Answer Key

Chapter 1.R: Algebraic Expressions, Equations, and Inequalities

1.R.1 Exercises

Concept Check

1. False; Equals 81

3. False; 7^0 is 1.

5. True

7. False; 7605 is divisible by 5.

9. False; A prime number has exactly 2 factors.

11. False; 231 is a composite number.

13. False; The LCM of 15 and 25 is 75.

15. True

Practice

17. **a.** 4 **b.** 0 **c.** 1

19. 3, 5

21. None

23. Prime

25. 5^3

27. 24

29. 15

Applications

31. **a.** No. The formula incorrectly shows that each shirt is \$10, and the total cost would be \$25 − \$10 · 11 = \$25 − \$110 = −\$85.

b. \$165; (\$25 − \$10)·11

33. 4 team members would work 110 hours each; 8 team members would work 55 hours each.

35. 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72

Writing & Thinking

37. If addition is within parentheses (or other grouping symbols), addition would be performed first.

39. No, some odd numbers are the product of two or more odd prime factors, for example, 3 · 3 = 9, 3 · 5 = 15, 3 · 7 = 21, etc.

41. Since the LCM is constructed using the prime factors of each number in the set, by definition, each number will divide the LCM.

1.R.2 Exercises

Concept Check

1. True

3. False; The statement $\frac{1}{3}\cdot\frac{2}{5}=\frac{2}{5}\cdot\frac{1}{3}$ is an example of the commutative property of multiplication.

5. False; The reciprocal of 1 is 1.

7. False; The reciprocal of 12 is $\frac{1}{12}$.

Practice

9. $\frac{1}{4}$

11. $\frac{1}{3}$

13. $\frac{8}{9}$

15. Undefined

Applications

17. $\frac{3}{8}$

19. 200 years

21. No. If a fraction is less than 1 then its product with another number will be less than that other number. So, if the other number is less than 1, the product will be less than 1. Answers will vary.

23. $0=\frac{0}{1}$ and the reciprocal would be $\frac{1}{0}$ but division by 0 is undefined. So 0 has no reciprocal.

1.R.3 Exercises

Concept Check

1. True

3. False; LCD stands for least common denominator.

5. True

Practice

7. $\frac{17}{21}$

9. $\frac{11}{15}$

11. $\frac{23}{42}$

13. $-\frac{1}{4}$

Applications

15. 1 ounce

Writing & Thinking

17. The LCM finds the least common multiple of a set of numbers. The LCD does the same thing for the set of numbers determined by the denominators.

1.R.4 Exercises

Concept Check

1. False; A proportion is a statement that two ratios are equal.

3. True

5. True

Practice

7. False

9. $B = 7.8$

Applications

11. 180 minutes or 3 hours

1.R.5 Exercises

Concept Check

1. True

3. False; A decimal number that is between 0.01 and 0.10 is between 1% and 10%.

5. False; Fractions that have denominators other than 100 can be changed to a percent.

Practice

7. 20%

9. 2%

11. 0.07

13. 75%

15. $1\frac{1}{5}$

Applications

17. 4%

19. 85%

Writing & Thinking

21. Percent means per centum or per 100. For example, fifty-eight percent means 58 out of 100. Percent can be written as a fraction with 100 in the denominator as in 58/100. The decimal equivalent, 0.58 is read as "fifty-eight hundredths," indicating percent can be written using the hundredths place, another connection.

23. 100% = 1 so anytime there is a mixed number, which has a value greater than 1, the percentage will be greater than 100%. Proper fractions (numerator is smaller than denominator) have a value less than 1 and therefore the percentage will be less than 100%.

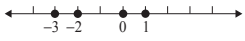
1.R.6 Exercises

Concept Check

1. True

3. True

Practice

5. 

7. 0, 4, 8

9. True

Applications

11. −4500 meters

Writing & Thinking

13. If y is a negative number then $-y$ represents a positive number. For example, if $y = -2$, then $-y = -(-2) = 2$.

1.R.7 Exercises

Concept Check

1. False; The sum of a positive and negative number can be positive, negative, or zero.

3. False; The sum of two positive numbers is always positive, zero is neither positive nor negative.

Practice

5. –6

7. –0.5

Applications

9. a. \$45,000 + (−\$8000) + (−\$2000) + \$15,000.

b. \$50,000.

Writing & Thinking

11. $|0| + |0| = 0$

1.R.8 Exercises

Concept Check

1. False; The sum of a number and its additive inverse is zero.

3. True

Practice

5. −11

7. 3

9. −15

Applications

11. −18°F (a decrease of 18 degrees Fahrenheit)

Writing & Thinking

13. Add the opposite of the second number to the first number.

1.R.9 Exercises

Concept Check

1. True.

3. False; The product and quotient will be positive.

Practice

5. 48

7. 2

Applications

9. −12

Writing & Thinking

11. Negative; The product of every two negative numbers will be positive and this result multiplied by the remaining negative will give a negative answer.

Chapter 2.R: Equations and Inequalities in Two Variables

2.R.1 Exercises

Concept Check

1. a. True

b. False; Not all rectangles have four equal sides.

3. True

5. True

7. False; The length of the radius of a circle is half of the length of the diameter.

9. True

11. a. B

b. C

c. A

d. E

e. D

Practice

13. 44 cm

15. 45 cm

17. 50 in.

19. 70 in.^{3}

21. 81 ft^2

23. 48 in.^{2}

25. 36 cm^2

27. a. 35.98 in.

b. 76.93 in.^{2}

29. 7536 m^2

31. 226.08 m^2

Applications

33. 135 square feet

35. a. 63.6 square inches

b. \$0.13 per square inch

Writing & Thinking

37. To find the volume of the ice cream itself, the volume is half the volume of a sphere and the formula used would be $V = \frac{1}{2} \cdot \frac{4}{3}\pi r^3 = \frac{2}{3}\pi r^3$. The result is the volume of the ice cream that is exposed. Next find the volume of the cone by using the formula $V = \frac{1}{3}\pi r^2 h$. The volume of the ice cream cone will be the sum of these two volumes.

39. One diameter is equal to two radii. Thus, $d = 2r$ and $C = 2\pi r = \pi d$.

2.R.2 Exercises

Concept Check

1. True

3. True

Practice

5. 6

7. Yes; $6^2 + 8^2 = 10^2$

9. $c = 5$

Applications

11. 17.0 inches

2.R.3 Exercises

Concept Check

1. False; If the original number is negative, the principal square root will not be the same as the original number.

3. False; The radicand is underneath the radical sign.

Practice

5. 7

7. 10

9. 0.2

Applications

11. **a.** 4 cm

b. 20 cm

Writing & Thinking

13. Cubing a negative real number is equivalent to multiplying a negative number by itself 3 times. The product of three negative numbers is negative.

2.R.4 Exercises

Concept Check

1. True

3. False; If x is a real number, then $\sqrt{x^2} = |x|$

Practice

5. $9\sqrt{2}$

7. $2x^5y\sqrt{6x}$

9. $-2x^2\sqrt[3]{x^2}$

Applications

11. $\sqrt{3} \approx 1.73$ amperes

Writing & Thinking

13. A cube root has no restrictions as the cube root of a negative number is negative.

2.R.5 Exercises

Concept Check

1. True

3. True

Practice

5. $\begin{Bmatrix} A(-5,1), B(-3,3), \\ C(-1,1), D(1,2), \\ E(2,-2) \end{Bmatrix}$

7. **a.** $(0,-1)$

b. $(4,1)$

c. $(2,0)$

d. $(8,3)$

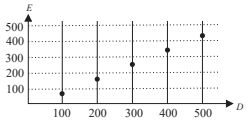
9. b, c

Applications

11 **a.**

D	*E*
100	85
200	170
300	255
400	340
500	425

b.



2.R.6 Exercises

Concept Check

1. False; The addition and multiplication principles of equality can be used with decimal or fractional coefficients.

3. True

Practice

5. $x = -3$

7. $x = -\frac{27}{10}$

Applications

9. 14,000 tickets per hour

Writing & Thinking

11. **a.** The 4 should have been multiplied by 3 so that the 3 was distributed over the entire left-hand side of the equation; Correct answer is $x = 15$.

b. 3 should be subtracted from each side, not from each term, and $5x - 3$ doesn't simplify to $2x$; Correct answer is $x = \frac{8}{5}$.

2.R.7 Exercises

Concept Check

1. True

3. False; It is called a contradiction.

Practice

5. $x = -5$

7. $x = -1$

9. Contradiction

Applications

11. 20 guests

Writing & Thinking

13. **a.** $5x + 1$

b. $x = 6$

c. Answers will vary.

2.R.8 Exercises

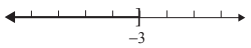
Concept Check

1. True

3. False; Only one value in the solution set needs to be checked.

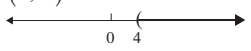
Practice

5.

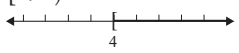


Half-open interval

7. $(4,\infty)$



9. $[4,\infty)$



Applications

11. **a.** The student must score at least 102 points, which is not possible. Thus he cannot earn an A in the course.

b. The student must score at least 192 points to earn an A in the course.

Writing & Thinking

13. **a.** Answers will vary.

b. Answers will vary.

2.R.9 Exercises

Concept Check

1. False; Radical equations may also have one or no solution.

3. False; The process needs to be repeated until all radicals have been eliminated.

Practice

5. $x = 3$

7. $x = 4$

Applications

9. 12 ft

Chapter 3.R: Relations, Functions, and Their Graphs

3.R.1 Exercises

Concept Check

1. True

3. True

Practice

5. $\begin{Bmatrix} (-5,-4), (-4,-2), \\ (-2,-2), (1,-2), (2,1) \end{Bmatrix}$;
$D = \{-5,-4,-2,1,2\}$;
$R = \{-4,-2,1\}$;
Function

7. Not a function;
$D = (-\infty,\infty)$;
$R = (-\infty,\infty)$

9. **a.** −10 **b.** 86 **c.** 86

3.R.2 Exercises

Concept Check

1. True

3. False; Subtraction is indicated by the phrase "five less than a number."

Practice

5. $x + 6$

7. $\frac{x}{2} - 18$

9. **a.** $4n - 6$

b. $6 - 4n$

11. The product of a number and negative nine

Writing & Thinking

13. The Commutative Property of Addition and Multiplication permits the order of items being added or multiplied to change and still have the same result. This property does not hold true for subtraction or division. Therefore, order is important for subtraction and division problems or the answer will change or be incorrect.

3.R.3 Exercises

Concept Check

1. True

3. False; Odd integers are integers that are not even.

Practice

5. $x - 5 = 13 - x$; 9

7. $n + (n + 1) + (n + 2) = 93$; 30, 31, 32

Applications

9. **a.** The unknown value is the length of the call in minutes.

b. $m = 20$

c. The collect call lasted 20 minutes.

Writing & Thinking

11. **a.** n, $n + 2$, $n + 4$, $n + 6$

b. n, $n + 2$, $n + 4$, $n + 6$

c. Yes; Answers will vary.

3.R.4 Exercises

Concept Check

1. False; Variables need to be considered as well.

3. True

Practice

5. 5

7. $7(2x + 3)$

9. $(3 + a)(x + y)$

Applications

11. **a.** 32 feet

b. $16x(3 - x)$

c. 32 feet

d. Yes; They are equivalent expressions.

3.R.5 Exercises

Concept Check

1. True

3. True

Practice

5. $(x - 9)(x + 3)$

7. $(y - 12)(y - 2)$

Applications

9. Base = $x + 48$; Height = x

Writing & Thinking

11. If the sign of the constant term is positive, the signs in the factors will both be positive or both be negative. If the sign of the constant term is negative, the sign in one factor will be positive and the sign in the other factor will be negative.

3.R.6 Exercises

Concept Check

1. False; The middle term should be the sum of the inner and outer products.

3. False; The first step is to multiply a and c.

Practice

5. $(6x + 5)(x + 1)$

7. Not factorable

9. $2(2x - 5)(3x - 2)$

Writing & Thinking

11. This is not an error, but the trinomial is not completely factored. The completely factored form of this trinomial is $2(x + 2)(x + 3)$.

3.R.7 Exercises

Concept Check

1. False; The first step is to check for a common monomial factor.

3. False; It might be factorable by the grouping method.

Practice

5. $(x + 5)^2$

7. $(5x + 6)(4x - 9)$

9. $(x + 5)(x^2 - 5x + 25)$

11. $(x + 12)(x - 3)$

13. $2(2x - 1)(x - 3)$

3.R.8 Exercises

Concept Check

1. True

3. True

Practice

5. $x = 2, 9$

7. $x = -4, 6$

Applications

9. **a.** 640 ft; 384 ft

b. 144 ft; 400 ft

c. 7 seconds; $0 = -16(t + 7)(t - 7)$

Writing & Thinking

11. This allows for use of the zero factor property which says that for the product to equal zero one of the factors must equal zero. Answers will vary.

3.R.9 Exercises

Concept Check

1. False; i, $-i$, 1, and -1

3. False; The product is -1.

Practice

5. $-28 - 24i$

7. $0 - \frac{5}{4}i$

9. $0 + i$

Writing & Thinking

11. Given a complex number $(a + bi)$: $(a + bi)(a - bi)$

$= a^2 - abi + abi - b^2i^2$

$= a^2 + b^2$

which is the sum of squares of real numbers. Thus the product must be a positive real number.

3.R.10 Exercises

Concept Check

1. True

3. False; Two real solutions

Practice

5. 68; Two real solutions

7. $x = -2 \pm 2\sqrt{2}$

9. $x = 1, \frac{4}{3}$

Writing & Thinking

11. $x^4 - 13x^2 + 36 = 0$; multiplied $(x - 2)(x + 2)(x - 3)(x + 3)$

Chapter 4.R: Working with Functions

4.R.1 Exercises

Concept Check

1. True.

3. True.

Practice

5. **a.** 36

b. 16

7. −10

9. 129

11. 143

Applications

13. **a.** −$42 − $35 − (3 · $5).

b. –$92.

Writing & Thinking

15. Smaller; When any positive number is multiplied by a fraction (or decimal) between 0 and 1, the result will be smaller. This is what is happening when a number between 0 and 1 is squared. Answers will vary.

4.R.2 Exercises

Concept Check

1. True.

3. False; In the term "12a," 12 is the coefficient.

Practice

5. −5, 3, and 8 are like terms; 7x and 9x are like terms.

7. 10x

9. 3y + 4; 13

Applications

11. $50,000

Writing & Thinking

13. Like terms have the same variables with the same exponents. For example, $4a^2bc^3$ and $-3a^2bc^3$ are like terms. Unlike terms either have different variables or possibly the same variables with different exponents. For example, $6ab$ and $-9a^2b$ are unlike terms and $5xy$ and $13ax$ are unlike terms.

4.R.3 Exercises

Concept Check

1. False; The distributive property can be used when multiplying any types of polynomials.

3. True

Practice

5. $-4x^8 + 8x^7 - 12x^4$

7. $y^3 + 2y^2 + y + 12$

Applications

9. $V = 10x^2 + 220x + 1200$ cubic inches

4.R.4 Exercises

Concept Check

1. True

3. False; Missing powers should be filled in with zeros.

Practice

5. $y^2 - 2y + 3$

7. $x - 6 + \dfrac{4}{x+4}$

9. $x^3 + 2x + 5 + \dfrac{17}{x-3}$

Applications

11. **a.** $x^2 - 4x - 5$ square inches

b. $x^2 - 3x - 10$ square inches

4.R.5 Exercises

Concept Check

1. True

3. False; A rational expression cannot have a zero denominator.

Practice

5. $\dfrac{3x}{4y}$; $x \neq 0, y \neq 0$

7. $\dfrac{x-3}{y-2}$; $y \neq -2, 2$

9. $\dfrac{1}{x-3}$; $x \neq 0, 3$

Applications

11. **a.** $p(x) = \dfrac{15x + 200}{x}$

b. $35

c. $x \neq 0$

d. The variable cannot be negative because you cannot have a negative quantity of people. There would also be a maximum number depending on the size of the room.

Writing & Thinking

13. **a.** A rational expression is an algebraic expression that can be written in the form $\dfrac{P}{Q}$ where P and Q are polynomials and $Q \neq 0$.

b. $\dfrac{x-1}{(x+2)(x-3)}$; Answers will vary.

c. $\dfrac{1}{x+5}$; Answers will vary.

4.R.6 Exercises

Concept Check

1. False; The reciprocal is $\dfrac{x+3}{x}$.

3. False; the restriction is 0.

Practice

5. $\dfrac{x+3}{x}$

7. $\dfrac{x}{12}$

Applications

9. **a.** $\dfrac{x^2 - 3x - 10}{x+3}$

b. $\dfrac{x^2 + 5x + 6}{x-5}$

c. $(x+2)^2 = x^2 + 4x + 4$

4.R.7 Exercises

Concept Check

1. True

3. True

Practice

5. $\dfrac{4}{5xy}$

7. $\dfrac{11}{2(1+4x)}$

9. $\dfrac{-5}{x+1}$

Applications

11. **a.** $\dfrac{4r + r^2}{4}$

b. 0.0609

c. 0.0609

d. Yes; They are calculated from different forms of the same expression.

e. 0.0009

f. Answers will vary. It is larger because the interest is compounded along with the principal.

Chapter 6.R: Exponential and Logarithmic Functions

6.R.1 Exercises

Concept Check

1. False; If there is no exponent written, the exponent is assumed to be 1.

3. True

Practice

5. y^{11}

7. $\frac{1}{x}$

9. $-18x^5y^7$

Applications

11. 2^8 GB

6.R.2 Exercises

Concept Check

1. True

3. False; The rules for exponents can be applied in any order, resulting in the same answer.

Practice

5. 64

7. $-\frac{2y^6}{27x^{15}}$

9. $\frac{y^8}{16x^8}$

6.R.3 Exercises

Concept Check

1. True

3. True

Practice

5. $\sqrt[3]{8}$

7. $\frac{1}{10}$

9. $a^{\frac{1}{4}}$

Applications

11. 576 ft^2

Writing & Thinking

13. No;

$\sqrt[5]{a}\cdot\sqrt{a}=a^{\frac{7}{10}}$, $\sqrt[5]{a^2}=a^{\frac{2}{5}}$, $a^{\frac{7}{10}}\neq a^{\frac{2}{5}}$

6.R.4 Exercises

Concept Check

1. True

3. True

Practice

5. $\log_7 49=2$

7. $x=-3$

9. $x=3.7$

Writing & Thinking

11. The two functions are symmetric about the x-axis.

Chapter 7.R: Trigonometric Functions

7.R.1 Exercises

Concept Check

1. True

3. True

Practice

5. **a.** Straight
b. Right
c. Acute
d. Obtuse

7. **a.** 150°

b. Yes; 2 and 3 are supplementary.

c. 1 and 3; 2 and 4

d. 1 and 2; 2 and 3; 3 and 4; 1 and 4

7.R.2 Exercises

Concept Check

1. True

3. False; Similar triangles have corresponding sides that are proportional.

5. False; If $\Delta ABC\cong\Delta DEF$, then $AC=DF$.

Practice

7. The triangles are not similar. The corresponding sides are not proportional.

9. Scalene

11. $x=50°$; $y=70°$

13. Congruent by SAS

Applications

15. No, since 19 = 13 + 6.

17. 7.5 feet

Writing & Thinking

19. **a.** $m\angle B$ should be equal to $m\angle E$ and $m\angle C$ should be equal to $m\angle F$.

b. Corresponding sides are proportional; they do not necessarily have the same length.

Chapter 10.R: Conic Sections

10.R.1 Exercises

Concept Check

1. False; The product will be a binomial.

3. True

Practice

5. $x^2-14x+49$;
Perfect square trinomial

7. $x^2+8x+16$;
Perfect square trinomial

9. $9x^2-12x+4$;
Perfect square trinomial

Applications

11. **a.** $A(x)=400-4x^2$

b. $P(x)=4(20-2x)+8x=80$

Writing & Thinking

13. $(x+5)^2=x^2+2(5x)+5^2$. Answers will vary.

10.R.2 Exercises

Concept Check

1. True

3. False; The sum of two squares is not factorable.

Practice

5. $(y-8)^2$

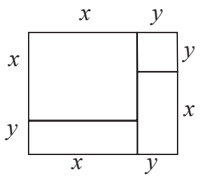
7. $2(x-8)(x+8)$

9. $(3x-y)(3x+y)$

Writing & Thinking

11. a. $xy + xy + x^2 + y^2$
$= x^2 + 2xy + y^2$
$= (x+y)^2$

b. $(x+y)(x+y)$
$= (x+y)^2$



Chapter 11.R: Systems of Equations and Inequalities

11.R.1 Exercises

Concept Check

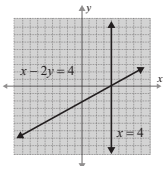
1. False; The solution must be checked in all equations.

3. True

Practice

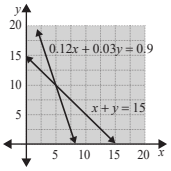
5. a, c

7. (4, 0)



Applications

9.



5 gallons of 12%; 10 gallons of 3%

Writing & Thinking

11. The solution to a consistent system of linear equations is a single point, which is easily written as an ordered pair.

11.R.2 Exercises

Concept Check

1. True

3. True

Practice

5. (2, 4)

7. No solution

Applications

9. 15 m × 10 m

Writing & Thinking

11. Answers will vary.

11.R.3 Exercises

Concept Check

1. False; The solution always needs to be checked in both original equations.

3. False; Both methods give exact solutions.

Practice

5. No solution

7. $(x, 2x-4)$

Applications

9. 1200 adults; 3300 children

Writing & Thinking

11. Answers will vary.

11.R.4 Exercises

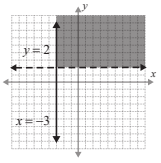
Concept Check

1. False; When boundary lines are parallel, the solution is either the strip between the boundary lines, a half-plane, or there is no solution.

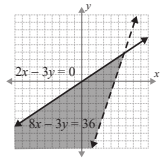
3. True

Practice

5.



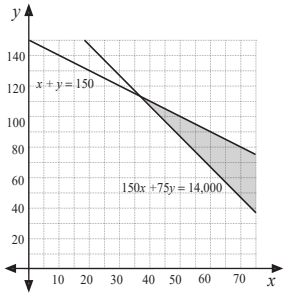
7.



Applications

9. a. $\begin{cases} 150x + 75y \geq 14{,}000 \\ x + y \leq 150 \end{cases}$

b.



c. Answers will vary.

d. No. 150 · \$75 = \$11,250