

1 72. -1 73. $-i$
 i 75. 1 76. 1 77. $-i$
 1 79. $-i$ 80. 1

Identify each number as real, complex, or pure imaginary. (More than one of these descriptions may apply.)

7. -6 8. 0 9. $10i$ 10. $-8i$ 11. $2 + i$
 12. $-5 - 2i$ 13. π 14. $\sqrt{8}$ 15. $\sqrt{-9}$ 16. $\sqrt{-16}$

Write each number as the product of a real number and i . See Example 1.

17. $\sqrt{-25}$ 18. $\sqrt{-36}$ 19. $\sqrt{-10}$ 20. $\sqrt{-15}$
 21. $\sqrt{-288}$ 22. $\sqrt{-500}$ 23. $-\sqrt{-18}$ 24. $-\sqrt{-80}$

Multiply or divide as indicated. Simplify each answer. See Example 2.

25. $\sqrt{-13} \cdot \sqrt{-13}$ 26. $\sqrt{-17} \cdot \sqrt{-17}$ 27. $\sqrt{-3} \cdot \sqrt{-8}$
 28. $\sqrt{-5} \cdot \sqrt{-15}$ 29. $\frac{\sqrt{-30}}{\sqrt{-10}}$ 30. $\frac{\sqrt{-70}}{\sqrt{-7}}$
 31. $\frac{\sqrt{-24}}{\sqrt{8}}$ 32. $\frac{\sqrt{-54}}{\sqrt{27}}$ 33. $\frac{\sqrt{-10}}{\sqrt{-40}}$
 34. $\frac{\sqrt{-40}}{\sqrt{20}}$ 35. $\frac{\sqrt{-6} \cdot \sqrt{-2}}{\sqrt{3}}$ 36. $\frac{\sqrt{-12} \cdot \sqrt{-6}}{\sqrt{8}}$

Write each number in standard form $a + bi$. See Example 3.

37. $\frac{-6 + \sqrt{-24}}{2}$ 38. $\frac{-9 + \sqrt{-18}}{3}$ 39. $\frac{10 - \sqrt{-200}}{5}$
 40. $\frac{20 - \sqrt{-8}}{2}$ 41. $\frac{3 + \sqrt{-18}}{24}$ 42. $\frac{5 + \sqrt{-50}}{10}$

Find each sum or difference. Write the answer in standard form. See Example 4.

43. $(3 + 2i) + (4 - 3i)$ 44. $(4 - i) + (2 + 5i)$
 45. $(-2 + 3i) - (-4 + 3i)$ 46. $(-3 + 5i) - (-4 + 5i)$
 47. $(2 - 5i) - (3 + 4i) - (-2 + i)$ 48. $(-4 - i) - (2 + 3i) + (-4 + 5i)$
 49. $-i - 2 - (6 - 4i) - (5 - 2i)$ 50. $3 - (4 - i) - 4i + (-2 + 5i)$

Find each product. Write the answer in standard form. See Example 5.

51. $(2 + i)(3 - 2i)$ 52. $(-2 + 3i)(4 - 2i)$ 53. $(2 + 4i)(-1 + 3i)$
 54. $(1 + 3i)(2 - 5i)$ 55. $(-3 + 2i)^2$ 56. $(2 + i)^2$
 57. $(3 + i)(-3 - i)$ 58. $(-5 - i)(5 + i)$ 59. $(2 + 3i)(2 - 3i)$
 60. $(6 - 4i)(6 + 4i)$ 61. $(\sqrt{6} + i)(\sqrt{6} - i)$ 62. $(\sqrt{2} - 4i)(\sqrt{2} + 4i)$
 63. $i(3 - 4i)(3 + 4i)$ 64. $i(2 + 7i)(2 - 7i)$ 65. $3i(2 - i)^2$
 66. $-5i(4 - 3i)^2$ 67. $(2 + i)(2 - i)(4 + 3i)$ 68. $(3 - i)(3 + i)(2 - 6i)$

Simplify each power of i . See Example 6.

69. i^{21} 70. i^{25} 71. i^{22} 72. i^{26}
 73. i^{23} 74. i^{27} 75. i^{24} 76. i^{32}
 77. i^{-9} 78. i^{-10} 79. $\frac{1}{i^{-11}}$ 80. $\frac{1}{i^{12}}$