

ALGEBRA 1 Topic 1 - 3

Student Workbook

Before



After



REAL NUMBERS

- 1.1 Variables and Expressions
- 1.2 Order of Operations and Evaluating Expressions
- 1.3 Real Numbers and the Number Line
- 1.4 Properties of Real Numbers
- 1.5 Adding and Subtracting Real Numbers
- 1.6 Multiplying and Dividing Real Numbers
- 1.7 Distributive Property

EXPRESSIONS

- 10.2 Simplify Radicals
- 7.1 Zero and Negative Exponents
- 7.2 Multiplying Powers with Same Base
- 7.3 More Multiplication of Exponents
- 7.4 Division Properties of Exponents
- 7.5 Rational Exponents and Radicals

Equations

- 2.1 One Step Equations
- 2.2 Two Step Equations
- 2.3 Solving Multi-Step Equations
- 2.4 Solving Equations with Variables on Both Sides

**Study
Island
Topics**

PA CORE 8

- Real Numbers Approx of Irrational Numbers Exponential Expressions
- Square and Cube Roots Scientific Notation Solve Linear Equations

KEYSTONE

- Compare and Order Numbers Simplify Square Roots GCF & LCM
- Simplify & Evaluate Expressions Estimation

Name: _____ **Period** _____

1-1**Practice**

Form G

Variables and Expressions**Write an algebraic expression for each word phrase.**1. 10 less than x 2. 5 more than d 3. 7 minus f 4. the sum of 11 and k 5. x multiplied by 66. a number t divided by 37. one fourth of a number n 8. the product of 2.5 and a number t 9. the quotient of 15 and y 10. a number q tripled11. 3 plus the product of 2 and h 12. 3 less than the quotient of 20 and x **Write a word phrase for each algebraic expression.**13. $n + 6$ 14. $5 - c$ 15. $11.5 + y$ 16. $\frac{x}{4} - 17$ 17. $3x + 10$ 18. $10x + 7z$ **Write a rule in words and as an algebraic expression to model the relationship in each table.**

19. The local video store charges a monthly membership fee of \$5 and \$2.25 per video.

| Videos (v) | Cost (c) |
|----------------|--------------|
| 1 | \$7.25 |
| 2 | \$9.50 |
| 3 | \$11.75 |

1-1

Practice (continued)

Form G

Variables and Expressions

20. Dorothy gets paid to walk her neighbor's dog. For every week that she walks the dog, she earns \$10.

| Weeks (w) | Pay (p) |
|---------------|-------------|
| 4 | \$40.00 |
| 5 | \$50.00 |
| 6 | \$60.00 |

Write an algebraic expression for each word phrase.

21. 8 minus the quotient of 15 and y
22. a number q tripled plus z doubled
23. the product of 8 and z plus the product of 6.5 and y
24. the quotient of 5 plus d and 12 minus w
25. **Error Analysis** A student writes $5y \cdot 3$ to model the relationship *the sum of $5y$ and 3*. Explain the error.
26. **Error Analysis** A student writes *the difference between 15 and the product of 5 and y* to describe the expression $5y - 15$. Explain the error.
27. Jake is trying to mail a package to his grandmother. He already has s stamps on the package. The postal worker tells him that he's going to have to double the number of stamps on the package and then add 3 more. Write an algebraic expression that represents the number of stamps that Jake will have to put on the package.

1-2 Practice

Form G

Order of Operations and Evaluating Expressions

Simplify each expression.

1. 4^2

2. 5^3

3. 1^{16}

4. $\left(\frac{5}{6}\right)^2$

5. $(1 + 3)^2$

6. $(0.1)^3$

7. $5 + 3(2)$

8. $\left(\frac{16}{2}\right) - 4(5)$

9. $4^4(5) + 3(11)$

10. $17(2) - 4^2$

11. $\left(\frac{20}{5}\right)^3 - 10(3)^2$

12. $\left(\frac{27-12}{8-3}\right)^3$

13. $(4(5))^3$

14. $2^5 - 4^2 \div 2^2$

15. $\left(\frac{3(6)}{17-5}\right)^4$

Evaluate each expression for $s = 2$ and $t = 5$.

16. $s + 6$

17. $5 - t$

18. $11.5 + s^2$

19. $\frac{s^4}{4} - 17$

20. $3(t)^3 + 10$

21. $s^3 + t^2$

22. $-4(s)^2 + t^3 \div 5$

23. $\left(\frac{s+2}{5t^2}\right)^2$

24. $\left(\frac{3s(3)}{11-5(t)}\right)^2$

25. Every weekend, Morgan buys interesting clothes at her local thrift store and then resells them on an auction website. If she brings \$150.00 and spends s , write an expression for how much change she has. Evaluate your expression for $s = \$27.13$ and $s = \$55.14$.

1-2

Practice(continued)

Form G

Order of Operations and Evaluating Expressions

- 26.** A bike rider is traveling at a speed of 15 feet per second. Write an expression for the distance the rider has traveled after s seconds. Make a table that records the distance for 3.0, 5.8, 11.1, and 14.0 seconds.

Simplify each expression.

27. $4[(12 + 5) - 4^4]$

28. $3[(4 - 6)^2 + 7]^2$

29. $2.5[13 - \left(\frac{36}{6}\right)^2]$

30. $[(48 \div 8)^3 - 7]^3$

31. $\left(\frac{4(-4)(3)}{11 - 5(1)}\right)^3$

32. $4[11 - (55 - 3^5) \div 3]$

- 33. a.** If the tax that you pay when you purchase an item is 12% of the sale price, write an expression that gives the tax on the item with a price p . Write another expression that gives the total price of the item, including tax.
- b.** What operations are involved in the expressions you wrote?
- c.** Determine the total price, including tax, of an item that costs \$75.
- d.** Explain how the order of operations helped you solve this problem.
- 34.** The cost to rent a hall for school functions is \$60 per hour. Write an expression for the cost of renting the hall for h hours. Make a table to find how much it will cost to rent the hall for 2, 6, 8, and 10 hours.

Evaluate each expression for the given values of the variables.

35. $4(c + 5) - f^4$; $c = -1$, $f = 4$

36. $-3[(w - 6)^2 + x]^2$; $w = 5$, $x = 6$

37. $3.5[h^3 - \left(\frac{3j}{6}\right)^2]$; $h = 3$, $j = -4$

38. $x[y^2 - (55 - y^5) \div 3]$; $x = -6$, $y = 6$

1-3 Practice

Form G

Real Numbers and the Number Line

Simplify each expression.

1. $\sqrt{4}$

2. $\sqrt{36}$

3. $\sqrt{25}$

4. $\sqrt{81}$

5. $\sqrt{121}$

6. $\sqrt{169}$

7. $\sqrt{625}$

8. $\sqrt{225}$

9. $\sqrt{\frac{64}{9}}$

10. $\sqrt{\frac{25}{81}}$

11. $\sqrt{\frac{225}{169}}$

12. $\sqrt{\frac{1}{625}}$

13. $\sqrt{0.64}$

14. $\sqrt{0.81}$

15. $\sqrt{6.25}$

Estimate the square root. Round to the nearest integer.

16. $\sqrt{10}$

17. $\sqrt{15}$

18. $\sqrt{38}$

19. $\sqrt{50}$

20. $\sqrt{16.8}$

21. $\sqrt{37.5}$

22. $\sqrt{67.5}$

23. $\sqrt{81.49}$

24. $\sqrt{121.86}$

Find the approximate side length of each square figure to the nearest whole unit.

25. a rug with an area of 64 ft²

26. an exercise mat that is 6.25 m²

27. a plate that is 49 cm²

1-3 Practice (continued)

Real Numbers and the Number Line

Form G

Name the subset(s) of the real numbers to which each number belongs.

28. $\frac{12}{18}$ 29. -5 30. π 31. $\sqrt{2}$

32. 5564 33. $\sqrt{13}$ 34. $-\frac{4}{3}$ 35. $\sqrt{61}$

Compare the numbers in each exercise using an inequality symbol.

36. $\sqrt{25}, \sqrt{64}$ 37. $\frac{4}{5}, \sqrt{1.3}$ 38. $\pi, \frac{19}{6}$

39. $\sqrt{81}, -\sqrt{121}$ 40. $\frac{27}{17}, 1.7781356$ 41. $-\frac{14}{15}, \sqrt{0.8711}$

Order the numbers from least to greatest.

42. $1.875, \sqrt{64}, -\sqrt{121}$ 43. $\sqrt{0.8711}, \frac{4}{5}, \sqrt{1.3}$ 44. $8.775, \sqrt{67.4698}, \frac{64.56}{8.477}$

45. $-\frac{14}{15}, 5.587, \sqrt{81}$ 46. $\frac{100}{22}, \sqrt{25}, \frac{27}{17}$ 47. $\pi, \sqrt{10.5625}, -\frac{15}{5.8}$

48. Marsha, Josh, and Tyler are comparing how fast they can type. Marsha types 125 words in 7.5 minutes. Josh types 65 words in 3 minutes. Tyler types 400 words in 28 minutes. Order the students according to who can type the fastest.

1-4**Practice**

Form G

Properties of Real Numbers**Name the property that each statement illustrates.**

1. $12 + 917 = 917 + 12$

2. $74.5 \cdot 0 = 0$

3. $35 \cdot x = x \cdot 35$

4. $3 \cdot (-1 \cdot p) = 3 \cdot (-p)$

5. $m + 0 = m$

6. $53.7 \cdot 1 = 53.7$

Use mental math to simplify each expression.

7. $36 + 12 + 4$

8. $19.2 + 0.6 + 12.4 + 0.8$

9. $2 \cdot 16 \cdot 10 \cdot 5$

10. $12 \cdot 18 \cdot 0 \cdot 17$

Simplify each expression. Justify each step.

11. $6 + (8x + 12)$

12. $5(16p)$

13. $(2 + 7m) + 5$

14. $\frac{12st}{4t}$

Tell whether the expressions in each pair are equivalent.

15. $7x$ and $7x \cdot 1$

16. $4 + 6 + x$ and $4 \cdot x \cdot 6$

17. $(12 - 7) + x$ and $5x$

18. $p(4 - 4)$ and 0

19. $\frac{24xy}{2x}$ and $12y$

20. $\frac{27m}{(3+9-12)}$ and $27m$

21. You have prepared 42 mL of distilled water, 18 mL of vinegar and 47 mL of salt water for an experiment.

- How many milliliters of solution will you have if you first pour the distilled water, then the salt water, and finally the vinegar into your beaker?
- How many milliliters of solution will you have if you first pour the salt water, then the vinegar, and finally the distilled water into your beaker?
- Explain why the amounts described in parts (a) and (b) are equal.

1-4

Practice (continued)

Form G

Properties of Real Numbers

Use deductive reasoning to tell whether each statement is *true* or *false*. If it is false, give a counterexample.

22. For all real numbers a and b , $a - b = -b + a$.

23. For all real numbers p , q and r , $p - q - r = p - r - q$.

24. For all real numbers x , y and z , $(x + y) + z = z + (x + y)$.

25. For all real numbers m and n , $\frac{m}{n} \cdot n = \frac{n}{m} \cdot m$.

26. **Writing** Explain why the commutative and associative properties don't hold true for subtraction and division but the identity properties do.

27. **Reasoning** A recipe for brownies calls for mixing one cup of sugar with two cups of flour and 4 ounces of chocolate. They are all to be mixed in a bowl before baking. Will the brownies taste different if you add the ingredients in different orders? Relate your answer to a property of real numbers.

Simplify each expression. Justify each step.

28. $(6^7)(5^3 + 2)(2 - 2)$

29. $(m - 16)(-7 \div -7)$

30. **Open-Ended** Provide examples to show the following.

- The associative property of addition holds true for negative integers.
- The commutative property of multiplication holds true for non-integers.
- The multiplicative property of negative one holds true regardless of the sign of the number on which the operation is performed.
- The commutative property of multiplication holds true if one of the factors is zero.

1-5**Practice**

Form G

Adding and Subtracting Real Numbers**Use a number line to find each sum.**

1. $4 + 8$

2. $-7 + 8$

3. $9 + (-4)$

4. $-6 + (-2)$

5. $-6 + 3$

6. $5 + (-10)$

7. $-7 + (-7)$

8. $9 + (-9)$

9. $-8 + 0$

Find each sum.

10. $22 + (-14)$

11. $-36 + (-13)$

12. $-15 + 17$

13. $45 + 77$

14. $19 + (-30)$

15. $-18 + (-18)$

16. $-1.5 + 6.1$

17. $-2.2 + (-16.7)$

18. $5.3 + (-7.4)$

19. $\frac{1}{9} + \left(-\frac{5}{9}\right)$

20. $\frac{3}{4} + \left(\frac{3}{8}\right)$

21. $\frac{1}{5} + \frac{7}{10}$

22. Writing Explain how you would use a number line to find $6 + (-8)$.**23. Open-Ended** Write an addition equation with a positive addend and a negative addend and a resulting sum of -8 .**24.** The Bears football team lost 7 yards and then gained 12 yards. What is the result of the two plays?

1-5**Practice** (continued)

Form G

Adding and Subtracting Real Numbers**Find each difference.**

25. $7 - 14$

26. $-8 - 12$

27. $-5 - (-16)$

28. $33 - (-14)$

29. $62 - 71$

30. $-25 - (-25)$

31. $1.7 - (-3.8)$

32. $-4.5 - 5.8$

33. $-3.7 - (-4.2)$

34. $\frac{7}{8} - \left(\frac{1}{8}\right)$

35. $\frac{2}{3} - \frac{1}{2}$

36. $\frac{4}{9} - \left(\frac{2}{3}\right)$

Evaluate each expression for $m = -4$, $n = 5$, and $p = 1.5$.

37. $m - p$

38. $-m + n - p$

39. $n + m - p$

40. At 4:00 a.m., the temperature was -9°F . At noon, the temperature was 18°F . What was the change in temperature?

41. A teacher had \$57.72 in his checking account. He made a deposit of \$209.54. Then he wrote a check for \$72.00 and another check for \$27.50. What is the new balance in his checking account?

42. A scuba diver went down 20 feet below the surface of the water. Then she dove down 3 more feet. Later, she rose 7 feet. What integer describes her depth?

43. **Reasoning** Without doing the calculations, determine whether $-47 - (-33)$ or $-47 + (-33)$ is greater. Explain your reasoning.

1-6**Practice***Form G***Multiplying and Dividing Real Numbers****Find each product. Simplify, if necessary.**

1. $-5(-7)$

2. $8(-11)$

3. $9 \cdot 12$

4. $(-9)^2$

5. -3×12

6. $-5(-9)$

7. $-3(2.3)$

8. $(-0.6)^2$

9. $8(-2.4)$

10. $-\frac{3}{4} \square \frac{2}{9}$

11. $-\frac{2}{5} \left(-\frac{5}{8} \right)$

12. $\left(\frac{2}{3} \right)^2$

13. After hiking to the top of a mountain, Raul starts to descend at the rate of 350 feet per hour. What real number represents his vertical change after $1\frac{1}{2}$ hours?

14. A dolphin starts at the surface of the water. It dives down at a rate of 3 feet per second. If the water level is zero, what real number describes the dolphin's location after $3\frac{1}{2}$ seconds?

Simplify each expression.

15. $\sqrt{1600}$

16. $-\sqrt{625}$

17. $\pm\sqrt{10,000}$

18. $-\sqrt{0.81}$

19. $\pm\sqrt{1.44}$

20. $\sqrt{0.04}$

21. $\pm\sqrt{\frac{4}{9}}$

22. $-\sqrt{\frac{16}{49}}$

23. $\sqrt{\frac{100}{121}}$

1-6

Practice (continued)

Form G

Multiplying and Dividing Real Numbers

24. Writing Explain the differences among $\sqrt{25}$, $-\sqrt{25}$, and $\pm\sqrt{25}$.

25. Reasoning Can you name a real number that is represented by $\sqrt{-36}$? Explain.

Find each quotient. Simplify, if necessary.

26. $-51 \div 3$

27. $-250 \div (-25)$

28. $98 \div 2$

29. $84 \div (-4)$

30. $-93 \div (-3)$

31. $\frac{-105}{5}$

32. $14.4 \div (-3)$

33. $-1.7 \div (-10)$

34. $-8.1 \div 3$

35. $17 \div \frac{1}{3}$

36. $-\frac{3}{8} \div \left(-\frac{9}{10}\right)$

37. $-\frac{5}{6} \div \frac{1}{2}$

Evaluate each expression for $a = -\frac{1}{2}$, $b = \frac{3}{4}$, and $c = -6$.

38. $-ab$

39. $b \div c$

40. $\frac{c}{a}$

41. Writing Explain how you know that -5 and $-\frac{1}{5}$ are multiplicative inverses.

42. At 6:00 p.m., the temperature was 55°F . At 11:00 p.m. that same evening, the temperature was 40°F . What real number represents the average change in temperature per hour?

1-7

Practice

Form G

The Distributive Property**Use the Distributive Property to simplify each expression.**

1. $3(h - 5)$

2. $7(-5 + m)$

3. $(6 + 9v)6$

4. $(5n + 3)12$

5. $20(8 - a)$

6. $15(3y - 5)$

7. $21(2x + 4)$

8. $(7 + 6w)6$

9. $(14 - 9p)1.1$

10. $(2b - 10)3.2$

11. $\frac{1}{3}(3z + 12)$

12. $4\left(\frac{1}{2}t - 5\right)$

13. $(-5x - 14)(5.1)$

14. $1\left(-\frac{1}{2}r - \frac{5}{7}\right)$

15. $10(6.85j + 7.654)$

16. $\frac{2}{3}\left(\frac{2}{3}m - \frac{2}{3}\right)$

Write each fraction as a sum or difference.

17. $\frac{3n + 5}{7}$

18. $\frac{14 - 6x}{19}$

19. $\frac{3d + 5}{6}$

20. $\frac{9p - 6}{3}$

21. $\frac{18 + 8z}{6}$

22. $\frac{15n - 42}{14}$

23. $\frac{56 - 28w}{8}$

24. $\frac{81f + 63}{9}$

Simplify each expression.

25. $-(14 + x)$

26. $-(-8 - 6t)$

27. $-(6 + d)$

28. $-(-r + 1)$

29. $-(4m - 6n)$

30. $-(5.8a + 4.2b)$

31. $-(-x + y - 1)$

32. $-(f + 3g - 7)$

Use mental math to find each product.

33. 3.2×3

34. 5×8.2

35. 149×2

36. 6×397

37. 4.2×5

38. 4×10.1

39. 8.25×4

40. 11×4.1

41. You buy 75 candy bars at a cost of \$0.49 each. What is the total cost of 75 candy bars? Use mental math.

42. The distance around a track is 400 m. If you take 14 laps around the track, what is the total distance you walk? Use mental math.

43. There are 32 classmates that are going to the fair. Each ticket costs \$19. What is the total amount the classmates spend for tickets? Use mental math.

1-7 Practice (continued)

The Distributive Property

Form G

Simplify each expression by combining like terms.

44. $4t + 6t$

45. $17y - 15y$

46. $-11b^2 + 4b^2$

47. $-2y - 5y$

48. $14n^2 - 7n^2$

49. $8x^2 - 10x^2$

50. $2f + 7g - 6 + 8g$

51. $8x + 3 - 5x - 9$

52. $-5k - 6k^2 - 12k + 10$

Write a word phrase for each expression. Then simplify each expression.

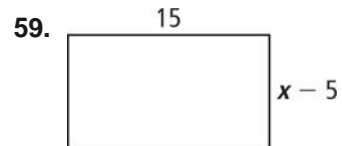
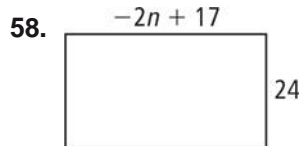
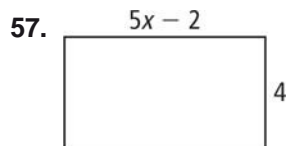
53. $2(n + 1)$

54. $-5(x - 7)$

55. $\frac{1}{2}(4m - 8)$

56. The tax a plumber must charge for a service call is given by the expression $0.06(35 + 25h)$ where h is the number of hours the job takes. Rewrite this expression using the Distributive Property. What is the tax for a 5 hour job and a 20 hour job? Use mental math.

Geometry Write an expression in simplified form for the area of each rectangle.



Simplify each expression.

60. $4jk - 7jk + 12jk$

61. $-17mn + 4mn - mn + 10mn$

62. $8xy^4 - 7xy^3 - 11xy^4$

63. $-2(5ab - 6)$

64. $z + \frac{2z}{5} - \frac{4z}{5}$

65. $7m^2n + 4m^2n^2 - 4m^2n - 5m^3n^2 - 5mn^2$

66. **Reasoning** Demonstrate why $\frac{12x - 6}{6} \neq 2x - 6$. Show your work.

Simplify each expression.

67. $4(2h + 1) + 3(4h + 7)$

68. $5(n - 8) + 6(7 - 2n)$

69. $7(3 + x) - 4(x + 1)$

70. $6(y + 5) - 3(4y + 2)$

71. $-(a - 3b + 27)$

72. $-2(5 - 4s + 6t) - 5s + t$

10-2 Practice

Simplifying Radicals

Form G

Simplify each radical expression.

1. $\sqrt{169}$

2. $\sqrt{200}$

3. $\sqrt{125}$

4. $-5\sqrt{112}$

5. $\sqrt{68}$

6. $3\sqrt{121}$

7. $\sqrt{63t^4}$

8. $\sqrt{48r^3}$

9. $-\sqrt{60m^7}$

10. $x\sqrt{150x^5}$

11. $-3\sqrt{45y^3}$

12. $-2b\sqrt{136b^2}$

Simplify each product.

13. $\sqrt{6} \cdot \sqrt{30}$

14. $\sqrt{5} \cdot \sqrt{70}$

15. $2\sqrt{3} \cdot \sqrt{96}$

16. $-4\sqrt{7} \cdot \sqrt{42}$

17. $\sqrt{4a} \cdot \sqrt{12a^5}$

18. $\sqrt{2r^2} \cdot \sqrt{30r}$

19. $-3\sqrt{40x} \cdot 2\sqrt{56x^5}$

20. $\frac{3}{4}\sqrt{12t^3} \cdot \sqrt{20t^5}$

21. $4\sqrt{14a^2} \cdot \frac{1}{2}\sqrt{28a^3}$

22. A pool is shaped like a rectangle with a length 4 times its width w . What is an expression for the distance between opposite corners of the pool?

23. Evelyn rode her horse along a triangular path. The distance she traveled south was five times the distance she traveled east. Then she rode directly back to her starting point. What is an expression for the total distance she rode?

10-2 Practice (continued)

Simplifying Radicals

Form G

Simplify each radical expression.

24. $\sqrt{\frac{36}{49}}$

25. $\sqrt{\frac{81}{16}}$

26. $\sqrt{\frac{100}{225}}$

27. $\sqrt{\frac{18y}{36y^3}}$

28. $\sqrt{\frac{49x^5}{25x}}$

29. $\sqrt{\frac{16a^2}{4b^4}}$

30. $\frac{\sqrt{5}}{\sqrt{2}}$

31. $\frac{\sqrt{12}}{\sqrt{15}}$

32. $\frac{\sqrt{72}}{\sqrt{40}}$

33. $\frac{\sqrt{25b}}{\sqrt{5b^3}}$

34. $\frac{\sqrt{24}}{\sqrt{3n}}$

35. $\frac{\sqrt{8}}{\sqrt{30m^2}}$

36. You are making a mosaic design on a square table top. You have already covered half of the table top with 150 1-inch square tile pieces.
- What are the dimensions of the table top?
 - What is the measure of the diagonal from one corner to the opposite corner of the table top?

37. The equation $r = \sqrt{\frac{SA}{4\pi}}$ gives the radius r of a sphere with surface area SA . What is the radius of a sphere with the given surface area? Use 3.14 for π .
- 1256 in².
 - 200.96 cm²
 - 379.94 ft²

38. **Open-Ended** What are three radical expressions that simplify to $2\sqrt{3}$?

7-1

Practice

Form G

Zero and Negative Exponents

Simplify each expression.

1. 13^0

2. 5^{-3}

3. $\frac{3}{3^{-4}}$

4. $\frac{2}{4^{-1}}$

5. $-(7)^{-2}$

6. 46^{-1}

7. -6^0

8. $-(12x)^{-2}$

9. $\frac{1}{8^0}$

10. $6bc^0$

11. $-(11x)^0$

12. $\left(\frac{2}{9}\right)^{-2}$

13. $3m^{-8}p^0$

14. $\frac{5a^{-4}}{2c}$

15. $\frac{-3k^{-3}(mn)^3}{p^{-8}}$

16. $\left(\frac{2m}{3n}\right)^{-3}$

17. $8^{-2}q^3r^{-5}$

18. $-(10a)^{-4}b^0$

19. $\frac{11xy^{-1}z^0}{v^{-3}}$

20. $\frac{5m^{-1}}{9(ab)^{-4}c^7}$

7-1**Practice** (continued)

Form G

Zero and Negative Exponents

Evaluate each expression for $a = -4$, $b = 3$, and $c = 2$.

21. $3a^{-1}$

22. b^{-3}

23. $4a^2 b^{-2} c^3$

24. $9a^0 c^4$

25. $-a^{-2}$

26. $(-c)^{-2}$

Write each number as a power of 10 using negative exponents.

27. $\frac{1}{1000}$

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

Write each expression as a decimal.

29. 10^{-3}

30. $8 \cdot 10^{-4}$

31. The number of people who vote early doubles every week leading up to an election. This week 1200 people voted early. The expression $1200 \cdot 2^w$ models the number of people who will vote early w weeks after this week. Evaluate the expression for $w = -3$. Describe what the value of the expression represents in the situation.

32. A pizza shop makes large pizzas with a target diameter of 16 inches. A pizza is acceptable if its diameter is within $3 \cdot 2^{-2}$ in. of the target diameter. Let d represent the diameter of a pizza. Write an inequality for the range of acceptable large pizza diameters in inches.

33. **Open-Ended** Choose a fraction to use as a value for the variable c . Find the values of c^{-1} , c^{-3} , and c^3 .

7-2**Practice**

Form G

Scientific Notation**Is the number written in scientific notation? If not, explain.**

1. 32.1×10^5

2. 5.6×10^{12}

3. 4.6×10^{-5}

4. 0.7×10^{34}

Write each number in scientific notation.

5. 3,200,000,000,000

6. 0.00000802

7. 70,030,000

8. 8.7 billion

Write each number in standard notation.

9. 3.37×10^{12}

10. 3.060×10^7

11. 4.2×10^{-6}

12. 4.56×10^0

Simplify. Write each answer using scientific notation.

13. $5(3.2 \times 10^{-4})$

14. $0.7(8.54 \times 10^4)$

15. $87(6.4 \times 10^5)$

16. $0.03(6 \times 10^{-7})$

17. Writing Scientific notation is often used for working with very small or very large numbers. Describe two situations where using scientific notation might be appropriate.

18. Reasoning How does a number in scientific notation change when you multiply it by 100?

19. Country A has a population of 8.7×10^9 . You hear that country B has twice as many people as country A and country C has twice as many people as country B. How many people live in country C?

7-2**Practice** (continued)

Form G

Scientific Notation

Write a number in scientific notation that is between the two given numbers.

20. 6.2×10^5 , 9.6×10^4

21. 3.7×10^{-3} , 9.4×10^{-2}

22. 7.94×10^6 , 7.93×10^7

23. 9×10^{-6} , 6×10^{-7}

Write a number in standard notation that is between the two given numbers.

24. 3.42×10^8 , 3.421×10^8

25. 1.3×10^{-4} , 1×10^{-3}

26. 5.708×10^{-6} , 5.7008×10^{-6}

27. 1.2×10^0 , 1.3×10^0

Write a number in words that is between the two given numbers.

28. 6.52×10^7 , 1.2×10^8

29. 3.9×10^{-5} , 2.8×10^{-4}

30. Open-Ended Write two factors that, when multiplied together, produce a product of 3.6×10^8 . One of the factors should be written in scientific notation.

31. Light travels at 1.86×10^5 miles per second. If a particle is traveling at half the speed of light, how fast is it moving?

32. An atom of carbon has a mass of 1.99×10^{-23} grams.

- What is the mass of two atoms of carbon?
- What is the mass of five atoms of carbon?

7-3

Practice

Form G

Multiplying Powers With the Same Base

Rewrite each expression using each base only once.

1. $4^5 \cdot 4^3$

2. $2^4 \cdot 2^6 \cdot 2^2$

3. $5^6 \cdot 5^{-2} \cdot 5^{-1}$

4. $10^{-4} \cdot 10^4 \cdot 10^2$

5. $7^9 \cdot 7^3 \cdot 7^{-10}$

6. $9^2 \cdot 9^{-8} \cdot 9^6$

Simplify each expression.

7. $z^8 z^5$

8. $-4k^{-3} \cdot 6k^4$

9. $(-5b^3)(-3b^6)$

10. $(13x^{-8})(3x^{10})$

11. $(-2h^5)(4h^{-3})$

12. $-8n \cdot 11n^9$

13. $(t^3)(t^6)(t^9)$

14. $(-f^{-8})(4f^{12})$

15. $(-5d^{-5})(6d^2)$

16. $mn^2 \cdot m^2n^{-4} \cdot mn^{-1}$

17. $(6a^3b^{-2})(-4ab^{-8})$

18. $(12mn)(-m^3n^{-2}p^5)(2m)$

19. $q^4 \cdot r^{-5} \cdot q^3 \cdot r^5$

20. $-3c^7d^{-2} \cdot 5c^{-3}d$

21. $fg^{-1}f^3g^5h^2 \cdot 2h^{-1}$

Simplify each expression. Write each answer in scientific notation.

22. $(5 \times 10^4)(1 \times 10^7)$

23. $(3 \times 10^{-6})(2 \times 10^{12})$

24. $(6 \times 10^7)(4 \times 10^{-5})$

25. $(7 \times 10^4)(7 \times 10^{-5})$

26. $(8 \times 10^3) \cdot 10^{-8}$

27. $(9 \times 10^{-6})(2 \times 10^{-7})$

Write each answer in scientific notation.

28. The population of a country in 1950 was 6.2×10^7 . The population in 2030 is projected to be 3×10^2 times the 1950 population. If the projection is correct, what will the population of the country be in 2030?

29. The area of land that Rhode Island covers is approximately 1.5×10^3 square miles. The area of land that Alaska covers is a little more than 4.3×10^2 times the land area of Rhode Island. What is the approximate area of Alaska in square miles?

Complete each equation.

30. $9^{-2} \cdot 9^4 = 9^\square$

31. $5^\square \cdot 5^3 = 5^{-5}$

32. $2^8 \cdot 2^\square = 2^{-2}$

33. $z^\square \cdot z^{-5} = z^3$

34. $m^{-3} \cdot m^6 \cdot m^\square = m^2$

35. $d^7 \cdot d^{-13} \cdot d^{-9} = d^\square$

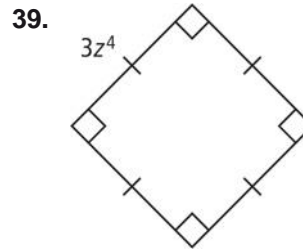
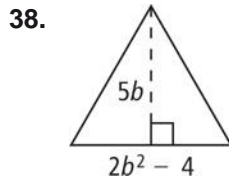
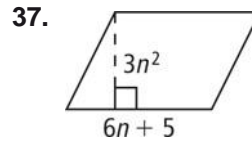
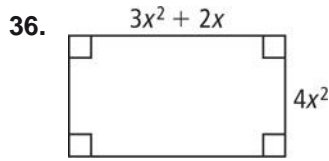
7-3

Practice (continued)

Form G

Multiplying Powers With the Same Base

Find the area of each figure.



Simplify each expression. Write each answer in scientific notation.

40. $(7 \times 10^{17})(8 \times 10^{-28})$ 41. $(4 \times 10^{-11})(0.8 \times 10^7)$ 42. $(0.9 \times 10^{15})(0.1 \times 10^{-6})$

43. $(0.8 \times 10^5)(0.6 \times 10^{-17})$ 44. $(0.5 \times 10^3)(0.6 \times 10^0)$ 45. $(0.2 \times 10^{11})(0.4 \times 10^{-14})$

46. The diameter of the moon is approximately 3.5×10^3 kilometers.
- The diameter of Earth is approximately 3.7 times the diameter of the moon. Determine the diameter of Earth. Write your answer in scientific notation.
 - The distance from the center of Earth to the center of the moon is approximately 30 times the diameter of Earth. Determine the distance from the center of Earth to the center of the moon. Write your answer in scientific notation.

Simplify each expression.

47. $\frac{1}{n^{-8}n^3}$

48. $\frac{1}{x^4x^{-9}}$

49. $7k^4(-2k^6 - k)$

50. $-2x^2(-3x^4 + 5)$

51. $4^x \cdot 4^{x+1} \cdot 4$

52. $(n + 2)^5(n + 2)^{-3}$

53. **Writing** Explain what moving the decimal point 4 places to the right or to the left does to the value of a number. In scientific notation, what power of 10 would you multiply by to make up for the movement of the decimal point?

7-4**Practice**

Form G

More Multiplication Properties of Exponents**Simplify each expression.**

- | | | | |
|-----------------------------|----------------------------|----------------------------|-------------------------------|
| 1. $(z^5)^3$ | 2. $(m^4)^{10}$ | 3. $(v^7)^2$ | 4. $(k^4)^3$ |
| 5. $(x^7)^{-2}$ | 6. $(r^4)^{-6}$ | 7. $b(b^{-8})^{-3}$ | 8. $h^2(h^7)^0$ |
| 9. $(m^2)^7n^5$ | 10. $(x^6)^2(y^3)^0$ | 11. $(g^5)^{-5}(g^6)^{-2}$ | 12. $(v^2)^3(w^4)^{-3}$ |
| 13. $(6a)^4$ | 14. $(5f)^{-3}$ | 15. $(9z)^{-4}$ | 16. $(10m^3)^{-2}$ |
| 17. $(6j^{-2})^{-3}$ | 18. $(9d^{10})^{-2}$ | 19. $(gh)^0$ | 20. $(qr^6)^4$ |
| 21. $(4a^3)^2a^5$ | 22. $(m^4n^3)^7(m^4)^3$ | 23. $(xy^2)(xy^2)^{-1}$ | 24. $z(y^{-5}z^7)^{-1}y^{-5}$ |
| 25. $(7t^{-3})^3(s^5t^4)^2$ | 26. $m^{-9}(m^{-1}n)^2n^8$ | 27. $(3b^{-4}c^{-2})^6c^3$ | 28. $5x^{-5}y^2(2x^{-14})^2$ |

Simplify. Write each answer in scientific notation.

- | | | | |
|---------------------------|---------------------------------|------------------------------|-------------------------------|
| 29. $(5 \times 10^7)^2$ | 30. $(2 \times 10^4)^6$ | 31. $(9 \times 10^{-12})^2$ | 32. $(3 \times 10^{-8})^3$ |
| 33. $(3.6 \times 10^5)^2$ | 34. $(9.3 \times 10^{-6})^{-2}$ | 35. $(1.7 \times 10^{-8})^3$ | 36. $(6.24 \times 10^{13})^3$ |
37. The radius of a cylinder is 5.4×10^6 cm. The height of the cylinder is 2.5×10^3 cm. What is the volume of the cylinder? (Hint: $V = \pi r^2 h$)
38. The side length of a square is 9.6×10^5 in. What is the area of the square?
39. The side length of a cube is 3.78×10^3 ft. What is the volume of the cube?

7-4

Practice (continued)

Form G

More Multiplication Properties of Exponents

Complete each equation.

40. $(p^4)^\square = p^8$

41. $(z^\square)^6 = z^{-24}$

42. $(t^{12})^\square = 1$

43. $(w^3)^\square = w^{-12}$

44. $(n^{-8})^\square = n^8$

45. $10(g^2)^\square = 10g^6$

46. $(3a^\square)^3 = 27a^{-9}$

47. $(6q^4r^\square)^2 = 36q^8$

48. $(x^4y^3)^\square = \frac{1}{x^8y^6}$

49. **Writing** Is $(y^m)^n = (y^n)^m$ a true statement? Explain your reasoning.50. **Reasoning** What is the difference between x^4x^3 and $(x^4)^3$? Justify your answer.**Simplify each expression.**

51. $2^3(2m)^2$

52. $(68.68)^8(68.68)^{-8}$

53. $(d^2)^{-5}d^3$

54. $(-7p)^3 + 7p^3$

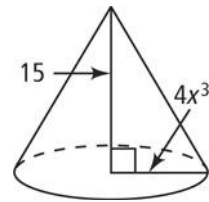
55. $4a(0^8)b^4(-b)^{-7}$

56. $(10^{-5})^3(9.9 \times 10^{-12})^2$

57. The volume of a circular cone can be determined by the formula

$$V = \frac{1}{3} 3.14r^2h,$$

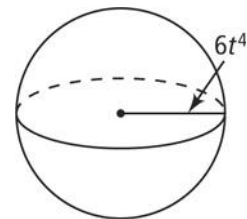
where r is the radius of the base and h is the height of the cone. Find the volume of the cone shown at the right in terms of x .



58. The volume of a sphere can be determined by the formula

$$V = \frac{4}{3} 3.14r^3,$$

where r is the radius. Find the volume of the sphere shown at the right in terms of t .



7-5 Practice

Division Properties of Exponents

Form G

Simplify each expression.

1. $\frac{5^6}{5^2}$

2. $\frac{5^5}{5^2}$

3. $\frac{x^7}{x^4}$

4. $\frac{m^{-3}}{m^{-5}}$

5. $\frac{x^6y^9}{x^2y^5}$

6. $\frac{21m^8}{3m^2}$

7. $\left(\frac{3}{5}\right)^4$

8. $\left(\frac{3x}{2y}\right)^3$

9. $\left(\frac{4}{7}\right)^{-2}$

10. $\left(-\frac{3x^4}{2y^5}\right)^{-3}$

11. $\left(\frac{12p^3}{15p}\right)^4$

12. $\left(\frac{ab^3}{a^5b}\right)^{-2}$

13. $\left(\frac{3x^2y^5z^{-2}}{5xz^5}\right)^{-3}$

14. $\frac{(4m^2)(3n^5)}{(2m^{-3})(-mn)^3}$

Explain why each expression is *not* in simplest form.

15. 2^4r^3

16. $(3x)^2$

17. m^3n^0

18. $\frac{y^5}{y}$

Simplify each quotient. Write each answer in scientific notation.

19. $\frac{3.6 \times 10^7}{1.5 \times 10^3}$

20. $\frac{4.5 \times 10^{-6}}{5 \times 10^{-2}}$

7-5 Practice (continued)

Division Properties of Exponents

Form G

21. Writing Explain how you divide expressions with numerators and denominators written in scientific notation. How do you handle the exponents? What do you do with the coefficients? Connect your response to the rules you have learned regarding the division properties of exponents.

22. A computer can do a computation in 6.8×10^{-9} seconds. How many computations can the computer do in 5 minutes?

23. Error Analysis A student simplifies the expression $\left(\frac{6^4}{3^2}\right)^3$ as follows:

$\left(\frac{6^4}{3^2}\right)^3 = [(6 \div 3)^{4-2}]^3 = (2^2)^3 = 64$. What mistake did the student make in simplifying the expression? What is the correct simplification?

24. Reasoning The division property of exponents says that to simplify powers with the same base you subtract the exponents. Use examples to show why powers need to have the same base in order for this technique to work.

25. The area of a triangle is $80x^5y^3$. The height of the triangle is x^4y . What is the length of the base of the triangle?

26. Open-Ended First simplify the expression $\left(\frac{12m^5}{15m}\right)^3$ by raising each factor in the parentheses to the third power and next reducing the result. Then simplify by some other method. Explain your method. Are the results the same? Which method do you prefer?

2-1**Practice**

Form G

Solving One-Step Equations**Solve each equation using addition or subtraction. Check your answer.**

1. $8 = a - 2$

2. $x + 7 = 11$

3. $r - 2 = -6$

4. $-18 = m + 12$

5. $f + 10 = -10$

6. $-1 = n + 5$

Solve each equation using multiplication or division. Check your answer.

7. $-3p = -48$

8. $-98 = 7t$

9. $-4.4 = -4y$

10. $2.8c = 4.2$

11. $\frac{k}{6} = 8$

12. $16 = \frac{w}{8}$

13. $-9 = \frac{y}{-3}$

14. $\frac{h}{10} = \frac{-22}{5}$

Solve each equation. Check your answer.

15. $\frac{3}{5}n = 12$

16. $-4 = \frac{2}{3}b$

17. $\frac{5}{8}x = -15$

18. $\frac{1}{4}z = \frac{2}{5}$

19. Jeremy mowed several lawns to earn money for camp. After he paid \$17 for gas, he had \$75 leftover to pay towards camp. Write and solve an equation to find how much money Jeremy earned mowing lawns.

2-1

Practice (continued)

Form G

Solving One-Step Equations**Define a variable and write an equation for each situation. Then solve.**

20. Susan's cell phone plan allows her to use 950 minutes per month with no additional charge. She has 188 minutes left for this month. How many minutes has she already used this month?
21. In the fifth year of operation, the profit of a company was 3 times the profit it earned in the first year of operation. If its profit was \$114,000 in the fifth year of operation, what was the profit in the first year?

Solve each equation. Check your answer.

22. $-9x = 48$

23. $-\frac{7}{8} = \frac{2}{3} + n$

24. $a + 1\frac{1}{4} = 2\frac{7}{10}$

25. $-7t = 5.6$

26. $2.3 = -7.9 + y$

27. $\frac{5}{3}p = \frac{8}{3}$

28. $\frac{g}{8} = -\frac{3}{4}$

29. $\frac{m}{8} = 8\frac{1}{3}$

30. A community center is serving a free meal to senior citizens. The center plans to feed 700 people in 4 hours.
- a. Write and solve an equation to find the average number of people the center is planning to feed each hour.
- b. During the first hour and a half, the center fed 270 people. Write and solve an equation to find the number of people that remain to be fed.

2-2**Practice**

Form G

Solving Two-Step Equations**Solve each equation. Check your answer.**

1. $6 + 3b = -18$

2. $-3 + 5x = 12$

3. $7n + 12 = -23$

4. $\frac{t}{6} - 3 = 8$

5. $-12 = 8 + \frac{f}{2}$

6. $13 = 8 - 5d$

7. $\frac{k}{4} + 6 = -2$

8. $-22 = -8 + 7y$

9. $16 - 3p = 34$

10. $15 + \frac{q}{6} = -21$

11. $-19 + \frac{c}{3} = 8$

12. $-18 - 11r = 26$

13. $-9 + \frac{y}{-3} = -6$

14. $14 + \frac{m}{10} = 24$

Define a variable and write an equation for each situation. Then solve.

15. Chip earns a base salary of \$500 per month as a salesman. In addition to the salary, he earns \$90 per product that he sells. If his goal is to earn \$5000 per month, how many products does he need to sell?

16. A pizza shop charges \$9 for a large cheese pizza. Additional toppings cost \$1.25 per topping. Heather paid \$15.25 for her large pizza. How many toppings did she order?

2-2**Practice** (continued)

Form G

Solving Two-Step Equations**Solve each equation. Check your answer.**

17. $\frac{z+6}{3} = 8$

18. $\frac{n-7}{2} = -11$

19. $\frac{j+18}{-4} = 8$

20. $\frac{1}{3}a - 6 = -15$

21. $\frac{1}{4} = \frac{1}{4}h + 4$

22. $6.42 - 10d = 2.5$

- 23.** The selling price of a television in a retail store is \$66 less than 3 times the wholesale price. If the selling price of a television is \$899, write and solve an equation to find the wholesale price of the television.
- 24.** The fare for a taxicab is \$5 per trip plus \$0.50 per mile. The fare for the trip from the airport to the convention center was \$11.50. Write and solve an equation to find how many miles the trip is from the airport to the convention center.
- 25.** An online movie club offers a membership for \$5 per month. Members can rent movies for \$1.50 per rental. A member was billed \$15.50 one month. Write and solve an equation to find how many movies the member rented.
- 26. Writing** Describe, using words, how to solve the equation $6 - 4x = 18$. List any properties utilized in the solution.

27. a. Solve $-8 = \frac{x+2}{4}$

- b. Write the right side of the equation in part (a) as the sum of two fractions. Solve the equation.
- c. Did you find the equation in part (a) or the rewritten equation easier to solve? Why?

2-3**Practice**

Form G

Solving Multi-Step Equations**Solve each equation. Check your answer.**

1. $19 - h - h = -13$

2. $14 + 6a - 8 = 18$

3. $25 = 7 + 3k - 12$

4. $5n - 16 - 8n = -10$

5. $-34 = v + 42 - 5v$

6. $x - 1 + 5x = 23$

7. $42j + 18 - 19j = -28$

8. $-49 = 6c - 13 - 4c$

9. $-28 + 15 - 22z = 31$

Write an equation to model each situation. Then solve the equation.

10. General admission tickets to the fair cost \$3.50 per person. Ride passes cost an additional \$5.50 per person. Parking costs \$6 for the family. The total costs for ride passes and parking was \$51. How many people in the family attended the fair?

11. Five times a number decreased by 18 minus 4 times the same number is -36 . What is the number?

Solve each equation. Check your answer.

12. $6(3m + 5) = 66$

13. $3(4y - 8) = 12$

14. $-5(x - 3) = -25$

15. $42 = 3(2 - 3h)$

16. $-10 = 5(2w - 4)$

17. $3p - 4 = 31$

18. $-3 = -3(2t - 1)$

19. $x - 2(x + 10) = 12$

20. $-15 = 5(3q - 10) - 5q$

21. Angela ate at the same restaurant four times. Each time she ordered a salad and left a \$5 tip. She spent a total of \$54. Write and solve an equation to find the cost of each salad.

2-3**Practice** (continued)

Form G

Solving Multi-Step Equations**Solve each equation. Choose the method you prefer to use. Check your answer.**

22. $\frac{a}{7} + \frac{5}{7} = \frac{2}{7}$

23. $6v - \frac{5}{8} = \frac{7}{8}$

24. $\frac{j}{6} - 9 = \frac{5}{6}$

25. $\frac{x}{3} - \frac{1}{2} = \frac{3}{4}$

26. $\frac{g}{5} + \frac{5}{6} = 6$

27. $\frac{b}{9} - \frac{1}{2} = \frac{5}{18}$

28. $0.52y + 2.5 = 5.1$

29. $4n + 0.24 = 15.76$

30. $2.45 - 3.1t = 21.05$

31. $-4.2 = 9.1x + 23.1$

32. $11.3 - 7.2f = -3.82$

33. $14.2 = -6.8 + 4.2d$

34. Reasoning Suppose you want to solve $-5 = 6x + 3 + 7x$. What would you do as your first step? Explain.

35. Writing Describe two different ways to solve $-10 = \frac{1}{4}(8y - 12)$.

Solve each equation. Round to the nearest hundredth if necessary.

36. $5 + \frac{2a}{-3} = \frac{5}{11}$

37. $\frac{3}{5}(p - 3) = -4$

38. $11m - (6m - 5) = 25$

39. The sum of three integers is 228. The second integer is 1 more than the first, and the third integer is 2 more than the first. Write an equation to determine the integers. Solve your equation. Show your work.

40. Can you solve the equation $\frac{2}{3}(4x - 5) = 8$ by using the Division Property of Equality? Explain.

2-4**Practice**

Form G

Solving Equations With Variables on Both Sides**Solve each equation. Check your answer.**

1. $3n + 2 = -2n - 8$

2. $8b - 7 = 7b - 2$

3. $-12 + 5k = 15 - 4k$

4. $-q - 11 = 2q + 4$

5. $4t + 9 = -8t - 13$

6. $22p + 11 = 4p - 7$

7. $17 - 9y = -3 + 16y$

8. $15m + 22 = -7m + 18$

9. $3x + 7 = 14 + 3x$

Write and solve an equation for each situation. Check your solution.

10. Shirley is going to have the exterior of her home painted. Tim's Painting charges \$250 plus \$14 per hour. Colorful Paints charges \$22 per hour. How many hours would the job need to take for Tim's Painting to be the better deal?

11. Tracey is looking at two different travel agencies to plan her vacation. ABC Travel offers a plane ticket for \$295 and a rental car for \$39 per day. M & N Travel offers a plane ticket for \$350 and a rental car for \$33 per day. What is the minimum number of days that Shirley's vacation should be for M & N Travel to have the better deal?

Solve each equation. Check your answer.

12. $7(h + 3) = 6(h - 3)$

13. $-(5a + 6) = 2(3a + 8)$

14. $-2(2f - 4) = -4(-f + 2)$

15. $3w - 6 + 2w = -2 + w$

16. $-8x - (3x + 6) = 4 - x$

17. $14 + 3n = 8n - 3(n - 4)$

Determine whether each equation is an *identity* or whether it has *no solution*.

18. $4(3m + 4) = 2(6m + 8)$

19. $5x + 2x - 3 = -3x + 10x$

20. $-(3z + 4) = 6z - 3(3z + 2)$

21. $-2(j - 3) = -2j + 6$

2-4**Practice** (continued)

Form G

Solving Equations With Variables on Both Sides

Solve each equation. If the equation is an identity, write *identity*. If it has no solution, write *no solution*.

22. $6.8 - 4.2b = 5.6b - 3$

23. $\frac{1}{3} + \frac{2}{3}m = \frac{2}{3}m - \frac{2}{3}$

24. $-2(5.25 + 6.2x) = 4(-3.1x + 2.68)$

25. $\frac{1}{2}r + 6 = 3 - 2r$

26. $0.5t + 0.25(t + 16) = 4 + 0.75t$

27. $2.5(2z + 5) = 5(z + 2.5)$

28. $-6(-p + 8) = -6p + 12$

29. $\frac{3}{8}f + \frac{1}{2} = 6(\frac{1}{16}f - 3)$

30. Three times the sum of a number and 4 is 8 less than one-half the number. Write and solve an equation to find the number.

31. A square and a rectangle have the same perimeters. The length of a side of the square is $4x - 1$. The length of the rectangle is $2x + 1$ and the width is $x + 2$. Write and solve an equation to find x .

32. A movie club charges a one-time membership fee of \$25 which allows members to purchase movies for \$7 each. Another club does not charge a membership fee and sells movies for \$12 each. How many movies must a member purchase for the cost of the two clubs to be equal?

33. Writing Describe the difference between an equation that is defined as an identity and an equation that has no solution. Provide an example of each and explain why each example is an identity or has no solution.

Finding GCF of Monomials

Find the GCF of each.

1) 22, 44

2) 33, 44

3) 14, 35

4) 16, 24

5) 44, 88

6) 57, 95

7) 75, 50

8) 90, 45

9) $36y^2, 21y^3$

10) $49x^2y^2, 21y^3$

11) $33b^2, 22b^2$

12) $33x, 44y^2x$

13) $54x^3, 36x^3$

14) $20v^2, 30uv^2$

15) $53m, 22m$

16) $14x^2y, 26x^3$

17) $15x^2, 12, 48$

18) $10v^3, 45v^3, 35v$

19) $45y^3x, 18y^2x, 18x^2y$

20) $24y, 36y, 24x^2y$

Finding the LCM of Monomials

Find the LCM of each.

1) $12x, 36y$

2) $24y^3x, 40x^3y$

3) $16y^2, 24y^2$

4) $30a^3b, 40a^3$

5) $10b^2a^2, 14a^2$

6) $27ab^2, 18b$

7) $18y^3, 32y$

8) $20n^2, 30m^2n^2$

9) $24b^3, 12ab^2$

10) $40xy, 32x^2y$

11) $14xy, 21y^2, 28y$

12) $28a^2, 40a, 24a$

13) $36, 27m^2, 18$

14) $32y^4, 40xy^2, 20x^2y^2$

15) $20, 32x, 12$

16) $27u^4, 18u^2, 27u^2$

17) $35y^2, 21xy, 14y$

18) $32m^2, 40mn, 24m$

19) $14yx, 38x^2, 28x^2$

20) $40y, 30x^2y, 20y^3$

GCF & LCM of Monomials

1. Look at the two monomials below.

$$9xy \quad 15x^2y^4$$

What is the least common multiple (LCM) of the monomials shown above?

Write your response here:
(show your work)

2.

$$14x^3y^2 \quad 10x^2y \quad 2x^4y^2$$

What is the greatest common factor (GCF) of the monomials shown above?

Write your response here:
(show your work)

3.

$$7xy^3 \quad 14xy^4 \quad 7x^2y^5$$

What is the greatest common factor (GCF) of the monomials shown above?

Write your response here:
(show your work)

4. Look at the two monomials below.

$$9u^3vw \quad 5u^2v^3w^3$$

What is the least common multiple (LCM) of the monomials shown above?

Write your response here:
(show your work)

5.

$$42x^3y^4 \quad 66x^3y$$

What is the greatest common factor (GCF) of the monomials shown above?

Write your response here:
(show your work)

6. $65x^2y^2$ $10x^4y$ $5x^3y^2$

What is the greatest common factor (GCF) of the monomials shown above?

Write your response here:
(show your work)

7. $6x^4y^3z^3$ $66x^3y^3$

What is the greatest common factor (GCF) of the monomials shown above?

Write your response here:
(show your work)

8. $18xy^4z^3$ $30x^4y^4$

What is the greatest common factor (GCF) of the monomials shown above?

Write your response here:
(show your work)

9. $7x^4y^3$ $35xy^2$ $7x^5y^3$

What is the greatest common factor (GCF) of the monomials shown above?

Write your response here:
(show your work)

10. Look at the three monomials below.

$$3x^3y^4z^4 \quad 5x^4y^2z^4 \quad 5x^3yz^3$$

What is the least common multiple (LCM) of the monomials shown above?

Write your response here:
(show your work)

11. Look at the two monomials below.

$$12x^2y \quad 20x^2y^4$$

What is the least common multiple (LCM) of the monomials shown above?

Write your response here:
(show your work)

12.

$$14x^2y^2 \quad 22x^4y$$

What is the greatest common factor (GCF) of the monomials shown above?

Write your response here:
(show your work)

13. Look at the two monomials below.

$$3xy \quad 5x^3y^4$$

What is the least common multiple (LCM) of the monomials shown above?

Write your response here:
(show your work)

14. Look at the two monomials below.

$$9x^2y^4 \quad 5x^2yz^3$$

What is the least common multiple (LCM) of the monomials shown above?

Write your response here:
(show your work)

15. Look at the two monomials below.

$$6x^2y^3 \quad 10x^2y^2z$$

What is the least common multiple (LCM) of the monomials shown above?

Write your response here:
(show your work)

Writing in Scientific Notation

Write each number in scientific notation.

1) 0.000006

2) 5400000

3) 60

4) 0.009

5) 6.7

6) 0.0000002

7) 2000000

8) 71×10^3

9) 48900

10) 0.0000009

11) 0.63×10^1

12) 33×10^{-3}

13) 0.000216

14) 0.0042

15) 0.15×10^{-2}

16) 4.8

Write each number in standard notation.

17) 0.9×10^{-1}

18) 2×10^{-1}

19) 2×10^5

20) 804×10^2

21) 2.66×10^4

22) 1.5×10^{-2}

23) 7.75×10^{-1}

24) 8.3×10^7

25) 9.5×10^7

26) 1.71×10^7

27) 0.9×10^{-3}

28) 38×10^2

29) 7.5×10^{-5}

30) 4×10^0

31) 8.4×10^5

32) 4×10^{-5}

Operations With Scientific Notation

Simplify. Write each answer in scientific notation.

1) $(1.08 \times 10^{-3})(9.3 \times 10^{-3})$

2) $(2 \times 10^{-4})(8.1 \times 10^{-1})$

3) $(2.32 \times 10^{-6})(4 \times 10^{-5})$

4) $(3.48 \times 10^3)(9.8 \times 10^4)$

5) $(7.1 \times 10^{-5})(6.7 \times 10^{-6})$

6) $(6 \times 10^3)(9.91 \times 10^0)$

7) $\frac{7.1 \times 10^6}{8.2 \times 10^1}$

8) $\frac{5.4 \times 10^{-1}}{3.4 \times 10^1}$

9) $\frac{4 \times 10^4}{3.63 \times 10^{-4}}$

10) $\frac{9 \times 10^{-5}}{9.24 \times 10^{-6}}$

11) $\frac{8.42 \times 10^3}{5 \times 10^2}$

12) $\frac{8.9 \times 10^6}{8.4 \times 10^6}$

13) $(8.9 \times 10^5)^4$

14) $(4 \times 10^{-5})^{-6}$

15) $(6 \times 10^{-5})^3$

16) $(6.3 \times 10^2)^{-6}$

17) $(5.21 \times 10^{-5})^2$

18) $(2.4 \times 10^{-5})^4$

19) $\frac{3 \times 10^{-2}}{8 \times 10^{-1}}$

20) $\frac{4.1 \times 10^4}{1.28 \times 10^{-5}}$

21) $\frac{1.91 \times 10^3}{5 \times 10^{-4}}$

22) $\frac{1.62 \times 10^{-6}}{5.3 \times 10^6}$

23) $\frac{3.59 \times 10^{-2}}{2.22 \times 10^1}$

24) $(8.8 \times 10^{-5})^{-5}$

25) $\frac{6 \times 10^{-3}}{8.08 \times 10^{-2}}$

26) $(3.5 \times 10^{-2})(9 \times 10^4)$

27) $(8.8 \times 10^2)(2.25 \times 10^{-2})$

28) $\frac{1.18 \times 10^{-4}}{3 \times 10^0}$

Directions: Drag each number to the correct location on the image.

Classify the real numbers below as rational or irrational numbers.

- $\frac{1}{4}$
 $\sqrt{90}$
 $\sqrt{8}$
 $\sqrt{4}$
 $\frac{\pi}{2}$
 $\frac{2}{3}$
 π

| | |
|---------------------------|--|
| Rational Numbers | |
| Irrational Numbers | |

Directions: Select the correct answer from each drop-down menu.

Complete the definition of an irrational number below.

An irrational number is a decimal.

Unlike rational numbers, irrational numbers be expressed as a fraction, $\frac{p}{q}$, where p and q are .

Directions

Directions: Select all the correct answers.

Yvette needs $\frac{5}{8}$ of a teaspoon of salt, $\frac{2}{3}$ of a tablespoon of baking soda, and $\frac{3}{4}$ of a cup of sugar to bake a cake.

Which of the following are correct concerning the decimal expansions of $\frac{5}{8}$, $\frac{2}{3}$, and $\frac{3}{4}$?

- The numbers $\frac{5}{8}$ and $\frac{3}{4}$ are terminating decimals while $\frac{2}{3}$ is a non-terminating decimal.
- The order of the measurements from least to greatest are $\frac{5}{8} < \frac{3}{4} < \frac{2}{3}$.
- The order of the measurements from least to greatest are $\frac{5}{8} < \frac{2}{3} < \frac{3}{4}$.
- The number $\frac{5}{8}$ is a terminating decimal while $\frac{3}{4}$ and $\frac{2}{3}$ are non-terminating decimals.
- The number $\frac{5}{8}$ expands to 0.625 while $\frac{3}{4}$ expands to 0.75.
- The number $\frac{3}{4}$ expands to 0.75 while $\frac{2}{3}$ expands to 0.6.
- The numbers $\frac{5}{8}$ and $\frac{2}{3}$ are terminating decimals.
- The order of the measurements from least to greatest are $\frac{2}{3} < \frac{5}{8} < \frac{3}{4}$.

Directions: Select all the correct answers.

Use estimation to determine which of the following numbers are between 4.5 and 4.9.

2π

$\sqrt[3]{85}$

$\sqrt[3]{115}$

$\frac{3\pi}{2}$

$\sqrt{22}$

$\sqrt{11}$

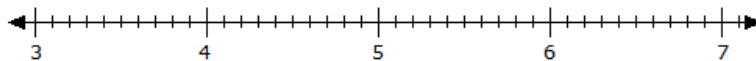
Directions: Drag each tile to the correct box.

Use rational approximations to place the irrational numbers in order from greatest to least.

| | | |
|-----------------|-------------------|-----------|
| $\frac{\pi}{2}$ | $2\pi - \sqrt{9}$ | $\pi + 3$ |
| > | > | |

Directions: Select the correct location on the number line.

Determine the value of $2\sqrt{7}$.



Directions: Drag each tile to the correct box.

Use rational approximations to place the irrational numbers in order from least to greatest.

| | | |
|--------------|-------------|-------------|
| $2\sqrt{14}$ | $\sqrt{27}$ | $\sqrt{42}$ |
| < | < | |

Directions: Type the correct answer in each box. Use numerals instead of words.

The red dot on the number line below represents the square root of an integer. Explain how to determine this integer, and then find it.



The red dot is located between 12 and 13.

The red dot is about half way between 12 and 13, but a little below the half way point, so the red dot represents a little below half way between the two square roots.

Since the square root of is equal to 12 and the square root of is equal to 13, then the red dot is located between the two square roots.

By extension, to the nearest integer, the approximate value of the dot will be a little below half way between $\sqrt{144}$ and $\sqrt{169}$, which is about the square root of .

Directions: Select all the correct answers.

Natalie has to list numbers that are greater than 1. Which of these expressions represent numbers greater than 1?

$4^4 \times 4^{-3}$

$3^4 \div 3^6$

$8^{-2} \div 8^{-3}$

$2^8 \div 2^5$

$7^3 \times 7^{-5}$

Directions: Drag each tile to the correct box.

Determine the value of each expression. Then, place the expressions in order from least to greatest.

$\frac{1}{2^{-5}} \div 2^3$

$5^3 \times 5^{-2}$

$(3^4)^2 \div 3^8$

<

<

Directions: Drag the tiles to the correct boxes to complete the pairs. Not all tiles will be used.

Match the correct expression to the correct solution.

$a^{(m \div n)}$

$a^{(m + n)}$

$a^{(m \times n)}$

$a^{(m^n)}$

$a^{(m - n)}$

$\frac{1}{a^m}$

$-a^m$

$a^m \div a^n$ \longleftrightarrow

$(a^m)^n$ \longleftrightarrow

a^{-m} \longleftrightarrow

$a^m \times a^n$ \longleftrightarrow

Directions: Drag the tiles to the boxes to form correct pairs. Not all tiles will be used.

Simplify the expressions, and match the expressions that are equal in value.

$5^{-3} \div 5^{-1}$

5^4

$\frac{1}{5^4}$

5^{-4}

$5^3 \times 5^{-1}$

$5^3 \div 5^{-1}$

\longleftrightarrow

\longleftrightarrow

Directions: Select all the correct answers.

Which of the following expressions have values that are less than the expression below?

$$6^{14} \div 6^2$$

$6^{15} \times 6^{-2}$

$6^9 \div 6^{-2}$

$6^8 \div 6^{-6}$

$(6^3)^3$

$6^{16} \times 6^{-4}$

SQUARE AND CUBE ROOTS – STUDY ISLAND

Directions: Select the correct answer from each drop-down menu.

$$x^2 = 17$$

The equation above has .

When $x = -\sqrt{17}$, x is to the equation.

When $x = -\sqrt{34}$, x is to the equation.

When $x = \frac{17}{2}$, x is to the equation.

Directions: Drag the tiles to the correct boxes to complete the pairs. Not all tiles will be used.

Match the square roots with the correct numbers.

- 10 11 50 9 40.5 12

$\sqrt{100}$ \longleftrightarrow

$\sqrt{121}$ \longleftrightarrow

$\sqrt{144}$ \longleftrightarrow

$\sqrt{81}$ \longleftrightarrow

Directions: Select all the correct answers.

Which of the following describes the positive solution to the equation below?

$$x^2 = 5$$

- The solution is greater than two but less than three.
- The solution is an irrational number.
- The solution is a repeating decimal.
- The solution is greater than one but less than two.
- The solution is a rational number.
- The solution is greater than zero but less than one.

Directions: Select the correct answer from each drop-down menu.

$$x^3 = 11$$

The equation above has .

When $x = -\sqrt[3]{11}$, x is to the equation.

When $x = \sqrt[3]{11}$, x is to the equation.

When $x = \frac{11}{3}$, x is to the equation.

SCIENTIFIC NOTATION

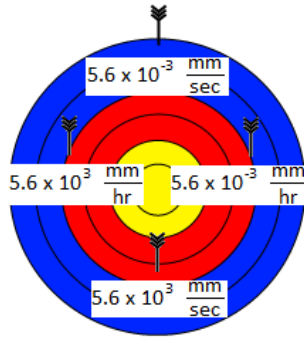
Directions: Select all the correct answers.

Charlie determined that the distance from her grandmother's house to her house is more than 20,000 feet but less than 26,000 feet. Which of the following could be a reasonable estimate for the distance between the houses?

- 2.1×10^3 ft
- 2.5×10^3 ft
- 2.1×10^{-4} ft
- 2.1×10^4 ft
- 2.5×10^{-4} ft
- 2.5×10^4 ft

Directions: Select the correct speed.

An archery range calculated the average speed of wooden arrows shot during a competition. Which is the best representation of the average speed?



Directions: Drag the tiles to the correct boxes to complete the pairs. Not all tiles will be used.

Match the given expressions to the answer that illustrates how a calculator would show the correct simplified form.

- 9E15
- 8E15
- 9E16
- 8E17
- 9E20
- 8E16

$(16 \times 10^{15}) - (7 \times 10^{15})$ \longleftrightarrow

$(5 \times 10^{16}) + (3 \times 10^{16})$ \longleftrightarrow

$(54 \times 10^{22}) \div (6 \times 10^6)$ \longleftrightarrow

$(8 \times 10^8) \times (1 \times 10^7)$ \longleftrightarrow

Directions: Select the correct answer from the drop-down menu.

An ice cream company produces approximately 6×10^5 half-gallons of strawberry ice cream a month. At the same time, they produce approximately 1×10^6 half-gallons of vanilla ice cream. Using this information, complete the statement.

The ice cream company produces approximately as much vanilla ice cream as strawberry ice cream.

Directions: Type the correct answer in the box. Use numerals instead of words.

Using a very precise measuring device, Dr. Calvin measured the thickness of a piece of metal to be 0.00064 of a meter. Dr. Amos measured another piece to be 2.5×10^{-5} of a meter thick.

If the doctors put the two pieces of metal on top of each other, the new piece of metal would be $\times 10^{-4}$ of a meter thick.

Directions: Select the correct answer from each drop-down menu.

In a particular year, the population of Dallas, TX, was approximately 1×10^6 people. If the population of Los Angeles, CA, was approximately three times that of Dallas, there were about \times 10^6 people living in Los Angeles that year.

The population of Pittsburgh, PA, was approximately 3×10^5 people during the same year, which was about times that of Dallas.

Directions: Drag the tiles to the boxes to form correct pairs.

The estimated measurements of four objects are shown below.

- length of a grain of salt: 0.0002 centimeters
- width of a key ring: 0.02 centimeters
- length of a stick: 200 centimeters
- length of a stretch of road: 20,000 centimeters

Match up the measurements written in standard notation to the estimated measurements in scientific notation.

| | | |
|--|-----------|--|
| 200 cm | 20,000 cm | between 1×10^{-3} cm and 1×10^{-2} |
| between 1×10^4 cm and 1×10^5 cm | 0.0002 cm | between 1×10^3 cm and 1×10^4 cm |
| between 1×10^{-4} cm and 1×10^{-3} cm | 0.02 cm | between 1×10^{-2} cm and 1×10^{-1} cm |
| between 1×10^2 cm and 1×10^3 cm | | |

Directions: Drag each expression and/or operation to the correct location on the equation. Not all expressions or operations will be used.

Recent statistics have reported that the total area of Brazil is about 3×10^6 square miles, while the total area of Japan is about 2×10^5 square miles.

Create and solve an equation that can be used to find about how many times larger the area of Brazil is than the area of Japan.

$$2 \times 10^5 \quad 15 \quad \div \quad 3 \times 10^6 \quad 1 \times 10^5 \quad - \quad + \quad 60$$

$$\boxed{} \bigcirc \boxed{} = \boxed{}$$

Directions: Drag the tiles to the correct boxes to complete the pairs. Not all tiles will be used.

Evaluate the given expressions, and choose the correct answer in scientific notation.

| | | | | | |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 8×10^2 | 8×10^4 | 7×10^2 | 7×10^3 | 7×10^4 | 8×10^3 |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|

$$(28 \times 10^6) \div (4 \times 10^3) \quad \longleftrightarrow$$

$$(4 \times 10^4) + (3 \times 10^4) \quad \longleftrightarrow$$

$$(2 \times 10^2) \times (4 \times 10^2) \quad \longleftrightarrow$$

$$(14 \times 10^3) - (6 \times 10^3) \quad \longleftrightarrow$$

Directions: Drag the tiles to the boxes to form correct pairs. Not all tiles will be used.

The measurements of four objects are shown below.

- diameter of a quinoa seed: 0.0016 meters
- wingspan of a dragonfly: 0.095 meters
- length of a computer monitor: 0.4572 meters
- height of a building: 30.48 meters

Match up each measurement to the correct description of an estimated measurement.

about half as many
meters as 9×10^{-1}

about twice as many
meters as 2×10^2

about three times as many
meters as 1×10^1

about half as many
meters as 3×10^{-3}

about five times as many
meters as 2×10^{-2}

about half as many
meters as 3×10^3

0.095 meters \longleftrightarrow

0.4572 meters \longleftrightarrow

0.0016 meters \longleftrightarrow

30.48 meters \longleftrightarrow