Note

For real numbers, we can check a quotient using the fact that if $\frac{a}{b} = c$, then $bc = a$. For instance, $\frac{12}{4} = 3$ and $4 \cdot 3 = 12$. For complex number division, the same applies. Note in Example 4, $\frac{16 - 11i}{5 + 2i} = 2 - 3i$ and

$$\begin{aligned}(5+2i)(2-3i) &= 10+4i-15i-6i^2 \\ &= 10-11i+6 \\ &= 16-11i\end{aligned}$$

Powers of i

The following powers of i illustrate a pattern:

$$\begin{aligned} i^1 &= i & i^5 &= i^4 \cdot i = 1 \cdot i = i \\ i^2 &= -1 & i^6 &= i^4 \cdot i^2 = 1(-1) = -1 \\ i^3 &= i^2 \cdot i = (-1)i = -i & i^7 &= i^4 \cdot i^3 = 1(-i) = -i \\ i^4 &= i^2 \cdot i^2 = (-1)(-1) = 1 & i^8 &= (i^4)^2 = 1^2 = 1 \end{aligned}$$

Because $i^4 = 1$, $(i^4)^n = 1^n = 1$ for any integer n. Thus it is possible to evaluate powers of i by factoring out powers of i^4, as shown in the following.

$$i^{27} = (i^4)^6 \cdot i^3 = 1^6 \cdot i^3 = 1 \cdot (-i) = -i$$

The following theorem can also be used to evaluate powers of i.

Powers of i

If n is a positive integer, then $i^n = i^r$, where r is the remainder of the division of n by 4.

Alternative to Example 5
Evaluate: i^{214}
■ -1

EXAMPLE 5 Evaluate a Power of i

Evaluate: i^{153}

Solution

Use the powers of i theorem.

$$i^{153} = i^1 = i \qquad \text{• Remainder of } 153 \div 4 \text{ is } 1.$$

Try Exercise 64, page 65

EXERCISE SET P.6

Concept Check

In Exercises 1 to 4, determine the real part and the imaginary part of the complex number.

1. $12 - 17i$ 12, −17
2. $-37i$ 0, −37
3. $\sqrt{7}$ $\sqrt{7}$, 0
4. 0 0, 0

In Exercises 5 to 8, write the conjugate of the complex number.

5. $4 - 9i$ $4 + 9i$
6. $3 + i\sqrt{7}$ $3 - i\sqrt{7}$
7. $-11i$ $11i$
8. i $-i$

In Exercises 9 to 18, write the complex number in standard form.

9. $\sqrt{-81}$ $9i$
10. $\sqrt{-64}$ $8i$
11. $\sqrt{-98}$ $7i\sqrt{2}$
12. $\sqrt{-27}$ $3i\sqrt{3}$
13. $\sqrt{16} + \sqrt{-81}$ $4 + 9i$
14. $\sqrt{25} + \sqrt{-9}$ $5 + 3i$
15. $5 + \sqrt{-49}$ $5 + 7i$
16. $6 - \sqrt{-1}$ $6 - i$
17. $8 - \sqrt{-18}$ $8 - 3i\sqrt{2}$
18. $11 + \sqrt{-48}$ $11 + 4i\sqrt{3}$

In Exercises 19 to 58, simplify and write the complex number in standard form.

19. $(5 + 2i) + (6 - 7i)$ $11 - 5i$
20. $(4 - 8i) + (5 + 3i)$ $9 - 5i$
21. $(-2 - 4i) - (5 - 8i)$ $-7 + 4i$
22. $(3 - 5i) - (8 - 2i)$ $-5 - 3i$
23. $(1 - 3i) + (7 - 2i)$ $8 - 5i$
24. $(2 - 6i) + (4 - 7i)$ $6 - 13i$
25. $(-3 - 5i) - (7 - 5i)$ -10
26. $(5 - 3i) - (2 + 9i)$ $3 - 12i$

Indicates Try It Exercises

27. $8i - (2 - 8i)$ $-2 + 16i$

28. $3 - (4 - 5i)$ $-1 + 5i$

29. $5i \cdot 8i$ -40

30. $(-3i)(2i)$ 6

31. $\sqrt{-50} \cdot \sqrt{-2}$ -10

32. $\sqrt{-12} \cdot \sqrt{-27}$ -18

33. $3(2 + 5i) - 2(3 - 2i)$ $19i$

34. $3i(2 + 5i) + 2i(3 - 4i)$ $-7 + 12i$

35. $(4 + 2i)(3 - 4i)$ $20 - 10i$

36. $(6 + 5i)(2 - 5i)$ $37 - 20i$

37. $(-3 - 4i)(2 + 7i)$ $22 - 29i$

38. $(-5 - i)(2 + 3i)$ $-7 - 17i$

39. $(4 - 5i)(4 + 5i)$ 41

40. $(3 + 7i)(3 - 7i)$ 58

41. $\dfrac{6}{i}$ $-6i$

42. $\dfrac{-8}{2i}$ $4i$

43. $\dfrac{6 + 3i}{i}$ $3 - 6i$

44. $\dfrac{4 - 8i}{4i}$ $-2 - i$

45. $\dfrac{1}{7 + 2i}$ $\dfrac{7}{53} - \dfrac{2}{53}i$

46. $\dfrac{5}{3 + 4i}$ $\dfrac{3}{5} - \dfrac{4}{5}i$

47. $\dfrac{2i}{1 + i}$ $1 + i$

48. $\dfrac{5i}{2 - 3i}$ $-\dfrac{15}{13} + \dfrac{10}{13}i$

49. $\dfrac{5 - i}{4 + 5i}$ $\dfrac{15}{41} - \dfrac{29}{41}i$

50. $\dfrac{4 + i}{3 + 5i}$ $\dfrac{1}{2} - \dfrac{1}{2}i$

51. $\dfrac{3 + 2i}{3 - 2i}$ $\dfrac{5}{13} + \dfrac{12}{13}i$

52. $\dfrac{8 - i}{2 + 3i}$ $1 - 2i$

53. $\dfrac{-7 + 26i}{4 + 3i}$ $2 + 5i$

54. $\dfrac{-4 - 39i}{5 - 2i}$ $2 - 7i$

55. $(3 - 5i)^2$ $-16 - 30i$

56. $(2 + 4i)^2$ $-12 + 16i$

57. $(1 + 2i)^2$ $-3 + 4i$

58. $(2 - i)^2$ $3 - 4i$

In Exercises 59 to 66, evaluate.

59. i^{15} $-i$

60. i^{66} -1

61. $-i^{40}$ -1

62. $-i^{51}$ i

63. $\dfrac{1}{i^{25}}$ $-i$

64. $\dfrac{1}{i^{83}}$ i

65. i^{-34} -1

66. i^{-52} 1

In Exercises 67 to 70, evaluate $\dfrac{-b + \sqrt{b^2 - 4ac}}{2a}$ for the given values of a, b, and c. Write your answer as a complex number in standard form.

67. $a = 2, b = 4, c = 4$ $-1 + i$

68. $a = 4, b = -4, c = 2$ $\dfrac{1}{2} + \dfrac{1}{2}i$

69. $a = 3, b = -3, c = 3$ $\dfrac{1}{2} + \dfrac{\sqrt{3}}{2}i$

70. $a = 2, b = 6, c = 6$ $-\dfrac{3}{2} + \dfrac{\sqrt{3}}{2}i$

Enrichment Exercises

In Exercises 71 and 72, expand the power of the complex number.

71. $(1 - 3i)^3$ $-26 + 18i$

72. $(2 + i)^4$ $-7 + 24i$

73. Show that $\sqrt{i} = \dfrac{1}{\sqrt{2}} + \dfrac{i}{\sqrt{2}}$.

74. Show that $\sqrt{-i} = \dfrac{1}{\sqrt{2}} - \dfrac{i}{\sqrt{2}}$.

Exploring Concepts with Technology

Can You Trust Your Calculator?

You may think that your calculator always produces correct results in a *predictable* manner. However, the following experiment may change your opinion.

First note that the algebraic expression

$$p + 3p(1 - p)$$

is equal to the expression

$$4p - 3p^2$$

Use a graphing calculator to evaluate both expressions with $p = 0.05$. You should find that both expressions equal 0.1925. So far, we do not observe any unexpected results. Now replace p in each expression with the current value of that expression (0.1925 in this case). This is called *feedback* because we are feeding our output back into each expression as input. Each new evaluation is referred to as an *iteration*. This time, each expression takes on the value

(*continued*)

Operations on Complex Numbers • To add or subtract two complex numbers, add or subtract the real parts and add or subtract the imaginary parts • To multiply two complex numbers, use the FOIL method (first, outer, inner, last) and the fact that $i^2 = -1$. • To divide two complex numbers, multiply the numerator and denominator by the conjugate of the denominator.	See Example 2, page 61, and then try Exercises 113 and 114, page 72. See Example 3, page 62, and then try Exercise 116, page 72. See Example 4, page 63, and then try Exercise 120, page 72.
Powers of *i* If n is a positive integer, then $i^n = i^r$, where r is the remainder when n is divided by 4.	See Example 5, page 64, and then try Exercise 118, page 72.

CHAPTER P REVIEW EXERCISES

In Exercises 1 to 4, classify each number as one or more of the following: integer, rational number, irrational number, real number, prime number, composite number.

1. 3 Integer, rational number, real number, prime number [P.1]

2. $\sqrt{7}$ Irrational number, real number [P.1]

3. $-\frac{1}{2}$ Rational number, real number [P.1]

4. $0.\overline{5}$ Rational number, real number [P.1]

In Exercises 5 and 6, list the four smallest elements of the set.

5. $\{y \mid y = x^2, x \in \text{integers}\}$ 0, 1, 4, 9 [P.1]

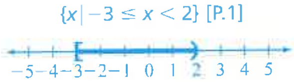
6. $\{y \mid y = 2x + 1, x \in \text{natural numbers}\}$ 3, 5, 7, 9 [P.1]

In Exercises 7 and 8, use $A = \{1, 5, 7\}$ and $B = \{2, 3, 5, 11\}$ to find the indicated intersection or union.

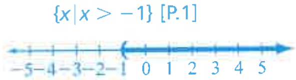
7. $A \cup B$ $\{1, 2, 3, 5, 7, 11\}$ [P.1] **8.** $A \cap B$ $\{5\}$ [P.1]

In Exercises 9 and 10, graph each interval and write the interval in set-builder notation.

9. $[-3, 2)$ $\{x \mid -3 \le x < 2\}$ [P.1]

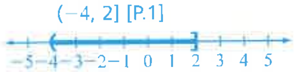


10. $(-1, \infty)$ $\{x \mid x > -1\}$ [P.1]

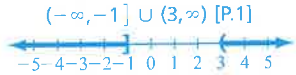


In Exercises 11 and 12, graph each set and write the set in interval notation.

11. $\{x \mid -4 < x \le 2\}$ $(-4, 2]$ [P.1]



12. $\{x \mid x \le -1\} \cup \{x \mid x > 3\}$ $(-\infty, -1] \cup (3, \infty)$ [P.1]



In Exercises 13 to 18, write each expression without absolute value symbols.

13. $|7|$ 7 [P.1] **14.** $|2 - \pi|$ $\pi - 2$ [P.1] **15.** $|4 - \pi|$ $4 - \pi$ [P.1] **16.** $|-11|$ 11 [P.1]

17. $|x - 2| + |x + 1|, -1 < x < 2$ 3 [P.1]

18. $|2x + 3| - |x - 4|, -3 \le x \le -2$ $-x - 7$ [P.1]

19. If -3 and 7 are the coordinates of two points on the real number line, find the distance between the two points. 10 [P.1]

20. If $a = 4$ and $b = -1$ are the coordinates of two points on the real number line, find $d(a, b)$. 5 [P.1]

In Exercises 21 to 24, evaluate the expression.

21. -4^4 -256 [P.1] **22.** $-4^2(-3)^2$ -144 [P.1]

23. $-5 \cdot 3^2 + 4\{5 - 2[-6 - (-4)]\}$ -9 [P.1]

24. $6 - 2\left[4 - \dfrac{(-5)^2 - 29}{-2^2}\right]$ 0 [P.1]

In Exercises 25 and 26, evaluate the variable expressions for $x = -2$, $y = 3$, and $z = -5$.

25. $-3x^3 - 4xy - z^2$ 23 [P.1] **26.** $2x - 3y(4z - x^3)$ 104 [P.1]

In Exercises 27 to 34, identify the real number property or property of equality that is illustrated.

27. $5(x + 3) = 5x + 15$ Distributive property [P.1]

28. $a(3 + b) = a(b + 3)$ Commutative property of addition [P.1]

29. $(6c)d = 6(cd)$ Associative property of multiplication [P.1]

30. $\sqrt{2} + 3$ is a real number. Closure property of addition [P.1]

31. $7 + 0 = 7$ Identity property of addition [P.1]

32. $1x = x$ Identity property of multiplication [P.1]

33. If $7 = x$, then $x = 7$. Symmetric property of equality [P.1]

34. If $3x + 4 = y$ and $y = 5z$, then $3x + 4 = 5z$. Transitive property of equality [P.1]

In Exercises 35 and 36, simplify the variable expression.

35. $8 - 3(2x - 5)$ $-6x + 23$ [P.1]

36. $5x - 3[7 - 2(6x - 7) - 3x]$ $50x - 63$ [P.1]

In Exercises 37 to 40, simplify the exponential expression.

37. -2^{-5} $-\frac{1}{32}$ [P.2]

38. $-\frac{1}{\pi^0}$ -1 [P.2]

39. $\frac{2}{z^{-4}}$ $2z^4$ [P.2]

40. $\frac{x^{-4}}{y^{-3}}$ $\frac{y^3}{x^4}$ [P.2]

In Exercises 41 and 42, write each number in scientific notation.

41. 620,000 6.2×10^5 [P.2]

42. 0.0000017 1.7×10^{-6} [P.2]

In Exercises 43 and 44, change each number from scientific notation to decimal form.

43. 3.5×10^4 35,000 [P.2]

44. 4.31×10^{-7} 0.000000431 [P.2]

In Exercises 45 to 48, evaluate each exponential expression.

45. $25^{1/2}$ 5 [P.2]

46. $-27^{2/3}$ -9 [P.2]

47. $36^{-1/2}$ $\frac{1}{6}$ [P.2]

48. $\frac{3}{81^{-1/4}}$ 9 [P.2]

In Exercises 49 to 58, simplify the expression.

49. $(-4x^3y^2)(6x^4y^3)$ $-24x^7y^5$ [P.2]

50. $\frac{12a^5b}{18a^3b^6}$ $\frac{2a^2}{3b^5}$ [P.2]

51. $(-3x^{-2}y^3)^{-3}$ $-\frac{x^6}{27y^9}$ [P.2]

52. $\left(\frac{2a^2b^{-4}}{6a^{-3}b^6}\right)^{-2}$ $\frac{9b^{20}}{a^{10}}$ [P.2]

53. $(-4x^{-3}y^2)^{-2}(8x^{-2}y^{-3})^2$ $\frac{4x^2}{y^{10}}$ [P.2]

54. $\frac{(-2x^4y^{-5})^{-3}}{(4x^{-3}y^4)^{-2}}$ $-\frac{2y^{23}}{x^{18}}$ [P.2]

55. $(x^{-1/2})(x^{3/4})$ $x^{1/4}$ [P.2]

56. $\frac{a^{2/3}b^{-3/4}}{a^{5/6}b^2}$ $\frac{1}{a^{1/6}b^{11/4}}$ [P.2]

57. $\left(\frac{8x^{5/4}}{x^{1/2}}\right)^{2/3}$ $4x^{1/2}$ [P.2]

58. $\left(\frac{x^2y}{x^{1/2}y^{-3}}\right)^{1/2}$ $x^{3/4}y^2$ [P.2]

In Exercises 59 to 72, simplify each radical expression. Assume that the variables are positive real numbers.

59. $\sqrt{48a^2b^7}$ $4ab^3\sqrt{3b}$ [P.2]

60. $\sqrt{12a^3b}$ $2a\sqrt{3ab}$ [P.2]

61. $\sqrt[3]{-135x^2y^7}$ $-3y^2\sqrt[3]{5x^2y}$ [P.2]

62. $\sqrt[3]{-250xy^6}$ $-5y^2\sqrt[3]{2x}$ [P.2]

63. $b\sqrt{8a^4b^3} + 2a\sqrt{18a^2b^5}$ $8a^2b^2\sqrt{2b}$ [P.2]

64. $3x\sqrt[3]{16x^5y^{10}} - 4y^2\sqrt[3]{2x^8y^4}$ $2x^2y^3\sqrt[3]{2x^2y}$ [P.2]

65. $(3 + 2\sqrt{5})(7 - 3\sqrt{5})$ $-9 + 5\sqrt{5}$ [P.2]

66. $(5\sqrt{2} - 7)(3\sqrt{2} + 6)$ $-12 + 9\sqrt{2}$ [P.2]

67. $(4 - 2\sqrt{7})^2$ $44 - 16\sqrt{7}$

68. $(2 - 3\sqrt{x})^2$ $4 - 12\sqrt{x} + 9x$ [P.2]

69. $\frac{6}{\sqrt{8}}$ $\frac{3\sqrt{2}}{2}$ [P.2]

70. $\frac{9}{\sqrt[3]{9x}}$ $\frac{3\sqrt[3]{3x^2}}{x}$ [P.2]

71. $\frac{3 + 2\sqrt{7}}{9 - 3\sqrt{7}}$ $\frac{23 + 9\sqrt{7}}{6}$ [P.2]

72. $\frac{5}{2\sqrt{x} - 3}$ $\frac{10\sqrt{x} + 15}{4x - 9}$ [P.2]

73. Write the polynomial $4x - 7x^2 + 5 - x^3$ in standard form. Identify the degree, the leading coefficient, and the constant term. $-x^3 - 7x^2 + 4x + 5$; 3, -1, 5 [P.3]

74. Evaluate the polynomial $3x^3 - 4x^2 + 2x - 1$ when $x = -2$. -45 [P.3]

In Exercises 75 to 82, perform the indicated operation and express each result as a polynomial in standard form.

75. $(2a^2 + 3a - 7) + (-3a^2 - 5a + 6)$ $-a^2 - 2a - 1$ [P.3]

76. $(5b^2 - 11) - (3b^2 - 8b - 3)$ $2b^2 + 8b - 8$ [P.3]

77. $(3x - 2)(2x^2 + 4x - 9)$ $6x^3 + 8x^2 - 35x + 18$ [P.3]

78. $(4y - 5)(3y^3 - 2y^2 - 8)$ $12y^4 - 23y^3 + 10y^2 - 32y + 40$ [P.3]

79. $(3x - 4)(x + 2)$ $3x^2 + 2x - 8$ [P.3]

80. $(5x + 1)(2x - 7)$ $10x^2 - 33x - 7$ [P.3]

81. $(2x + 5)^2$ $4x^2 + 20x + 25$ [P.3]

82. $(4x - 5y)(4x + 5y)$ $16x^2 - 25y^2$ [P.3]

In Exercises 83 to 86, factor out the GCF.

83. $12x^3y^4 + 10x^2y^3 - 34xy^2$ $2xy^2(6x^2y^2 + 5xy - 17)$ [P.4]

84. $24a^4b^3 + 12a^3b^4 - 18a^2b^5$ $6a^2b^3(4a^2 + 2ab - 3b^2)$ [P.4]

85. $(2x + 7)(3x - y) - (3x + 2)(3x - y)$ $(3x - y)(-x + 5)$ [P.4]

86. $(5x + 2)(3a - 4) - (3a - 4)(2x - 6)$ $(3a - 4)(3x + 8)$ [P.4]

In Exercises 87 to 102, factor the polynomial over the integers.

87. $x^2 + 7x - 18$ $(x - 2)(x + 9)$ [P.4]

88. $x^2 - 2x - 15$ $(x - 5)(x + 3)$ [P.4]

89. $2x^2 + 11x + 12$ $(2x + 3)(x + 4)$ [P.4]

90. $3x^2 - 4x - 15$ $(3x + 5)(x - 3)$ [P.4]

91. $6x^3y^2 - 12x^2y^2 - 144xy^2$ $6xy^2(x - 6)(x + 4)$ [P.4]

92. $-2a^4b^3 - 2a^3b^3 + 12a^2b^3$ $-2a^2b^3(a - 2)(a + 3)$ [P.4]

93. $9x^2 - 100$ $(3x - 10)(3x + 10)$ [P.4]

94. $25x^2 - 30xy + 9y^2$ $(5x - 3y)^2$ [P.4]

95. $x^4 - 5x^2 - 6$ $(x^2 - 6)(x^2 + 1)$ [P.4]

96. $x^4 + 2x^2 - 3$ $(x - 1)(x + 1)(x^2 + 3)$ [P.4]

97. $x^3 - 27$ $(x - 3)(x^2 + 3x + 9)$ [P.4]

98. $3x^3 + 192$ $3(x + 4)(x^2 - 4x + 16)$ [P.4]

99. $4x^4 - x^2 - 4x^2y^2 + y^2$ $(x + y)(x - y)(2x + 1)(2x - 1)$ [P.4]

100. $2a^3 + a^2b - 2ab^2 - b^3$ $(a - b)(a + b)(2a + b)$ [P.4]

101. $24a^2b^2 - 14ab^3 - 90b^4$ $2b^2(3a + 5b)(4a - 9b)$ [P.4]

102. $3x^5y^2 - 9x^3y^2 - 12xy^2$ $3xy^2(x - 2)(x + 2)(x^2 + 1)$ [P.4]

In Exercises 103 and 104, simplify each rational expression.

103. $\dfrac{6x^2 - 19x + 10}{2x^2 + 3x - 20}$ $\dfrac{3x-2}{x+4}$ [P.5]

104. $\dfrac{4x^3 - 25x}{8x^4 + 125x}$ $\dfrac{2x-5}{4x^2 - 10x + 25}$ [P.5]

In Exercises 105 to 108, perform the indicated operation and simplify, if possible.

105. $\dfrac{10x^2 + 13x - 3}{6x^2 - 13x - 5} \cdot \dfrac{6x^2 + 5x + 1}{10x^2 + 3x - 1}$ $\dfrac{2x+3}{2x-5}$ [P.5]

106. $\dfrac{15x^2 + 11x - 12}{25x^2 - 9} \div \dfrac{3x^2 + 13x + 12}{10x^2 + 11x + 3}$ $\dfrac{2x+1}{x+3}$ [P.5]

107. $\dfrac{x}{x^2 - 9} + \dfrac{2x}{x^2 + x - 12}$ $\dfrac{x(3x+10)}{(x+3)(x-3)(x+4)}$ [P.5]

108. $\dfrac{3x}{x^2 + 7x + 12} - \dfrac{x}{2x^2 + 5x - 3}$ $\dfrac{x(5x-7)}{(x+3)(x+4)(2x-1)}$ [P.5]

In Exercises 109 and 110, simplify each complex fraction.

109. $\dfrac{2 + \dfrac{1}{x-5}}{3 - \dfrac{2}{x-5}}$ $\dfrac{2x-9}{3x-17}$ [P.5]

110. $\dfrac{1}{2 + \dfrac{3}{1 + \dfrac{4}{x}}}$ $\dfrac{x+4}{5x+8}$ [P.5]

In Exercises 111 and 112, write the complex number in standard form.

111. $5 + \sqrt{-64}$ $5 + 8i$ [P.6]

112. $2 - \sqrt{-18}$ $2 - 3i\sqrt{2}$ [P.6]

In Exercises 113 to 120, perform the indicated operation and write the answer in simplest form.

113. $(2 - 3i) + (4 + 2i)$ $6 - i$ [P.6]

114. $(4 + 7i) - (6 - 3i)$ $-2 + 10i$ [P.6]

115. $2i(3 - 4i)$ $8 + 6i$ [P.6]

116. $(4 - 3i)(2 + 7i)$ $29 + 22i$ [P.6]

117. $(3 + i)^2$ $8 + 6i$ [P.6]

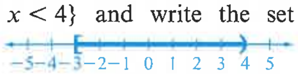
118. i^{345} i [P.6]

119. $\dfrac{4 - 6i}{2i}$ $-3 - 2i$ [P.6]

120. $\dfrac{2 - 5i}{3 + 4i}$ $-\dfrac{14}{25} - \dfrac{23}{25}i$ [P.6]

CHAPTER P TEST

1. For real numbers a, b, and c, identify the property that is illustrated by $(a + b)c = ac + bc$. Distributive property [P.1]

2. Graph $\{x \mid -3 \le x < 4\}$ and write the set in interval notation. $[-3, 4)$  [P.1]

3. Given $-1 < x < 4$, simplify $|x + 1| - |x - 5|$. $2x - 4$ [P.1]

4. Simplify: $(-2x^0y^{-2})^2(-3x^2y^{-1})^{-2}$ $\dfrac{4}{9x^4y^2}$ [P.2]

5. Simplify: $\dfrac{(2a^{-1}bc^{-2})^2}{(3^{-1}b)(2^{-1}ac^{-2})^3}$ $\dfrac{96bc^2}{a^5}$ [P.2]

6. Write 0.00137 in scientific notation. 1.37×10^{-3} [P.2]

7. Simplify: $\dfrac{x^{1/3}y^{-3/4}}{x^{-1/2}y^{3/2}}$ $\dfrac{x^{5/6}}{y^{9/4}}$ [P.2]

8. Simplify: $3x\sqrt[3]{81xy^4} - 2y\sqrt[3]{3x^4y}$ $7xy\sqrt[3]{3xy}$ [P.2]

9. Simplify: $(2\sqrt{3} - 4)(5\sqrt{3} + 2)$ $22 - 16\sqrt{3}$ [P.2]

10. Simplify: $(2 - \sqrt{x+4})^2$ $x - 4\sqrt{x+4} + 8$ [P.2]

11. Simplify: $\dfrac{x}{\sqrt[4]{2x^3}}$ $\dfrac{\sqrt[4]{8x}}{2}$ [P.2]

12. Simplify: $\dfrac{3}{2 - 3\sqrt{7}}$ $-\dfrac{6 + 9\sqrt{7}}{59}$ [P.2]

13. Simplify: $\dfrac{2 + \sqrt{5}}{4 - 2\sqrt{5}}$ $-\dfrac{9 + 4\sqrt{5}}{2}$ [P.2]

14. Subtract: $(3x^3 - 2x^2 - 5) - (2x^2 + 4x - 7)$ $3x^3 - 4x^2 - 4x + 2$ [P.3]

15. Multiply: $(3a + 7b)(2a - 9b)$ $6a^2 - 13ab - 63b^2$ [P.3]

16. Multiply: $(2x + 5)(3x^2 - 6x - 2)$ $6x^3 + 3x^2 - 34x - 10$ [P.3]

17. Factor: $7x^2 + 34x - 5$ $(7x - 1)(x + 5)$ [P.4]

18. Factor: $3ax - 12bx - 2a + 8b$ $(a - 4b)(3x - 2)$ [P.4]

19. Factor: $16x^4 - 2xy^3$ $2x(2x - y)(4x^2 + 2xy + y^2)$ [P.4]

20. Factor: $x^4 - 15x^2 - 16$ $(x - 4)(x + 4)(x^2 + 1)$ [P.4]

21. Simplify: $\dfrac{x^2 - 2x - 15}{25 - x^2}$ $-\dfrac{x+3}{x+5}$ [P.5]

22. Simplify: $\dfrac{x}{x^2 + x - 6} - \dfrac{2}{x^2 - 5x + 6}$ $\dfrac{(x-6)(x+1)}{(x+3)(x-2)(x-3)}$ [P.5]

23. Multiply: $\dfrac{x^2 - 3x - 4}{x^2 + x - 20} \cdot \dfrac{x^2 + 3x - 10}{x^2 + 2x - 8}$ $\dfrac{x+1}{x+4}$ [P.5]

24. Simplify: $\dfrac{2x^2 + 3x - 2}{x^2 - 3x} \div \dfrac{2x^2 - 7x + 3}{x^3 - 3x^2}$ $\dfrac{x(x+2)}{x-3}$ [P.5]

25. Simplify: $x - \dfrac{x}{x + \dfrac{1}{2}}$ $\dfrac{x(2x-1)}{2x+1}$ [P.5]

26. Write $7 + \sqrt{-20}$ in standard form. $7 + 2i\sqrt{5}$ [P.6]

In Exercises 27 to 30, write the complex number in simplest form.

27. $(4 - 3i) - (2 - 5i)$
$2 + 2i$ [P.6]

28. $(2 + 5i)(1 - 4i)$
$22 - 3i$ [P.6]

29. $\dfrac{3 + 4i}{5 - i}$ $\dfrac{11}{26} + \dfrac{23}{26}i$ [P.6]

30. i^{97} i [P.6]