

Chapter P: Preliminary Concepts

Section P.1 Sets

Sets

- Identify the integer numbers in the set $\left\{5, -\frac{7}{20}, -7, 10\pi, 15, 0.4, \sqrt{7}, -\frac{7}{25}\right\}$.
(a) $\sqrt{7}, 1.5, -\frac{7}{25}, 0.5$ (b) $5, -7, 15$ (c) $10\pi, 15$ (d) $0.5, \sqrt{7}$
- Which of the following is an irrational number?
(a) $-\frac{3}{7}$ (b) $\frac{1}{6}$ (c) $0.9818181\dots$ (d) $\sqrt{32}$ (e) $\sqrt{9}$
- Which represents the set in a different way?
 $\{x \mid x \text{ is an integer greater than } 4\}$
(a) $\{5, 6, 7\}$ (b) $\{4, 5, 6, \dots\}$ (c) $\{5, 6, 7, 8, 9, \dots\}$ (d) $\{4, 5, 6, 7, 8, 9\}$
- Use set-builder notation to write the set.
even integers greater than -52
(a) $\{x \mid x > -52, x \in \text{even integers}\}$ (b) $\{x \mid x < -52, x \in \text{positive integers}\}$
(c) $\{x \mid x < -52, x \in \text{even integers}\}$ (d) $\{x \mid x > -52, x \in \text{integers}\}$

Union and Intersection of Sets

- Given $K = \{1, 6, 12, 14, 23\}$ and $D = \{2, 9, 12, 16, 23\}$, find $K \cup D$.
(a) $K \cup D = \{1, 2, 6, 9, 12, 14, 16, 23\}$ (b) $K \cup D = \{12, 23\}$ (c) $K \cup D = \{ \}$ (d) none of these
- Given $A = \{3, 5, 7, 9\}$ and $B = \{1, 2, 3, 4\}$, find $A \cap B$.
 $\{x \mid x\}$
(a) $A \cap B = \{1, 2, 3, 4, 5, 7, 9\}$ (b) $A \cap B = \{3, 4\}$ (c) $A \cap B = \{3\}$ (d) $A \cap B = \{ \}$
- Find $A \cap B$ if $A = \{x \mid x \text{ is prime}\}$ and $B = \{2, 4, 6, 8, 10, 12\}$.
(a) $A \cap B = \{2, 10\}$ (b) $A \cap B = \{ \}$ (c) $A \cap B = \{2\}$ (d) $A \cap B = \{x \mid x \text{ is a multiple of } 2\}$
- If $A = \{5, 10, 15, 20\}$, $B = \{6, 11, 16, 21\}$, and $C = \{5, 11, 15, 16\}$, find $(A \cup C) \cap B$.
(a) $\{10, 20\}$ (b) $\{5, 10, 15, 16, 20\}$ (c) $\{11, 16\}$ (d) $\{6, 21\}$

Absolute Value and Distance

- Which of the following is the distance between the numbers 11.8 and -1.9 ?
(a) 13.7 (b) -13.7 (c) 9.9 (d) -9.9
- Find the distance between the points whose coordinates are 6 and -3 .
(a) 3 (b) -9 (c) -3 (d) 9

11. Find the distance between the points whose coordinates are $\frac{2}{3}$ and $\frac{-1}{4}$.

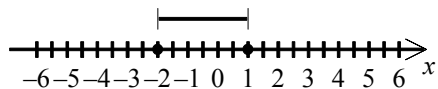
(a) $\frac{7}{6}$

(b) $-\frac{7}{6}$

(c) $-\frac{11}{12}$

(d) $\frac{11}{12}$

12. Which is an expression for the distance shown with the bar?



(a) $|2-1|$

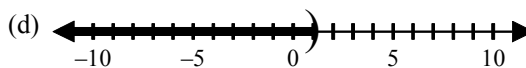
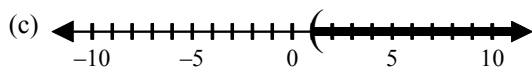
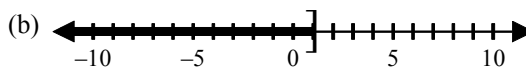
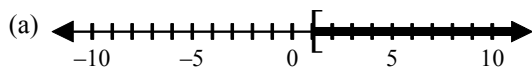
(b) $|-2-1|$

(c) $-2+1$

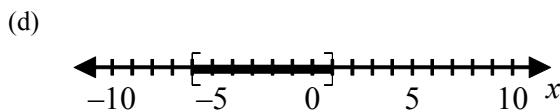
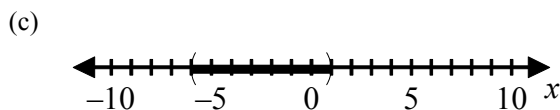
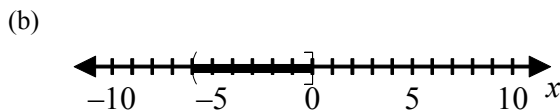
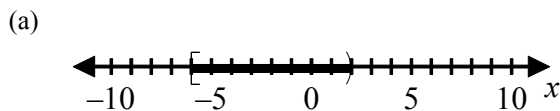
(d) $-2-1$

Interval Notation

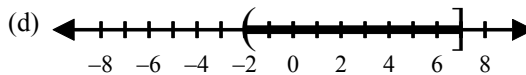
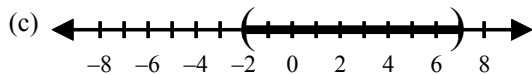
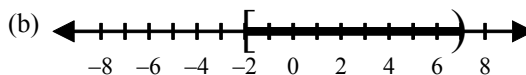
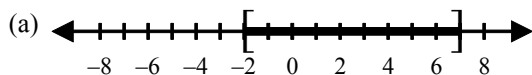
13. Which of the following is the graph of $x > 1$?



14. Which of the following is the graph of $-6 < x < 1$?

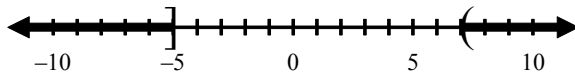


15. Which of the following is the graph of $\{x | x > -2\} \cap \{x | x \leq 7\}$?

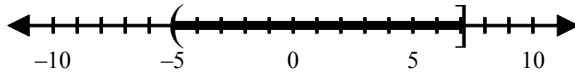


16. Which of the following is the graph of $\{x \mid x \leq -5\} \cup \{x \mid x > 7\}$?

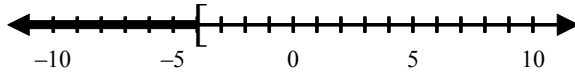
(a)



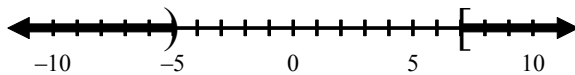
(b)



(c)



(d)



Order of Operations Agreement

Evaluate the polynomial.

17. $-x^2 - 4xy + y^2$ when $x = 6$ and $y = -2$ (a) 16 (b) 32 (c) 8 (d) 88

18. $3c^3 - 3c^2 + 8c - 3$ when $c = 2$ (a) 19 (b) 16 (c) 25 (d) 22

19. $x^4 - 4x^2 - 21$ when $x = -4$ (a) 171 (b) -5 (c) -25 (d) 11

20. $2x^2 + x - 3$ when $x = 2$ (a) 13 (b) 6 (c) 7 (d) 14

Simplifying Variable Expressions

21. Which equation demonstrates the Associative Property of Addition?

(a) $2 - 5 = -5 + 2$ (b) $2 + (-2) = 0$ (c) $2 + (-5 - 9) = (2 - 5) - 9$ (d) $2 + 0 = 2$

Which property illustrates the following fact?

22. $34 \cdot 1 = 34$

- (a) Distributive Property (b) Commutative Property of Multiplication
(c) Identity Property of Multiplication (d) Associative Property of Multiplication

23. $69 + 0 = 69$

- (a) Commutative Property of Addition (b) Closure Property of Addition
(c) Associative Property of Addition (d) Identity Property of Addition

24. $8 + 6 = 6 + 8$

- (a) Commutative Property of Addition (b) Associative Property of Multiplication
(c) Associative Property of Addition (d) Commutative Property of Multiplication

Section P.2 Integer and Rational Number Exponents**Properties of Exponents**

25. Simplify. $64^{2/3}$ (a) $\frac{1}{4}$ (b) 64 (c) 16 (d) $\frac{128}{3}$
26. Simplify. (a) $-\frac{y^{12}}{256}$ (b) $\frac{y^{12}}{256}$ (c) $\frac{y^{81}}{256}$ (d) $-\frac{y^{81}}{4}$
 $\left(-\frac{1}{4}y^3\right)^4$
27. Simplify. $(-4u^3r^6t^5)^3$ (a) $-64u^9r^{18}t^{15}$ (b) $-12u^6r^9t^8$ (c) $-12u^9r^9t^{15}$ (d) $-64u^6r^{18}t^8$
28. Simplify. (a) $2a^7b^{-1}$ (b) $\frac{1}{2a^7b^{-1}}$ (c) $\frac{1}{2a^7b}$ (d) $2a^7b$
 $\frac{2a^{-3}b^{-9}}{4a^4b^{-8}}$

Scientific Notation

Express the number in scientific notation.

29. 560,000 (a) 5.6×10^5 (b) 5.6×10^6 (c) 5.6×10^7 (d) 56×10^4
30. 0.00000481 (a) 481×10^{-6} (b) 4.81×10^{-6} (c) 4.81×10^{-4} (d) 4.81×10^7
31. 423.15 (a) 4.2315×10^2 (b) 4.2315×10^4 (c) 423.15 (d) 4.2315×10^3
32. Identify the number written in decimal form.
 6.96×10^7
 (a) 0.000000696 (b) 6,960,000 (c) 69,600,000 (d) 696,000,000

Rational Exponents and Radicals

33. Rewrite the exponential expression as a radical expression.
 $4^{2/3}$
 (a) $\sqrt{4^{3/2}}$ (b) $\sqrt[3]{4^2}$ (c) $\sqrt{4^{2/3}}$ (d) $\frac{1}{\sqrt[3]{4^2}}$
34. Rewrite the exponential expression as a radical expression.
 $b^{3/2}$
 (a) $\sqrt{b^{3/2}}$ (b) $\sqrt{b^3}$ (c) $\sqrt{b^{2/3}}$ (d) $\frac{1}{\sqrt{b^3}}$
35. Rewrite the exponential expression as a radical expression.
 $(4x)^{2/3}$
 (a) $\sqrt{4x^{2/3}}$ (b) $\sqrt[3]{16x^2}$ (c) $\sqrt{4x^{3/2}}$ (d) $\frac{1}{\sqrt[3]{16x^2}}$

36. Rewrite the exponential expression as a radical expression.

$$(a^7b^3)^{4/3}$$

(a) $\sqrt[3]{a^{11}b^7}$

(b) $\sqrt[4]{a^{21}b^9}$

(c) $\sqrt[3]{a^{28}b^{12}}$

(d) $\sqrt[4]{a^{10}b^6}$

Simplify Radical Expressions

Simplify.

37. $\sqrt{63}$ (a) $7\sqrt{3}$ (b) $3\sqrt{7}$ (c) $21\sqrt{3}$ (d) $3\sqrt{21}$

38. $\sqrt[3]{64x^5}$ (a) $x\sqrt[3]{64x^2}$ (b) $2x\sqrt[3]{x^4}$ (c) $4x\sqrt[3]{x^2}$ (d) $4x^3$

39. $\sqrt{18x^{11}y^6}$ (a) $3x^5y^3\sqrt{2x}$ (b) $9x^{10}y^3\sqrt{2xy}$ (c) $3xy^3\sqrt{18x}$ (d) $x\sqrt{2x}$

40. $\sqrt{27q^4r^{10}s^{12}}$ (a) $\sqrt{3}$ (b) $3q^2r^5s^6\sqrt{3}$ (c) $3q^2r^5s^6$ (d) $27\sqrt{3}$

Section P.3 Polynomials**Operations on Polynomials**

Simplify.

41. $(2x^2 + 8x + 10) + (-7x^2 - x + 2)$

(a) $9x^2 + 9x + 8$

(b) $-9x^2 - 9x - 8$

(c) $5x^2 - 7x - 12$

(d) $-5x^2 + 7x + 12$

42. $(x^5 + 8x) - (4x + 8 - 7x^5)$

(a) $x^5 + 12x + 8$

(b) $-3x^5 + x + 8$

(c) $-6x^5 - 4x - 8$

(d) $8x^5 + 4x - 8$

43. $(y - 3)(y^2 - 3y - 1)$

(a) $y^3 - 6y^2 + 8y + 3$

(b) $y^3 - 6y^2 + 3$

(c) $y^3 + 6y^2 - 8y + 3$

(d) $y^3 - 6y^2 - 3$

44. $(3x^2 - 7x + 5)(x^2 - 4x + 4)$

(a) $3x^4 + 45x^3 - 11x^2 - 48x + 9$

(b) $4x^4 + 3x^3 - 11x^2 + 9x + 20$

(c) $3x^4 - 19x^3 + 45x^2 - 48x + 20$

(d) $4x^4 - 48x^3 + 45x^2 - 19x + 9$

Applications of Polynomials

45. Since 1993, Isabel Rueda has owned a franchise of take-out restaurants called Basically Bagels. The number of customers
- C
- , in thousands, that Basically Bagels has served each year can be represented by the equation

 $C = t^2 + 34t + 500$, where t is the number of years after 1993. Using this model, estimate the number of customers served in 1996.

(a) 611,000

(b) 608,000

(c) 809,000

(d) 611

46. A water balloon is thrown from an apartment window. The height of the balloon can be modeled by
- $h = -16t^2 + 543$
- , where
- h
- is the height in feet above the ground and
- t
- is the time in seconds. Which is the balloon's height after 3 seconds?

(a) 399 ft

(b) 409 ft

(c) 687 ft

(d) 798 ft

47. The height, h , of an arrow shot upward with an initial velocity of 59 meters per second is described by the function $h(t) = 59t - 16t^2$. Find the height of the arrow when $t = 2$ seconds.
- (a) 86 m (b) 54 m (c) 204 m (d) 43 m
48. A biologist estimated the population of seals over a span of 20 years after restrictions were put on hunting. Her data can be modeled by the equation $P = 0.6x^4 - 18x^3 + 200x^2 - 900x + 2400$, where x is the number of years after the restrictions went into place, and P is the total population of seals. Evaluate the population for $x = 5$.
- (a) 995 seals (b) 1025 seals (c) 1018 seals (d) 905 seals

Section P.4 Factoring**Greatest Common Factor**

Factor.

49. $12x^3 - 18x^5$ (a) $x^3(12 - 18x^2)$ (b) $6(2x^3 - 3x^5)$ (c) $6x^2(2x - 3x^4)$ (d) $6x^3(2 - 3x^2)$
50. $4x^5 + 4x^3$ (a) $4x^2(x^3 + 1)$ (b) $4x^3(x + 1)^2$ (c) $4x^3(x^2 + 1)$ (d) $4x^3(x + 1)$
51. Factor the polynomial. $4x^3 - 12x^2 + 20x$
- (a) $4x(x^2 - 3x + 5)$ (b) $4x(x - 3)(x + 5)$ (c) $x(4x^2 - 12x + 20)$ (d) $4(x^3 - 3x^2 + 5x)$
52. Factor: $9x^6 - 12x^5 + 15x^4 + 12x^3$
- (a) $3x^2(3x^4 - 4x^3 + 5x^2 + 4x)$ (b) $3x^3(3x - 4)(5x + 4)$
- (c) $3x^5(3x - 4)(x + 4x^3)$ (d) $3x^3(3x^3 - 4x^2 + 5x + 4)$

Factoring Trinomials

53. Factor. $x^2 + 7x + 10$ (a) $(x - 5)(x - 2)$ (b) $(x + 7)(x + 10)$ (c) $(x + 5)(x + 2)$ (d) $(x - 5)(x + 2)$
54. Factor. $x^2 + 6x - 27$ (a) $(x + 9)(x + 3)$ (b) $(x + 9)(x - 3)$ (c) $(x - 9)(x + 3)$ (d) $(x - 9)(x - 3)$

Factor.

55. $5x^2 - 46x + 48$ (a) $(5x - 6)(x + 8)$ (b) $(5x + 6)(x + 8)$ (c) $(x - 8)(5x + 6)$ (d) $(5x - 6)(x - 8)$
56. $15x^2 - 19x + 6$
- (a) $(15x + 2)(x + 3)$ (b) $(5x - 2)(3x - 3)$ (c) $(3x - 2)(5x - 3)$ (d) $(3x + 2)(5x + 3)$

Special Factoring

Factor.

57. $81x^2 - 49y^2$ (a) $(9x + 7y)(9x - 7y)$ (b) $(9x + 7)(9x - 7)$ (c) $(9x - 7y)^2$ (d) $(9x + 7y)^2$
58. $f^2 + 6f + 9$ (a) $(f - 3)^2$ (b) $(f + 3)^2$ (c) $(f - 9)(f + 1)$ (d) $(f + 3)(f - 3)$

Factor.

59. $4x^2 - 12x + 9$ (a) $(4x-3)(x-3)$ (b) $(2x+3)(2x-3)$ (c) $(2x+3)^2$ (d) $(2x-3)^2$

60. $k^3 - 8$ (a) $(k-2)^3$ (b) $(k+2)(k^2 - 2k + 4)$ (c) $(k-2)(k^2 + 2k + 4)$ (d) $(k-2)(k^2 + 4)$

Factor by Grouping

61. Factor by grouping. $3x^3 + 9x^2 - 21x^2 - 63x$

(a) $3x(x+3)(x-7)$ (b) $3(x+3)(x-7)$ (c) $x(3x+4)(3x-6)$ (d) $(3x+4)(3x-6)$

Factor:

62. $3x^2 + 9x + 5x + 15$

(a) $3 + (x+5)(x+3)$ (b) $(3x+3)(x+5)$ (c) $x(3x+3) + 15$ (d) $(3x+5)(x+3)$

63. $4x^3 - 12x^2 + x - 3$ (a) $(x-3)(4x^2 + 1)$ (b) $x(4x^2 - 3x - 3)$ (c) $4x^2(x-3)$ (d) $(x-12)(4x^2 - 1)$

64. $3x^2 + 6xy + 12y + 6x$

(a) $3(x+2y)$ (b) $3(x+2y)(x+2)$ (c) $3(x+2y)(x+2)(x+3y)$ (d) $3(x-2y)(x-2)$

General Factoring

65. Factor. $64x^3 - 48x^2 - 4x + 3$

(a) $(4x+1)(4x-1)(4x+3)$ (b) $x(64x^2 - 48x - 4x) + 3$

(c) $(4x+1)(4x-1)(4x-3)$ (d) $-16x^2(4x-3) + (-4x+3)$

Factor the trinomial.

66. $5x^6 - 25x^4 + 4x^5 - 20x^3$

(a) $(x-5)(x^2 + 4)$ (b) $(x^2 + 3)(4x+5)(x^3 - 5)$ (c) $x^3(5x+4)(x^2 - 5)$ (d) $x^3(x^2 + 4)$

67. $(f+g)z^2 + 11z(f+g) + 30(f+g)$

(a) $-(f+g)(z^2 - 11z + 30)$ (b) $(f+g)(z-6)(z-5)$ (c) $(f+g)(z+6)(z+5)$ (d) $(z+6)(z+5)$

68. $8(x+4)^2 - 18(x+4) - 18$

(a) $(x+2)(4x+19)$ (b) $2(x+1)(4x+19)$ (c) $(x+2)(5x+19)$ (d) $2(x+1)(5x+19)$

Section P.5 Rational Expressions**Simplify a Rational Expression**

Simplify.

69.
$$\frac{12x^7 - 3x^3 - 3x^2}{3x^5}$$

(a) $4x^7 + \frac{1}{x^2} - \frac{1}{x^3}$

(b) $4x^2 - 3x^3 - 3x^2$

(c) $4x^2 - \frac{1}{x^2} - \frac{1}{x^3}$

(d) $12x^7 - 3x^2 - 1$

70.
$$\frac{-6x}{x-x^2}$$

(a) $-\frac{6}{x+1}$

(b) $-\frac{6}{x-1}$

(c) $\frac{6}{x+1}$

(d) $\frac{6}{x-1}$

71. Simplify the rational expression. Find the excluded values of the variables.

$$\frac{x^2 - 2x - 48}{8 - x}$$

(a) $-(x+6), x \neq 8$

(b) $x-6, x \neq 8$

(c) $x+6, x \neq 8$

(d) $-(x-6), x \neq 8$

72. Simplify:
$$\frac{2x^2 - 2x - 12}{-6x^2 + 54}$$

(a) $\frac{-x-3}{3(x+3)}$

(b) $\frac{-x+2}{3(x-3)}$

(c) $\frac{-x-2}{3(x-3)}$

(d) $\frac{-x-2}{3(x+3)}$

Operations on Rational Expressions

Simplify.

73.
$$\frac{1}{4(x-4)} + \frac{11}{4(x-4)}$$

(a) $\frac{1}{4(x-4)}$

(b) $\frac{12}{x-4}$

(c) $\frac{3}{x-4}$

(d) $3(x-4)$

74.
$$\frac{x}{x^2-1} + \frac{1}{x^2-1}$$

(a) $\frac{1}{x-1}$

(b) $\frac{1}{x+1}$

(c) $\frac{x-1}{x+1}$

(d) $\frac{x+1}{x-1}$

Simplify.

75.
$$\frac{2x^2 - 7x + 3}{2x^2 + x - 1} \div \frac{x^2 - 8x + 15}{3x^2 - 12x - 15}$$

(a) $x-3$

(b) 3

(c) $x-5$

(d) 6

76.
$$\frac{x+1}{3x+y} \cdot \frac{9x^2 - y^2}{4x^2 + 3x - 1}$$

(a) $\frac{3x-y}{4x-1}$

(b) $\frac{3x^2 - y^2}{4x-1}$

(c) $\frac{3x-y}{3}$

(d) $\frac{3x+y}{3x+3}$

Determining the LCD of Rational Expressions

Simplify.

77.
$$\frac{3}{c-4} + \frac{3}{c^2-16}$$

(a) $\frac{6}{(c-4)(c+4)}$

(b) $\frac{3(c+5)}{(c-4)(c+4)}$

(c) $\frac{6c}{(c-4)(c+4)}$

(d) $\frac{3(c-3)}{(c-4)(c+4)}$

Simplify.

78. $\frac{x-1}{x^2-x-12} + \frac{x-6}{x^2-9}$

(a) $\frac{2x^2-14x+27}{(x+3)(x-3)(x-4)}$

(b) $\frac{2x^2-8x+21}{(x+3)(x-3)(x-4)}$

(c) $\frac{2x^2-14x+21}{(x+3)(x-3)(x-4)}$

(d) $\frac{2x^2-8x+27}{(x+3)(x-3)(x-4)}$

79. Subtract: $-\frac{8}{x^2-14x+48} - \frac{4}{x-8}$

(a) $\frac{-4x+16}{x^2-14x+48}$

(b) $\frac{-4x-32}{x^2-14x+48}$

(c) $\frac{-4x-14}{x^2-14x+48}$

(d) $-\frac{12}{x^2-15x+56}$

80. Add: $\frac{-9x}{y^4z^4} + \frac{-7}{y^5z^2}$

(a) $\frac{-9xy^5z^2-7y^4z^4}{y^9z^6}$

(b) $\frac{-9x-7}{y^9z^6}$

(c) $\frac{-9x-7}{y^4z^2}$

(d) $\frac{-9xy-7z^2}{y^5z^4}$

Complex Fractions

81. Simplify the complex fraction.

$$\frac{x - \frac{1}{x^2}}{x - \frac{1}{x^3}}$$

(a) $\frac{x(x^2+x+1)}{(x+1)(x^2+1)}$

(b) $\frac{1}{x+1}$

(c) $\frac{x}{x^2-1}$

(d) $\frac{x(x^2-x+1)}{(x+1)(x^2+1)}$

82. Simplify the complex fraction.

$$\frac{\frac{4x^4}{2y^2}}{\frac{20x^6}{12y^6}}$$

(a) $\frac{6y^4}{5x^2}$

(b) $\frac{15x^3}{13y^4}$

(c) $\frac{13y^4}{15x^3}$

(d) $\frac{5x^2}{6y^4}$

83. Simplify the complex fraction.

$$\frac{b - \frac{1}{a}}{b^2 + \frac{2}{a^2}}$$

(a) $\frac{a^2b-a}{a^2b^2+2}$

(b) $\frac{a^2b-1}{a^2b^2+2a}$

(c) $\frac{a^2b+2}{a^2b^2-a}$

(d) $\frac{a^2(b-1)}{a^2b^2+2}$

84. Simplify: $2 + \frac{e}{2 + \frac{2}{2+e}}$

(a) $2 + \frac{e^2}{6}$

(b) $\frac{e^2+6e+12}{2e+6}$

(c) e^2+6

(d) $\frac{e^2+e+6}{e+1}$

Application of Rational Expressions

85. The total resistance of two resistors wired in a parallel circuit is described by

$$\frac{1}{r_{total}} = \frac{1}{r_1} + \frac{1}{r_2}$$

where r_1 and r_2 are the resistances of the two resistors and r_{total} is the total resistance in the circuit. If the total resistance of a circuit with two resistors wired in parallel must be at least 50 ohms, what is the resistance of r_1 if the resistance of r_2 is 150 ohms?

- (a) 80 ohms (b) 65 ohms (c) 70 ohms (d) 75 ohms
86. A publishing company estimates that the average cost (in dollars) for one copy of a new scenic calendar it plans to produce can be approximated by the function

$$C(x) = \frac{4.75x + 600}{x}$$

where x is the number of calendars printed. Find the average cost per calendar when the company prints 5000 calendars.

- (a) \$5.95 (b) \$0.12 (c) \$4.81 (d) \$4.87
87. The learning curve for a certain task is given by the equation

$$P = \frac{0.5 + 0.6(n-1)}{1 + 0.8(n-1)}, \quad n > 0$$

where P is the fraction of correct responses after n trials. Find the value of P after 10 trials.

- (a) 0.72 (b) 0.71 (c) 0.74 (d) 0.75
88. The production rate of a small factory is modeled by $\frac{(x+16)}{2x(x+5)}$, while the production rate of another factory is

modeled by $\frac{(4x+15)}{2x(x+5)}$. What would be a model for the combined production rate of the two factories?

- (a) $\frac{(5x+31)}{2x^2+10}$ (b) $\frac{(4x^2+31)}{2x^2+10}$ (c) $\frac{(x+16)}{(4x+15)}$ (d) $\frac{(5x+31)}{2x(x+5)}$

Section P.6 Complex Numbers**Introduction to Complex Numbers**

89. Express $\sqrt{-34}$ in the form bi where b is a real number.

- (a) $\sqrt{34}i$ (b) $-\sqrt{34}i$ (c) $-34i$ (d) $\sqrt{-34}i$

90. Rewrite in $a+bi$ form. (a) $4-i$ (b) $2+2i$ (c) $2-2i$ (d) $4+i$
 $2 + \sqrt{-4}$

91. Write the expression as a complex number in the form $a+bi$.

$$\sqrt{-16} + \sqrt{-36}$$

- (a) $2+i$ (b) $0+10i$ (c) $0-10i$ (d) $2-i$

92. Find the standard form of the given complex number.

$$-12i + 8i^2$$

- (a) $8-12i$ (b) $-8-12i$ (c) $-20i$ (d) $-8+12i$

Addition and Subtraction of Complex Numbers

Simplify:

93. $(-9-4i)-(3+2i)$ (a) $-12-6i$ (b) $-6-2i$ (c) $-6+2i$ (d) $-19-30i$

94. $9+12i-(-6+6i)$ (a) $-3-18i$ (b) $3+18i$ (c) $-15-6i$ (d) $15+6i$

95. $(5+9i)-(8+5i)$ (a) $-3+4i$ (b) $13-14i$ (c) $13+14i$ (d) $-5+97i$

96. Simplify. Use a calculator to check answer.

$(3-7i)+2(1+9i)$

(a) $5-25i$

$$\begin{array}{r} (3-7i)+2(1+9i) \\ 5-25i \end{array}$$

(b) $5+11i$

$$\begin{array}{r} (3-7i)+2(1+9i) \\ 5+11i \end{array}$$

(c) $5+25i$

$$\begin{array}{r} (3+7i)+2(1+9i) \\ 5+25i \end{array}$$

(d) $5-11i$

$$\begin{array}{r} (3+7i)+2(1+9i) \\ 5-11i \end{array}$$

Multiplication of Complex Numbers

Simplify:

97. $8i(8-4i)$ (a) $32+64i$ (b) $-64+32i$ (c) $64+32i$ (d) $32-64i$

98. $(2i-2)(i+4)$ (a) $-6+6i$ (b) $-6-6i$ (c) $-10+6i$ (d) $-10-6i$

99. $(8-4i)^2$ (a) $-48+64i$ (b) $48-64i$ (c) $-68+4i$ (d) $68-4i$

100. Simplify. Use a calculator to check answer.

$$(-1-7i)^2$$

(a) $48+14i$

$$\begin{array}{l} (-7-i)^2 \\ 48+14i \end{array}$$

(b) $48-14i$

$$\begin{array}{l} (-7+i)^2 \\ 48-14i \end{array}$$

(c) $-48+14i$

$$\begin{array}{l} (-1-7i)^2 \\ -48+14i \end{array}$$

(d) $-48-14i$

$$\begin{array}{l} (-1+7i)^2 \\ -48-14i \end{array}$$

(e) $146+322i$

$$\begin{array}{l} (-1-7i)^3 \\ 146+322i \end{array}$$

Division of Complex Numbers

101. Solve. $\frac{\sqrt{3}}{\sqrt{10}+\sqrt{-3}}$ (a) $\frac{\sqrt{30}+3i}{7}$ (b) $\frac{\sqrt{30}+3i}{13}$ (c) $\frac{\sqrt{30}-3i}{13}$ (d) $\frac{\sqrt{30}-3i}{7}$

Perform the operation and write the result in standard form.

102. $\frac{-7}{5i}$ (a) $\frac{7i}{5}$ (b) $\frac{-5}{7i}$ (c) $\frac{5}{7i}$ (d) $\frac{-7i}{5}$

103. $\frac{8+8i}{4+2i}$ (a) $\frac{12}{5} + \frac{12}{5}i$ (b) $\frac{4}{3} + \frac{4}{3}i$ (c) $\frac{4}{3} + 4i$ (d) $\frac{12}{5} + \frac{4}{5}i$

104. Divide and write the result in standard form.

$$\frac{-5-6i}{-4i}$$

(a) $\frac{-24+5i}{16}$ (b) $\frac{6-5i}{16}$ (c) $\frac{6-5i}{4}$ (d) $\frac{-24+5i}{4}$

Powers of i

105. Simplify: i^{72} (a) 1 (b) $-i$ (c) i (d) -1
106. Evaluate the given power of i .
 i^{53} (a) $-i$ (b) i (c) -1 (d) 1
107. Simplify: $i^8 \cdot i^{51}$ (a) i (b) 1 (c) $-i$ (d) -1
108. Evaluate: $i^{90} - i^{71}$ (a) $2i$ (b) $-1+i$ (c) $-2i$ (d) $-i^{161}$

Chapter P: Preliminary Concepts (Answer Key)

Section P.1 Sets

Sets

[1] (b) _____

[2] (d) _____

[3] (c) _____

[4] (a) _____

Union and Intersection of Sets

[5] (a) _____

[6] (c) _____

[7] (c) _____

[8] (c) _____

Absolute Value and Distance

[9] (a) _____

[10] (d) _____

[11] (d) _____

[12] (b) _____

Interval Notation

[13] (c) _____

[14] (c) _____

[15] (d) _____

[16] (a) _____

Order of Operations Agreement

[17] (a) _____

[18] (c) _____

[19] (a) _____

[20] (c) _____

Simplifying Variable Expressions

[21] (c) _____

[22] (c) _____

[23] (d) _____

[24] (a) _____

Section P.2 Integer and Rational Number Exponents

Properties of Exponents

[25] (c) _____

[26] (b) _____

[27] (a) _____

[28] (c) _____

Scientific Notation

[29] (a) _____

[30] (b) _____

[31] (a) _____

[32] (c) _____

Rational Exponents and Radicals

[33] (b) _____

[34] (b) _____

[35] (b) _____

[36] (c) _____

Simplify Radical Expressions

[37] (b) _____

[38] (c) _____

[39] (a) _____

[40] (b) _____

Section P.3 Polynomials Operations on Polynomials

[41] (d) _____

[42] (d) _____

[43] (a) _____

[44] (c) _____

Applications of Polynomials

[45] (a) _____

[46] (a) _____

[47] (b) _____

[48] (b) _____

Section P.4 Factoring Greatest Common Factor

[49] (d) _____

[50] (c) _____

[51] (a) _____

[52] (d) _____

Factoring Trinomials

[53] (c) _____

[54] (b) _____

[55] (d) _____

[56] (c) _____

Special Factoring

[57] (a) _____

[58] (b) _____

[59] (d) _____

[60] (c) _____

Factor by Grouping

[61] (a) _____

[62] (d) _____

[63] (a) _____

[64] (b) _____

General Factoring

[65] (c) _____

[66] (c) _____

[67] (c) _____

[68] (b) _____

Section P.5 Rational Expressions
Simplify a Rational Expression

[69] (c) _____

[70] (d) _____

[71] (a) _____

[72] (d) _____

Operations on Rational Expressions

[73] (c) _____

[74] (a) _____

[75] (b) _____

[76] (a) _____

Determining the LCD of Rational Expressions

[77] (b) _____

[78] (a) _____

[79] (a) _____

[80] (d) _____

Complex Fractions

[81] (a) _____

[82] (a) _____

[83] (a) _____

[84] (b) _____

Application of Rational Expressions

[85] (d) _____

[86] (d) _____

[87] (a) _____

[88] (d) _____

Section P.6 Complex Numbers
Introduction to Complex Numbers

[89] (a) _____

[90] (b) _____

[91] (b) _____

[92] (b) _____

Addition and Subtraction of Complex Numbers

[93] (a) _____

[94] (d) _____

[95] (a) _____

[96] (b) _____

Multiplication of Complex Numbers

[97] (a) _____

[98] (c) _____

[99] (b) _____

[100] (c) _____

Division of Complex Numbers

[101] (c) _____

[102] (a) _____

[103] (d) _____

[104] (c) _____

Powers of i

[105] (a) _____

[106] (b) _____

[107] (c) _____

[108] (b) _____