GRADE

6

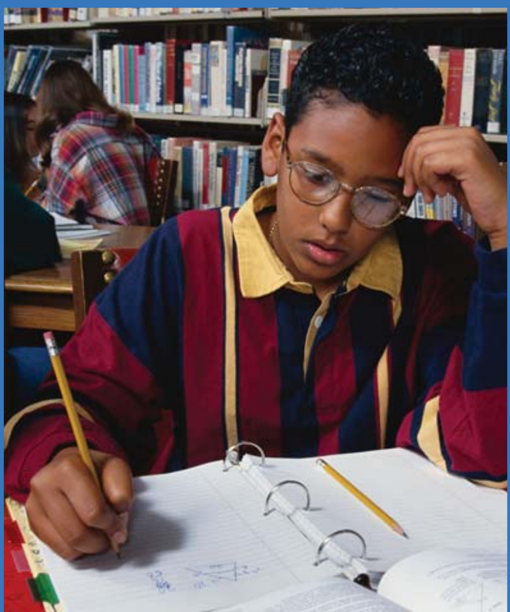
Revised 2007

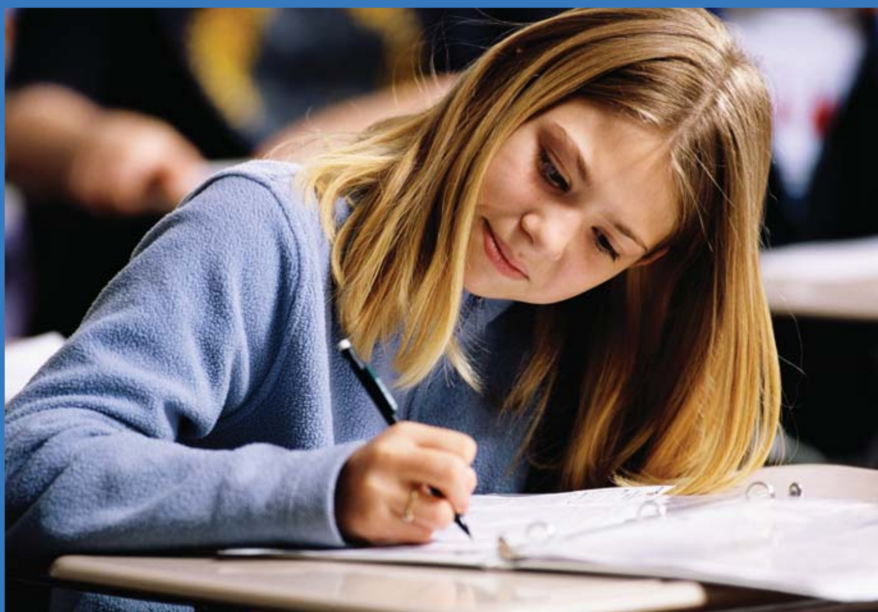
TAKS STUDY GUIDE

Texas Assessment of Knowledge and Skills

Mathematics

A Student and Family Guide





Revised Based on TEKS Refinements

TAKS STUDY GUIDE

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A Letter from the Deputy Associate Commissioner for Student Assessment

Dear Student and Parent:

The Texas Assessment of Knowledge and Skills (TAKS) is a comprehensive testing program for public school students in grades 3–11. TAKS, including TAKS (Accommodated) and Linguistically Accommodated Testing (LAT), has replaced the Texas Assessment of Academic Skills (TAAS) and is designed to measure to what extent a student has learned, understood, and is able to apply the important concepts and skills expected at each tested grade level. In addition, the test can provide valuable feedback to students, parents, and schools about student progress from grade to grade.

Students are tested in mathematics in grades 3–11; reading in grades 3–9; writing in grades 4 and 7; English language arts in grades 10 and 11; science in grades 5, 8, 10, and 11; and social studies in grades 8, 10, and 11. Every TAKS test is directly linked to the Texas Essential Knowledge and Skills (TEKS) curriculum. The TEKS is the state-mandated curriculum for Texas public school students. Essential knowledge and skills taught at each grade build upon the material learned in previous grades. By developing the academic skills specified in the TEKS, students can build a strong foundation for future success.

The Texas Education Agency has developed this study guide to help students strengthen the TEKS-based skills that are taught in class and tested on TAKS. The guide is designed for students to use on their own or for students and families to work through together. Concepts are presented in a variety of ways that will help students review the information and skills they need to be successful on TAKS. Every guide includes explanations, practice questions, detailed answer keys, and student activities. At the end of this study guide is an evaluation form for you to complete and mail back when you have finished the guide. Your comments will help us improve future versions of this guide.

There are a number of resources available for students and families who would like more information about the TAKS testing program. Information booklets are available for every TAKS subject and grade. Brochures are also available that explain the Student Success Initiative promotion requirements and the new graduation requirements for eleventh-grade students. To obtain copies of these resources or to learn more about the testing program, please contact your school or visit the Texas Education Agency website at www.tea.state.tx.us/student.assessment.

Texas is proud of the progress our students have made as they strive to reach their academic goals. We hope the study guides will help foster student learning, growth, and success in all of the TAKS subject areas.

Sincerely,

Gloria Zyskowski

Gloria Zyskowski
Deputy Associate Commissioner for Student Assessment
Texas Education Agency

Contents

Math

MATHEMATICS

INTRODUCTION

What Is This Book?

This is a study guide to help your child strengthen the skills tested on the Grade 6 Texas Assessment of Knowledge and Skills (TAKS). TAKS is a state-developed test administered with no time limit. It is designed to provide an accurate measure of learning in Texas schools.

By acquiring all the skills taught in sixth grade, your child will be better prepared to succeed on the Grade 6 TAKS and during the next school year.

What Are Objectives?

Objectives are goals for the knowledge and skills that a student should achieve. The specific goals for instruction in Texas schools were provided by the Texas Essential Knowledge and Skills (TEKS). The objectives for TAKS were developed based on the TEKS.

How Is This Book Organized?

This study guide is divided into the six objectives tested on TAKS. A statement at the beginning of each objective lists the mathematics skills your child needs to acquire. The study guide covers a large amount of material, which your child should not complete all at once. It may be best to help your child work through one objective at a time.

Each objective is organized into review sections and a practice section. The review sections present examples and explanations of the mathematics skills for each objective. The practice sections feature mathematics problems that are similar to the ones used on the TAKS test.

How Can I Use This Book with My Child?

First look at your child's Confidential Student Report. This is the report the school gave you that shows your child's TAKS scores. This report will tell you which TAKS subject-area test(s) your child passed and which one(s) he or she did not pass. Use your child's report to determine which skills need improvement. Once you know which skills need to be improved, you can guide your child through the instructions and examples that support those skills. You may also choose to have your child work through all the sections.

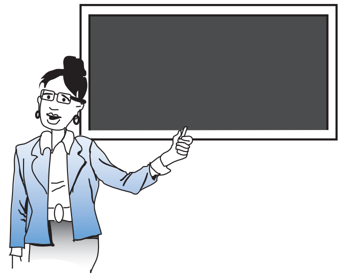
How Can I Help My Child Work on the Study Guide?

- When possible, review each section of the guide before working with your child. This will give you a chance to plan how long the study session should be.
- Sit with your child and work through the study guide with him or her.
- Pace your child through the questions in the study guide. Work in short sessions. If your child becomes frustrated, stop and start again later.
- There are several words in this study guide that are important for your child to understand. These words are boldfaced in the text and are defined when they are introduced. Help your child locate the boldfaced words and discuss the definitions.

What Are the Helpful Features of This Study Guide?

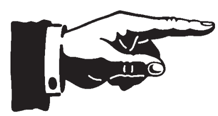
- Examples are contained inside shaded boxes.
- Each objective has “Try It” problems based on the examples in the review sections.
- A Grade 6 Mathematics Chart is included on pages 8–9 and also as a tear-out page in the back of the book. This chart includes useful mathematics information. The tear-out Mathematics Chart in the back of the book also provides both a metric and a customary ruler to help solve problems requiring measurement of length.
- Look for the following features in the margin:

  Ms. Mathematics provides important instructional information about a topic.



Detective Data offers a question that will help remind the student of the appropriate approach to a problem.

Do you see that . . . points to a significant sentence in the instruction.



How Should the "Try It" Problems Be Used?

"Try It" problems are found throughout the review sections of the mathematics study guide. These problems provide an opportunity for a student to practice skills that have just been covered in the instruction. Each "Try It" problem features lines for student responses. The answers to the "Try It" problems are found immediately following each problem.

While your child is completing a "Try It" problem, have him or her cover up the answer portion with a sheet of paper. Then have your child check the answer.

What Kinds of Practice Questions Are in the Study Guide?

The mathematics study guide contains questions similar to those found on the Grade 6 TAKS test. There are two types of questions in the mathematics study guide.

- Multiple-Choice Questions: Most of the practice questions are multiple choice with four answer choices. These questions present a mathematics problem using numbers, symbols, words, a table, a diagram, or a combination of these. Read each problem carefully. If there is a table or diagram, study it. Your child should read each answer choice carefully before choosing the best answer.
- Griddable Questions: Some practice questions use a seven-column answer grid like those used on the Grade 6 TAKS test.

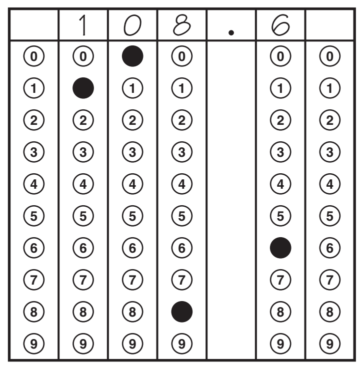
How Do You Use an Answer Grid?

The answer grid contains seven columns, including columns for two decimal places: tenths and hundredths.

Suppose 108.6 is the answer to a problem. First write the number in the blank spaces. Be sure to use the correct place value. For example, 1 is in the hundreds place, 0 is in the tens place, 8 is in the ones place, and 6 is in the tenths place.

Then fill in the correct bubble under each digit. Notice that if there is a zero in the answer, you need to fill in the bubble for the zero.

The grid shows 108.6 correctly entered. The zero in the tens place is bubbled in because it is part of the answer. It is not necessary to bubble in the zeros in the thousands place or the hundredths place, because these zeros will not affect the value of the correct answer.



Where Can Correct Answers to the Practice Questions Be Found?

The answers to the practice questions are in the answer key at the back of this book (pages 145–154). The answer key explains the correct answer, and it also includes some explanations for incorrect answers. After your child answers the practice questions, check the answers. Each question includes a reference to the page number in the answer key for the answer to the problem.

Even if your child chose the correct answer, it is a good idea to read the answer explanation because it may help your child better understand why the answer is correct.

Grade 6
Mathematics Chart

LENGTH

Metric	Customary
1 kilometer = 1000 meters	1 mile = 1760 yards
1 meter = 100 centimeters	1 mile = 5280 feet
1 centimeter = 10 millimeters	1 yard = 3 feet
	1 foot = 12 inches

CAPACITY AND VOLUME

Metric	Customary
1 liter = 1000 milliliters	1 gallon = 4 quarts
	1 gallon = 128 fluid ounces
	1 quart = 2 pints
	1 pint = 2 cups
	1 cup = 8 fluid ounces

MASS AND WEIGHT

Metric	Customary
1 kilogram = 1000 grams	1 ton = 2000 pounds
1 gram = 1000 milligrams	1 pound = 16 ounces

TIME

1 year = 365 days
1 year = 12 months
1 year = 52 weeks
1 week = 7 days
1 day = 24 hours
1 hour = 60 minutes
1 minute = 60 seconds

Metric and customary rulers can be found on the tear-out Mathematics Chart in the back of this book.

Grade 6 Mathematics Chart

Perimeter	square	$P = 4s$
	rectangle	$P = 2l + 2w$ or $P = 2(l + w)$
Circumference	circle	$C = 2\pi r$ or $C = \pi d$
Area	square	$A = s^2$
	rectangle	$A = lw$ or $A = bh$
	triangle	$A = \frac{1}{2}bh$ or $A = \frac{bh}{2}$
	trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$ or $A = \frac{(b_1 + b_2)h}{2}$
	circle	$A = \pi r^2$
Volume	cube	$V = s^3$
	rectangular prism	$V = lwh$
Pi	π	$\pi \approx 3.14$ or $\pi \approx \frac{22}{7}$

Objective 1

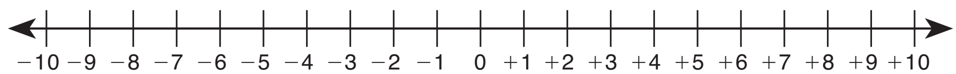
The student will demonstrate an understanding of numbers, operations, and quantitative reasoning.

For this objective you should be able to

- represent and use rational numbers in a variety of equivalent forms; and
- add, subtract, multiply, and divide to solve problems and justify solutions.

What Are Integers?

Integers include whole numbers, zero, and negative whole numbers. You can represent them on a number line, which extends in both directions from 0.



You can use a number line to model the integers.

- Integers to the right of 0 are read using the word positive. For example, the integer +3 is read as *positive* 3.
- Integers to the left of 0 are read using the word negative. For example, the integer −3 is read as *negative* 3.
- The number 0 is neither negative nor positive.
- The integers decrease from right to left on the number line. The integer −7 is less than −6. The integer 6 is less than 7.
- The integers increase from left to right on the number line. The integer −4 is greater than −5. The integer 5 is greater than 4.

How Can You Use Integers?

You can represent many real-life situations with integers.

> The Thompsons went shopping for a new television. The store window had a sign that read "Save $150 off the marked price." What integer can be used to represent the change in price?
>
> The price decreased $150.
>
> The integer −150 represents this change in price.

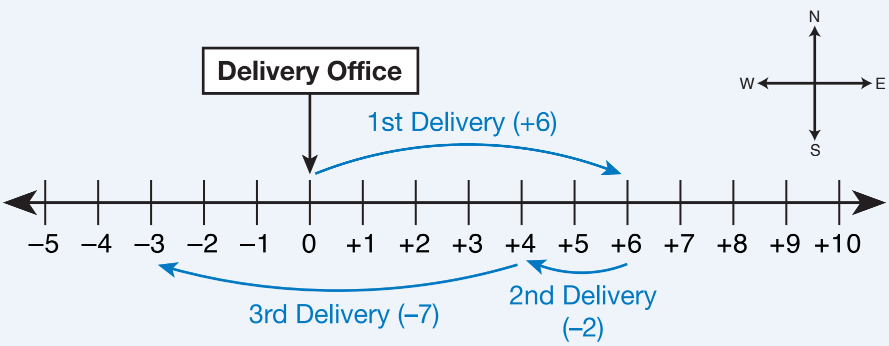
Do you see that . . .

When writing integers, be sure to use the negative sign to indicate a negative number, such as −4. Positive integers can be written without a sign. You can write either 4 or +4 to represent positive 4. If a number does not have a sign in front of it, you can assume the number is positive.

Tom makes deliveries along Main Street. His starting point is the delivery office on Main Street. His first delivery is 6 blocks directly east of the office. His next delivery is 2 blocks directly west of the first delivery. His third delivery is 7 blocks directly west of the second delivery. How can you use integers to model his travels?

You can use a number line to model Tom's travels for these deliveries. Let east be to the right of 0 on the number line and west to the left.

- Tom starts at the delivery office. Let the integer 0 on the number line represent the delivery office.
- Tom's first delivery is 6 blocks east. Count 6 units to the right of 0 on the number line. The integer $+6$ can be used to represent this part of his travels. You are now at $+6$ on the number line.
- Tom's second delivery is 2 blocks west of his first delivery. Count 2 units to the left of $+6$ on the number line. The integer -2 can be used to represent this part of his travels. You are now at $+4$ on the number line.
- Tom's third delivery is 7 blocks west of his second delivery. Count 7 units to the left of $+4$ on the number line. The integer -7 can be used to represent this part of his travels. You are now at -3 on the number line.



Objective 1

Try It

Javonte is playing a board game. He moved his game piece three times: 8 spaces forward, 2 spaces backward, and 4 spaces backward. Which integers can be used to represent Javonte's moves in this game?

Javonte moved his game piece ______ times.

- First he moved ______ spaces forward. The integer ______ can be used to represent this move.
- Next he moved ______ spaces backward. The integer ______ can be used to represent this move.
- Then he moved ______ more spaces backward. The integer ______ can be used to represent this move.

The integers ______ , ______ , and ______ represent Javonte's moves in this game.

Javonte moved his game piece three times. First he moved 8 spaces forward. The integer +8 can be used to represent this move. Next he moved 2 spaces backward. The integer −2 can be used to represent this move. Then he moved 4 more spaces backward. The integer −4 can be used to represent this move. The integers +8, −2, and −4 represent Javonte's moves in this game.

How Do You Compare and Order Whole Numbers?

Look at the place value of the digits to help you compare and order whole numbers.

Look at the whole numbers 34,652,859 and 34,839,064.

Which of these two whole numbers is the greater number?

To determine which number is greater, compare the digits in each place value. A place-value chart can help you compare the digits.

Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
3	4	6	5	2	8	5	9
3	4	8	3	9	0	6	4

- Start at the left. Both numbers have a digit in the ten-millions place. Compare those digits. Both numbers have a 3 in the ten-millions place.

  $\underline{3}4{,}652{,}859 \qquad \underline{3}4{,}839{,}064$

- Look at the digit in the next place value. Both numbers have a 4 in the millions place.

  $3\underline{4}{,}652{,}859 \qquad 3\underline{4}{,}839{,}064$

- Look at the digit in the next place value. Since 8 > 6, then 34,839,064 > 34,652,859.

  $34{,}\underline{6}52{,}859 \qquad 34{,}\underline{8}39{,}064$

The number 34,839,064 is the greater number.

Objective 1

How Do You Use the Order of Operations to Simplify Numerical Expressions?

Many problems require you to perform several arithmetic operations to reach a solution. There are rules for the order in which these operations are performed.

To simplify an expression, follow this order of operations:

1. Simplify any operations in parentheses and brackets. If there is more than one operation within a set of parentheses, follow the order of operations in steps 2 and 3.
2. Do all multiplication and division from left to right.
3. Do all addition and subtraction from left to right.

Simplify the expression $6 \cdot 2 + 4 \cdot 5 - 4 \cdot 7$.

- There are no parentheses.
- Begin at the left and multiply from left to right.

$$6 \cdot 2 + 4 \cdot 5 - 4 \cdot 7 =$$
$$12 + 20 - 28$$

- Then begin at the left and add or subtract from left to right.

$$12 + 20 - 28 =$$
$$32 - 28 =$$
$$4$$

The expression $6 \cdot 2 + 4 \cdot 5 - 4 \cdot 7$ simplifies to 4.

Objective 1

Simplify the expression $8 + (5 \cdot 3 - 1) \div 2 \cdot 3$.

- First perform any operations in parentheses. There are multiplication and subtraction signs within the parentheses. The order of operations says to multiply before you subtract.

$$\begin{aligned} &8 + (5 \cdot 3 - 1) \div 2 \cdot 3 = \\ &8 + \quad (15 - 1) \div 2 \cdot 3 = \\ &8 + \qquad 14 \quad \div 2 \cdot 3 \end{aligned}$$

- Next divide and multiply from left to right.

$$\begin{aligned} &8 + 14 \div 2 \cdot 3 = \\ &8 + \quad 7 \quad \cdot 3 = \\ &8 + \qquad 21 \end{aligned}$$

- Finally, add and subtract from left to right.

$$\begin{aligned} &8 + 21 = \\ &29 \end{aligned}$$

The expression $8 + (5 \cdot 3 - 1) \div 2 \cdot 3$ simplifies to 29.

Try It

Simplify the expression $(5 \cdot 9 + 3) - 8 \div 2$.

Follow the order of operations.

$(5 \cdot 9 + 3) - 8 \div 2 =$

$(\_\_\_\_\_ + 3) - 8 \div 2 =$

$\_\_\_\_\_ - 8 \div 2 =$

$\_\_\_\_\_ - \_\_\_\_\_ =$

$\_\_\_\_\_$

$(5 \cdot 9 + 3) - 8 \div 2 = \_\_\_\_\_$

$(5 \cdot 9 + 3) - 8 \div 2 =$

$(45 + 3) - 8 \div 2 =$

$48 - 8 \div 2 =$

$48 - 4 =$

44

$(5 \cdot 9 + 3) - 8 \div 2 = 44$

When Do You Use Multiplication and Division to Solve Problems?

Use multiplication when you want to combine groups of equal size. Use division when you want to separate a whole into groups of equal size.

Jennifer has 36 packages of cookies for a party. Each package contains 24 cookies. How many cookies does Jennifer have in all?

Multiply 36 × 24 to find the total number of cookies.

- First multiply the ones.

$$\begin{array}{r} {}^{2} \\ 36 \\ \times 24 \\ \hline 144 \end{array}$$

- Then multiply the tens.

$$\begin{array}{r} {}^{1} \\ 36 \\ \times 24 \\ \hline 144 \\ 720 \\ \hline \end{array}$$

- Next add the products.

The 0 is a placeholder.

$$\begin{array}{r} 36 \\ \times 24 \\ \hline 144 \\ +720 \\ \hline 864 \end{array}$$

Jennifer has 864 cookies in all.

Objective 1

A gymnastics coach ordered 15 T-shirts for her team. The total cost of the T-shirts was \$165.00. How much did each T-shirt cost?

Divide to find the cost of each T-shirt.

$$\begin{array}{r} 1 \\ 15\overline{)165} \\ \underline{-15} \\ 1 \end{array}$$

- Divide: 16 ÷ 15 = 1.
- Multiply: 1 × 15 = 15.
- Subtract: 16 − 15 = 1.
- Compare: 1 < 15.

$$\begin{array}{r} 11 \\ 15\overline{)165} \\ \underline{-15}\downarrow \\ 15 \\ \underline{-15} \\ 0 \end{array}$$

- Bring down the 5.
- Divide: 15 ÷ 15 = 1.
- Multiply: 1 × 15 = 15.
- Subtract: 15 − 15 = 0.

Each T-shirt cost \$11.

As you continue learning mathematics, you will see different ways to indicate multiplication and division.

Do you see that . . .

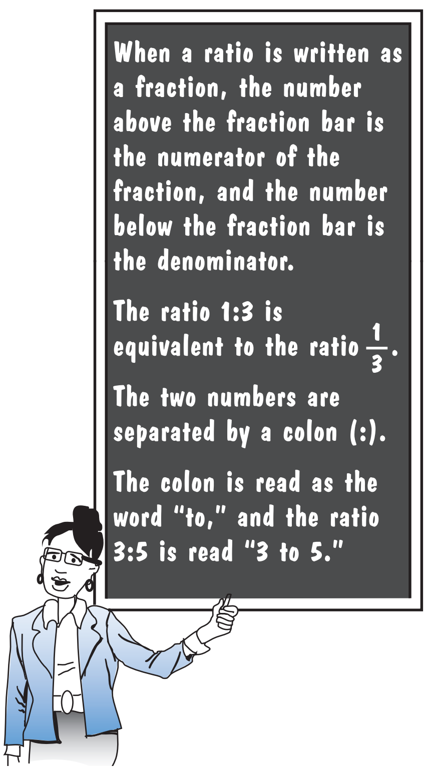
Multiplication can be indicated by a dot (•) or by parentheses. For example, 24 × 30 can be written as 24 • 30. It can also be written as (24)(30).

Division can be indicated by a fraction bar. For example, 165 ÷ 15 can be written as $\frac{165}{15}$.

How Do You Solve Problems Involving Ratios and Rates?

You can use multiplication and division to solve problems involving ratios and rates.

A **ratio** is a comparison of two quantities. For example, if you sleep 8 out of every 24 hours, the ratio of the number of hours you sleep to the number of hours in a day is $\frac{8}{24}$. The ratio $\frac{8}{24}$ simplifies to $\frac{1}{3}$. When two ratios are equal, such as $\frac{8}{24}$ and $\frac{1}{3}$, they are called equivalent ratios. The ratio $\frac{1}{3}$ can also be written in the form 1:3. The ratio of the number of hours you sleep to the number of hours in a day is 1:3.



Some ratio problems use the word rate. For example, a ratio can be used to describe how far you walk in a given amount of time. If you walk 5 miles in 2 hours, the ratio 5:2 refers to the rate at which you walk.

Suppose you and a friend made two types of holiday decorations. In the time it took you to make 7 window decorations, your friend made 5 door decorations. The ratio of decorations made is 7 window decorations to 5 door decorations, or 7:5.

Bill can swim 3 laps in 2 minutes. If he continues to swim at this rate, how many laps will Bill swim in 26 minutes?

- Find the rate at which Bill swims. The numerator of the ratio is the number of laps he swims. The denominator of the ratio is the number of minutes it takes him to swim those laps.

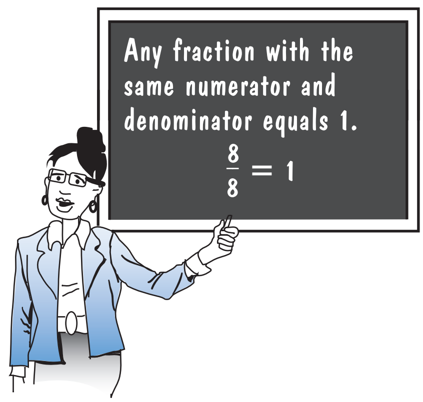
$$\frac{3 \text{ laps}}{2 \text{ minutes}} = \frac{3}{2}$$

Bill's swimming rate is 3 laps to 2 minutes, or 3:2.

- Find an equivalent ratio with a denominator of 26 minutes. Multiply by a fraction equal to 1 that results in 26 minutes in the denominator.

$$\frac{3 \cdot 13}{2 \cdot 13} = \frac{39}{26}$$

If Bill continues to swim at the same rate, he will swim 39 laps in 26 minutes.



John is taking a test with 150 questions. He has answered 45 of the first 50 questions correctly. If John continues at this rate, how many questions will he answer correctly out of 150?

- Find the rate at which John has answered questions correctly on the first part of the test. The numerator of the ratio is the number of questions answered correctly. The denominator of the ratio is the total number of questions answered so far.

$$\frac{45 \text{ correct}}{50 \text{ questions}} = \frac{45}{50}$$

John answered questions correctly at the rate 45:50.

- Find an equivalent ratio with a denominator of 150 questions. Multiply by a fraction equal to 1 that results in 150 questions in the denominator.

$$\frac{45 \cdot 3}{50 \cdot 3} = \frac{135}{150}$$

If John continues to answer questions correctly at the same rate, he will answer 135 out of 150 questions correctly.

Objective 1

Try It

George earns \$30 in 2 hours. If George's rate of pay remains the same, how much money will he earn in 36 hours?

- Find the rate at which George is paid in dollars per hour.

  The numerator of the ratio is the number of ________________

  ________________________ .

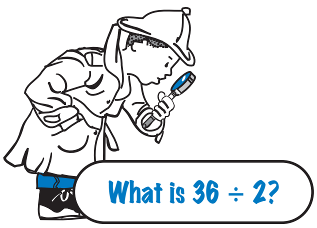
  The denominator of the ratio is the number of ______________

  ________________________ .

  He is paid at the rate $\frac{\$\square}{\square\ \text{h}}$.

- Find an equivalent ratio with a denominator of ______ hours.

$$\frac{30 \cdot \square}{2 \cdot \square} = \frac{\square}{36}$$



If George continues to be paid at the same rate, he will earn

\$______ in 36 hours.

The numerator of the ratio is the number of dollars he earns. The denominator of the ratio is the number of hours he works.

He is paid at the rate $\frac{\$30}{2\text{h}}$. Find an equivalent ratio with a denominator of 36 hours.

$$\frac{30 \cdot 18}{2 \cdot 18} = \frac{540}{36}$$

If George continues to be paid at the same rate, he will earn \$540 in 36 hours.

How Do You Compare and Order Decimals?

Look at the value of the digits to help you compare and order decimals. Looking at the numbers in a place-value chart can also help you compare decimals.

Order these numbers from least to greatest.

4.3 4.03 5.3 0.53

Look at the numbers in a place-value chart. You can place zeros at the end of a decimal number without changing its value.

Ones	.	Tenths	Hundredths
0	.	5	3
4	.	0	3
4	.	3	0
5	.	3	0

- Start at the left. Three of the numbers have a digit in the ones place. These numbers will be greater than the number that does not have a digit in the ones place. The number 0.53 is the least number.
- Look at the ones place again. Two of the numbers have a 4 in the ones place, and one number has a 5 in the ones place. The numbers with a 4 in the ones place are less than the number with a 5 in the ones place.
- Decide which of the two numbers with a 4 in the ones place is less. Look at the next place value, the tenths place. One of the numbers with a 4 in the ones place has a 0 in the tenths place. The other number with a 4 in the ones place has a 3 in the tenths place. The number 4.03 is less than the number 4.3.
- The number 5.3 is the greatest number because it has a 5 in the ones place and no other number has anything greater than or equal to a 5 in the ones place.

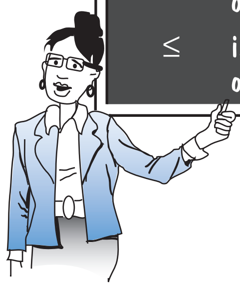
The numbers in order from least to greatest are as follows:

0.53 4.03 4.3 5.3

Do you see that . . .

Here are some math symbols you need to know.

Symbol	Meaning
$=$	is equal to
$>$	is greater than
$<$	is less than
$\geq$	is greater than or equal to
$\leq$	is less than or equal to



Which of these two decimals, 0.127 or 0.13, is greater?

Look at the numbers in a place-value chart.

Ones	.	Tenths	Hundredths	Thousandths
0	.	1	2	7
0	.	1	3	0

- Start at the left. Look at the digits in the ones place. Both numbers have a 0 in the ones place.
- Look at the digits in the tenths place. Both numbers have a 1 in the tenths place.
- Look at the digits in the hundredths place. Since $3 > 2$, the decimal 0.13 is the greater number.

Try It

Ricci was measuring the volume of water in several containers for a science experiment. The table below shows the measurements he took in milliliters.

Water Samples

Sample	Volume (mL)
1	15.23
2	15.25
3	15.03

List the samples in order from greatest to least volume.

To compare the numbers, look at the digits. Start with the digits on the left.

Look at the digits in the ______________ place. All three numbers have a _______ in the tens place.

Look at the digits in the ______________ place. All three numbers have a _______ in the ones place.

Look at the digits in the ______________ place.

Since _______ > _______ , the decimals 15.23 and 15.25 are both greater than 15.03.

To determine whether 15.23 or 15.25 is greater, look at the digits in the ______________ place.

Since _______ > _______ , the decimal _______ is greater than

_______ .

The measurements listed in order from greatest to least are as follows:

__________ mL, __________ mL, __________ mL

The samples listed in order from greatest to least volume are as follows:

Sample _______ , Sample _______ , Sample _______

Start with the digits on the left. Look at the digits in the tens place. All three numbers have a 1 in the tens place. Look at the digits in the ones place. All three numbers have a 5 in the ones place. Look at the digits in the tenths place. Since $2 > 0$, the decimals 15.23 and 15.25 are both greater than 15.03. Look at the digits in the hundredths place. Since $5 > 3$, the decimal 15.25 is greater than 15.23. The measurements listed in order from greatest to least are 15.25 mL, 15.23 mL, and 15.03 mL. The samples listed in order from greatest to least volume are Sample 2, Sample 1, and Sample 3.

How Do You Add or Subtract Decimals?

To add or subtract decimals, follow these steps:

- Line up the decimal points of the numbers being added or subtracted. Whole numbers can be written with a decimal after the number (14 = 14.0).
- When necessary, place zeros at the end of the decimals so that each number has the same number of decimal places.
- Add or subtract.
- Regroup when necessary.
- Bring the decimal point straight down in the answer.

Hannah is making a picture frame. The length of the frame is 34.5 cm. The width of the frame is 7.25 cm less than the length. How wide is the frame in centimeters?

Write the numbers in a column and line up the decimal points. Use subtraction to find the difference. Be sure to place the decimal point in the answer.

$$\begin{array}{r} {\scriptstyle 2\;14\;\;4\;10} \\ \cancel{3}\cancel{4}.\cancel{5}\cancel{0} \\ -\;7.25 \\ \hline 27.25 \end{array}$$

The frame is 27.25 centimeters in width.

Objective 1

Gail mixed together several chemicals in the science laboratory to form a compound. The table below shows the masses of the chemicals she mixed together.

Compound

Chemical	Mass (g)
A	182.74
B	51.03
C	0.29
D	0.045

What was the total mass of the compound in grams?

Write the numbers in a column. Line up the decimal points. If necessary, place zeros at the end of the decimals so that each number has the same number of decimal places.

$$\begin{array}{r} \overset{1}{1}8\overset{1}{2}.\overset{2}{7}40 \\ 51.030 \\ 0.290 \\ +\quad 0.045 \\ \hline 234.105 \end{array}$$

The total mass of the compound was 234.105 grams.

Jennie has a spool with 35.5 meters of ribbon on it. She uses 2.14 meters of ribbon to wrap one gift and 2.23 meters of ribbon to wrap another gift. How many meters of ribbon are left on the spool?

- Add to find the amount of ribbon Jennie used in all.

$$\begin{array}{r} 2.14 \\ +\ 2.23 \\ \hline 4.37 \end{array}$$

- Subtract to find how much ribbon is left.
- Add a zero so that the numbers have the same number of decimal places.
- Regroup 5 tenths as 4 tenths and 10 hundredths.

$$\begin{array}{r} 35.\overset{4}{\cancel{5}}\overset{10}{\cancel{0}} \\ -\ 4.37 \\ \hline 31.13 \end{array}$$

There are 31.13 meters of ribbon left on the spool.

Try It

Jolene is on the track team. She runs the 100-yard dash. The table below shows her times for the last four races she ran.

100-Yard Dash

Race	Time (seconds)
1	17.024
2	16.91
3	16.835
4	17.1

What is the difference between her fastest and slowest times?

Her fastest time is __________ seconds.

Her slowest time is __________ seconds.

Use the operation of ________________ to find the difference between these times.

Use the space below to find the answer.

_______ _______ . _______ _______ _______

– _______ _______ . _______ _______ _______

_______ _______ . _______ _______ _______

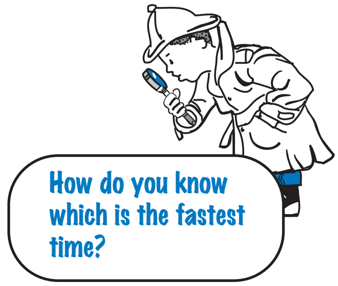
The difference between her fastest and slowest times is _______ second.

Her fastest time is 16.835 seconds. Her slowest time is 17.1 seconds. Use the operation of subtraction to find the difference between these times.

Line up the decimal points, place zeros at the end of 17.1, and regroup to subtract.

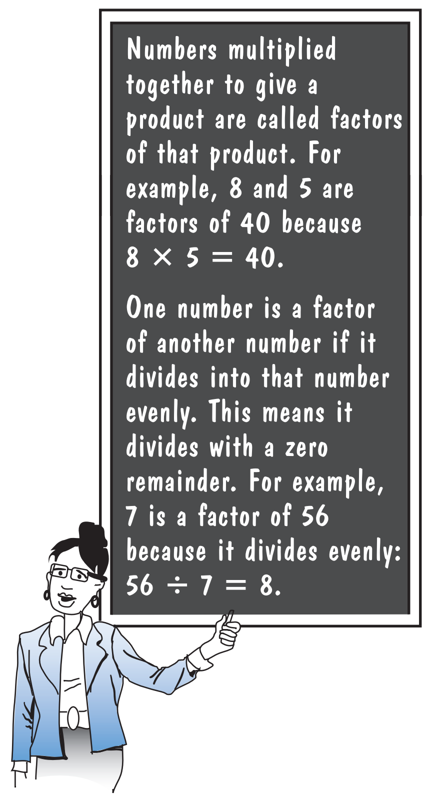
The difference between her fastest and slowest times is 0.265 second.

$$\begin{array}{r} \scriptstyle 10\ 9 \\ \scriptstyle 6\ \cancel{11}\cancel{10}\ 10 \\ 1\cancel{7}.\cancel{1}\cancel{0}\cancel{0} \\ -16.835 \\ \hline 00.265 \end{array}$$



What Is a Common Factor?

Factors shared by two or more numbers are called **common factors** of those numbers. For example, 7 is a factor of 21 because 21 ÷ 7 = 3. It is also a factor of 63 because 63 ÷ 7 = 9. Therefore, 7 is a common factor of 21 and 63.



Objective 1

Find all the common factors of 18 and 27.

- List the factors of each number.

  Factors of 18: 1, 2, 3, 6, 9, 18

  Factors of 27: 1, 3, 9, 27

- Circle the factors that 18 and 27 have in common.

The common factors of 18 and 27 are 1, 3, and 9.

How Do You Identify a Greatest Common Factor?

The greatest factor shared by two numbers is called the **greatest common factor** of the two numbers.

What is the greatest common factor of 42 and 70?

- List the factors of each number.

  Factors of 42: 1, 2, 3, 6, 7, 14, 21, 42

  Factors of 70: 1, 2, 5, 7, 10, 14, 35, 70

- Circle the factors that 42 and 70 have in common.

The greatest common factor is 14. It is the greatest number that is a factor of both 42 and 70.

Try It

Find the common factors of 36 and 54. Then identify the greatest common factor.

Factors of 36 are 1, _______ , _______ , _______ , _______ , _______ ,

_______ , _______ , and 36.

Factors of 54 are 1, _______ , _______ , _______ , _______ , _______ ,

_______ , and 54.

The common factors of 36 and 54 are _______ , _______ , _______ ,

_______ , _______ , and _______ .

The greatest common factor of 36 and 54 is _______ .

Factors of 36 are 1, 2, 3, 4, 6, 9, 12, 18, and 36. Factors of 54 are 1, 2, 3, 6, 9, 18, 27, and 54. The common factors of 36 and 54 are 1, 2, 3, 6, 9, and 18. The greatest common factor of 36 and 54 is 18.

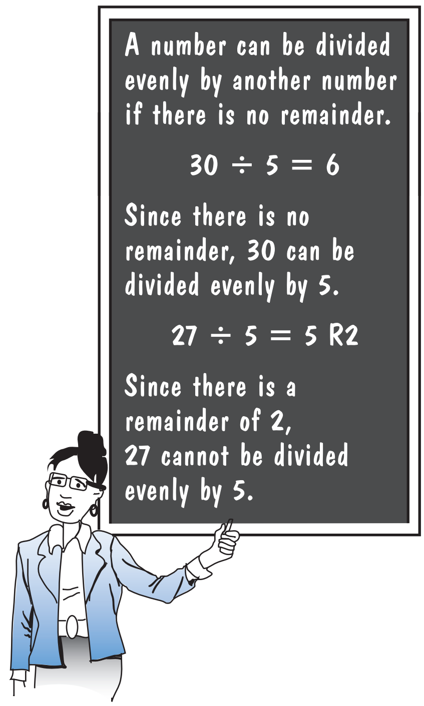
What Is a Multiple of a Number?

A **multiple** of a number is any product of that number and another whole number.

> Is 20 a multiple of 4?
>
> - The number 20 can be written as the product of 4 and another whole number.
> - $20 = 4 \cdot 5$
>
> Since 20 is the product of 4 and 5, the number 20 is a multiple of 4.

To determine whether a given number is a multiple of another number, you can also divide. If a number can be divided evenly by another number, the first number is a multiple of the second number.

> Is 55 a multiple of 11?
>
> - Does 55 divide evenly by 11, or is there a remainder?
> - $55 \div 11 = 5$ There is no remainder, so it divides evenly.
>
> Since 55 divides evenly by 11, the number 55 is a multiple of 11.



How Do You Identify a Least Common Multiple?

The **least common multiple** of two or more numbers is the least number that is in each of their list of multiples.

To list the multiples of a number, multiply that number by 1, and then by 2, and then by 3, and so on. For example, find the first five multiples of 7.

$$1 \cdot 7 = 7 \quad 2 \cdot 7 = 14 \quad 3 \cdot 7 = 21 \quad 4 \cdot 7 = 28 \quad 5 \cdot 7 = 35$$

The first five multiples of 7 are 7, 14, 21, 28, and 35.

To find the least common multiple of two or more numbers, follow these steps:

- List the first several multiples of each of the numbers.
- Identify the least number that appears in all the lists.
- If there is no common number in the lists, find more multiples.

> What is the least common multiple of 24 and 18?
>
> - List the first several multiples of both numbers.
>
>   Multiples of 24: 24, 48, 72, 96, 120, 144, …
>
>   Multiples of 18: 18, 36, 54, 72, 90, 108, …
>
> - The least number in both lists of multiples is 72.
>
> The least common multiple of 24 and 18 is 72.

Objective 1

Try It

What is the least common multiple of 40 and 50?

The first six multiples of 40 are as follows:

40, ______ , ______ , ______ , ______ , and ______ .

The first six multiples of 50 are as follows:

50, ______ , ______ , ______ , ______ , and ______ .

The least number that appears in both lists is ______ .

The least common multiple of 40 and 50 is ______ .

The first six multiples of 40 are 40, 80, 120, 160, 200, and 240. The first six multiples of 50 are 50, 100, 150, 200, 250, and 300. The least number that appears in both lists is 200. The least common multiple of 40 and 50 is 200.

What Is an Exponent?

An **exponent** is a number that tells how many times a number, the **base**, is used as a factor.

3^4 ← Exponent
← Base

- The expression 3^4 means the number 3 is used as a factor 4 times.

$$3^4 = 3 \times 3 \times 3 \times 3$$

- The expression 3^4 is read as *three to the fourth power*. In this expression, 3 is the base, and 4 is the exponent.
- Since $3 \times 3 \times 3 \times 3 = 81$, you can also write $3^4 = 81$.

Here are some examples of expressions that use exponents and what they are equal to:

- $3^2 = 3 \times 3 = 9$
- $4^3 = 4 \times 4 \times 4 = 64$
- $5 \times 6^2 = 5 \times (6 \times 6) = 5 \times 36 = 180$
- $3^2 \times 2^4 = (3 \times 3) \times (2 \times 2 \times 2 \times 2) = 9 \times 16 = 144$

How Can You Use Exponents?

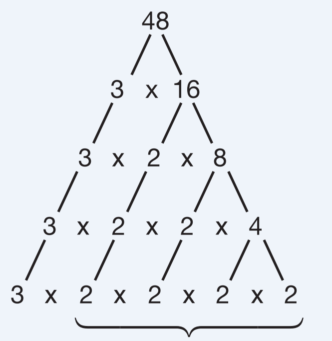
You can use exponents to write the **prime factorization** of a number. Every composite number can be written as a product of prime numbers. This is called the prime factorization of the number.

When a factor is repeated in a prime factorization, express the repeated factor using an exponent.

A factor tree also can help you find the prime factorization of a composite number. It does not matter which factor pair you start with, as long as you continue factoring until you have only prime numbers.

What is the prime factorization of 48 using exponents?

- $48 = 3 \times 16$ — The number 3 is prime, but 16 is composite. Find the factors of 16.
- $48 = 3 \times 2 \times 8$ — The numbers 3 and 2 are prime, but 8 is composite. Find the factors of 8.
- $48 = 3 \times 2 \times 2 \times 4$ — The numbers 3 and 2 are prime, but 4 is composite. Find the factors of 4.
- $48 = 3 \times 2 \times 2 \times 2 \times 2$ — The numbers 3 and 2 are prime. There is 1 factor of 3 and 4 factors of 2.



Four of the factors are 2.

The number 3 is prime, but 16 is composite. Find the factors of 16.

The numbers 3 and 2 are prime, but 8 is composite. Find the factors of 8.

The numbers 3 and 2 are prime, but 4 is composite. Find the factors of 4.

The numbers 3 and 2 are prime. There is 1 factor of 3 and 4 factors of 2.

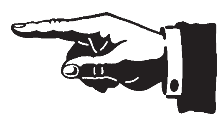
The prime factorization of 48 is 3×2^4.

The exponent 4 shows how many times the base number 2 is used as a factor. The factor 3 is used only once. It has an exponent of 1. Exponents of 1 do not need to be written.

Prime factorizations are usually written in order from least to greatest base number. The prime factorization of 48 can also be written $2^4 \times 3$.

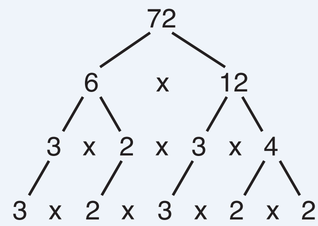
A prime number is a number with exactly two factors, 1 and itself. The first eight prime numbers are 2, 3, 5, 7, 11, 13, 17, and 19.

A composite number is a number that has more than two factors. For example, the factors of 39 are 1, 3, 13, and 39. Therefore, 39 is a composite number. The numbers 0 and 1 are neither prime nor composite.


Do you see that . . .

Objective 1

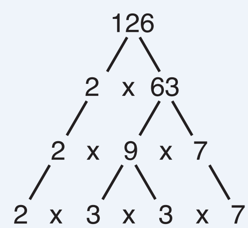
Here is one way to find the prime factorization of 72 using a factor tree.



- $72 = 6 \times 12$ — The numbers 6 and 12 are composite. Continue factoring.
- $72 = 3 \times 2 \times 3 \times 4$ — The numbers 2 and 3 are prime, but 4 is composite. Factor 4.
- $72 = 3 \times 2 \times 3 \times 2 \times 2$ — Both 2 and 3 are prime.
- $72 = (2 \times 2 \times 2) \times (3 \times 3)$ — Arrange the factors in order and then group them. There are 3 factors of 2 and 2 factors of 3.

The prime factorization of 72 is $2^3 \times 3^2$.

What is the prime factorization of 126 using exponents?

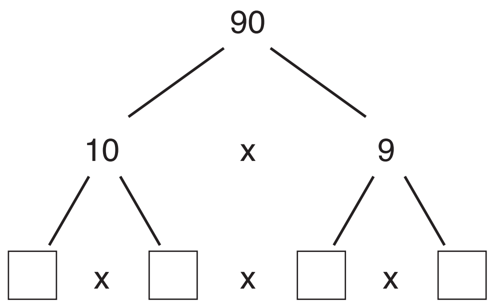


- $126 = 2 \times 63$ — The number 2 is prime, but 63 is composite. Factor 63.
- $126 = 2 \times 7 \times 9$ — The numbers 2 and 7 are prime, but 9 is composite. Factor 9.
- $126 = 2 \times 7 \times 3 \times 3$ — The numbers 2, 3, and 7 are all prime.
- $126 = 2 \times (3 \times 3) \times 7$ — Arrange the factors in order and then group them.

The prime factorization of 126 is $2 \times 3^2 \times 7$.

Try It

Complete the factor tree below to find the prime factorization of 90.



The prime factors of 90 are _______ , _______ , _______ , and _______ .

There are _______ factors of 3.

The prime factorization of 90 written using exponents is

_____________________________ .

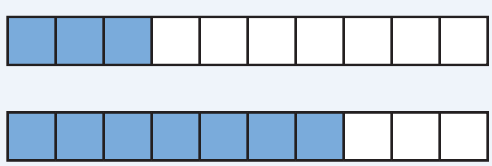
The prime factors of 90 are 2, 3, 3, and 5. There are 2 factors of 3.
The prime factorization of 90 written using exponents is $2 \times 3^2 \times 5$.

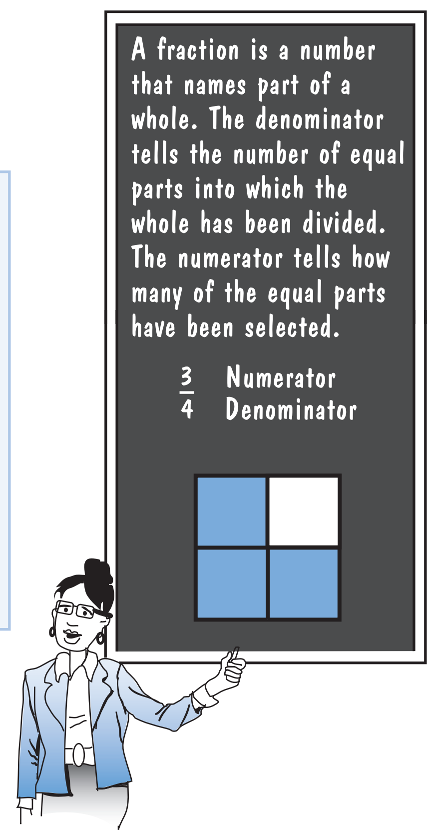
How Do You Compare and Order Fractions?

To compare and order fractions with the same denominator, compare their numerators.

Compare the fractions $\frac{3}{10}$ and $\frac{7}{10}$. These two fractions have the same denominator. Compare their numerators. Since $3 < 7$, the fraction $\frac{3}{10}$ is less than $\frac{7}{10}$.

The model below also shows that $\frac{3}{10} < \frac{7}{10}$.





Objective 1

Order the fractions below from least to greatest.

$$\frac{1}{12} \quad \frac{5}{12} \quad \frac{3}{12} \quad \frac{2}{12} \quad \frac{7}{12}$$

All the denominators are the same. Compare the numerators.

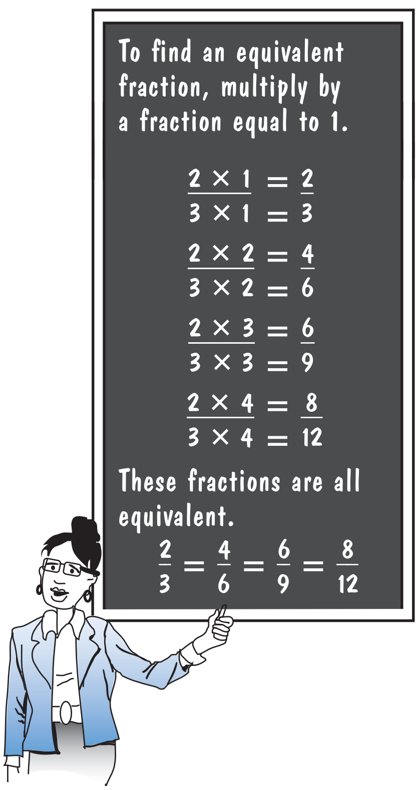
The numerators are 1, 5, 3, 2, and 7.

The numerators in order from least to greatest are 1, 2, 3, 5, and 7.

The fractions in order from least to greatest are as follows:

$$\frac{1}{12} \quad \frac{2}{12} \quad \frac{3}{12} \quad \frac{5}{12} \quad \frac{7}{12}$$

To compare two fractions that have different denominators, rewrite them as equivalent fractions with the same denominator. Then compare the numerators.



Which of these two fractions, $\frac{4}{9}$ or $\frac{7}{18}$, is greater?

- Because the fractions have different denominators, you cannot compare them directly. You must first rewrite them as equivalent fractions with common denominators.
- Find the least common multiple of 9 and 18.

  Multiples of 9: 9, 18, 27, 36, …

  Multiples of 18: 18, 36, 54, 72, …

  The least common multiple is 18. Use 18 as the common denominator.
- Find a fraction that is equivalent to $\frac{4}{9}$ with a denominator of 18. Since $9 \times 2 = 18$, multiply by the fraction $\frac{2}{2}$, which is equal to one.

  $$\frac{4 \cdot 2}{9 \cdot 2} = \frac{8}{18}$$

  The fraction $\frac{8}{18}$ is equivalent to $\frac{4}{9}$.
- Now compare $\frac{8}{18}$ and $\frac{7}{18}$.

  Since $8 > 7$, the fraction $\frac{8}{18}$ is greater than $\frac{7}{18}$.

  Since $\frac{8}{18} = \frac{4}{9}$, the fraction $\frac{4}{9}$ is greater than $\frac{7}{18}$.

Try It

Which of these two fractions, $\frac{5}{6}$ or $\frac{12}{15}$, is greater?

The fractions have different denominators. Find a ______________________.

Multiples of 6: _____ , _____ , _____ , _____ , _____ , _____ , ...

Multiples of 15: _____ , _____ , _____ , _____ , _____ , ...

The least common multiple of 6 and 15 is ______ . Use ______ as the common denominator.

Find a fraction that is equivalent to $\frac{5}{6}$ and has a denominator of ______ . Since

$6 \times$ ______ $= 30$, multiply by the fraction $\frac{\square}{\square}$: $\frac{5 \times 5}{6 \times 5} = \frac{\square}{\square}$.

Find a fraction that is equivalent to $\frac{12}{15}$ and has a denominator of ______ . Since

$15 \times$ ______ $= 30$, multiply by the fraction $\frac{\square}{\square}$: $\frac{12 \times 2}{15 \times 2} = \frac{\square}{\square}$.

Now compare $\frac{\square}{30}$ and $\frac{\square}{30}$. Since ______ $>$ ______ , the fraction

$\frac{\square}{30} > \frac{\square}{30}$. Therefore, $\frac{\square}{30}$ is the greater fraction.

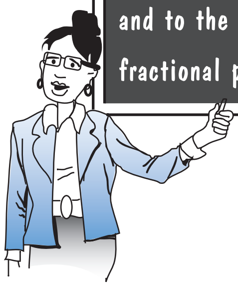
Since $\frac{\square}{30} = \frac{\square}{6}$, the simplified fraction $\frac{\square}{\square}$ is the greater fraction.

Find a common denominator. Multiples of 6: 6, 12, 18, 24, 30, 36, . . . Multiples of 15: 15, 30, 45, 60, 75, . . . The least common multiple of 6 and 15 is 30. Use 30 as the common denominator. Find a fraction that is equivalent to $\frac{5}{6}$ and has a denominator of 30. Since $6 \times 5 = 30$, multiply by the fraction $\frac{5}{5}$: $\frac{5 \times 5}{6 \times 5} = \frac{25}{30}$. Find a fraction that is equivalent to $\frac{12}{15}$ and has a denominator of 30. Since $15 \times 2 = 30$, multiply by the fraction $\frac{2}{2}$: $\frac{12 \times 2}{15 \times 2} = \frac{24}{30}$. Now compare $\frac{25}{30}$ and $\frac{24}{30}$. Since $25 > 24$, it follows that $\frac{25}{30} > \frac{24}{30}$. The fraction $\frac{25}{30}$ is the greater fraction. Since $\frac{25}{30} = \frac{5}{6}$, the simplified fraction $\frac{5}{6}$ is the greater fraction.

Objective 1

A mixed number is a number that represents a whole number plus a fraction. The mixed number $5\frac{1}{3}$ is equivalent to $5 + \frac{1}{3}$.

In the mixed number $5\frac{1}{3}$, we refer to the 5 as the whole-number part and to the $\frac{1}{3}$ as the fractional part.



How Do You Compare and Order Mixed Numbers?

To compare two mixed numbers, first compare the whole-number parts. Then compare the fractional parts.

Compare the mixed numbers $2\frac{1}{5}$ and $2\frac{3}{8}$.

- Compare the whole-number parts of the two mixed numbers.

  $$2 = 2$$

  The whole-number parts are equal.
- Compare the fractional parts.

  To compare $\frac{1}{5}$ and $\frac{3}{8}$, you will need to find a common denominator. The least common multiple of 5 and 8 is the common denominator.

  Multiples of 5: 5, 10, 15, 20, 25, 30, 35, 40, 45, . . .

  Multiples of 8: 8, 16, 24, 32, 40, 48, . . .

  The common denominator is 40. Multiply by fractions equal to one to change each fraction to an equivalent fraction with a denominator of 40.

  $$\frac{1 \cdot 8}{5 \cdot 8} = \frac{8}{40}$$
  $$\frac{3 \cdot 5}{8 \cdot 5} = \frac{15}{40}$$
- Since $\frac{15}{40} > \frac{8}{40}$, the fraction $\frac{3}{8}$ is greater than $\frac{1}{5}$.

Therefore, $2\frac{3}{8}$ is greater than $2\frac{1}{5}$, or $2\frac{3}{8} > 2\frac{1}{5}$.

Place the mixed numbers below in order from least to greatest.

$$6\frac{5}{8} \qquad 6\frac{1}{4} \qquad 4\frac{2}{3} \qquad 5\frac{1}{3}$$

- Compare the whole-number parts of the mixed numbers:

  6, 6, 4, and 5.

  The number 4 is the least number in this list, so the mixed number $4\frac{2}{3}$ is the least. List it first.
- The next-lowest number on the list of whole numbers is 5.

  The mixed number $5\frac{1}{3}$ is next on the list.

- The mixed numbers $6\frac{5}{8}$ and $6\frac{1}{4}$ have 6 as the whole-number part.
- Compare the fractional parts, $\frac{5}{8}$ and $\frac{1}{4}$.

  To compare $\frac{5}{8}$ to $\frac{1}{4}$, find a common denominator. The least common multiple of 8 and 4 is the common denominator.

  Multiples of 4: 4, 8, 12, 16, . . .

  Multiples of 8: 8, 16, 24, . . .

  The common denominator is 8. The fraction $\frac{5}{8}$ already has the denominator of 8. Multiply to change $\frac{1}{4}$ to an equivalent fraction with a denominator of 8.

$$\frac{1 \cdot 2}{4 \cdot 2} = \frac{2}{8}$$

- Since $\frac{2}{8} < \frac{5}{8}$, then the fraction $\frac{1}{4} < \frac{5}{8}$, and $6\frac{1}{4} < 6\frac{5}{8}$.
  The mixed numbers listed in order from least to greatest are as follows:

$$4\frac{2}{3} \qquad 5\frac{1}{3} \qquad 6\frac{1}{4} \qquad 6\frac{5}{8}$$

Try It

Place the numbers below in order from least to greatest.

$$3\frac{5}{12} \qquad 3\frac{1}{2} \qquad \frac{7}{12} \qquad 4\frac{3}{10} \qquad 6\frac{1}{2}$$

The list includes mixed numbers and a fraction. Since $\frac{\square}{\square}$ is a fraction without a whole-number part, it is the least number. Compare the whole-number parts of the remaining numbers: 3, 3, 4, and 6.

Two of the mixed numbers have a ______ as their whole-number part.

Since 3 < 4 and 3 < ______ , the numbers with a 3 as their whole-number part are next on the list.

Compare the fractional parts of $3\frac{5}{12}$ and $3\frac{1}{2}$.

Find the least common multiple of ______ and ______ .

Multiples of 12: ______ , ______ , ______ , ______ , . . .

Multiples of 2: ______ , ______ , ______ , ______ , ______ ,

______ , ______ , . . .

Objective 1

The least common multiple is ______ . Use ______ as the common denominator.

Find a fraction that is equivalent to $\frac{\square}{\square}$ and has a denominator of 12.

Since $2 \times$ ______ $= 12$, multiply by the fraction $\frac{6}{6}$.

$$\frac{1 \times 6 =}{2 \times 6 =} \frac{\square}{\square}$$

The fraction $\frac{1}{2}$ is equivalent to $\frac{\square}{12}$.

Compare $\frac{\square}{12}$ and $\frac{\square}{12}$. Since ______ $<$ ______ , the

fraction $\frac{5}{12}$ ______ $\frac{6}{12}$.

So the mixed number ______ $<$ ______ , or the simplified mixed

number ______ $<$ ______ .

The remaining numbers are $4\frac{3}{10}$ and $6\frac{1}{2}$. Since ______ < 6, the

numbers written in order from least to greatest are as follows:

________ , ________ , ________ , ________ , ________

Since $\frac{7}{12}$ is a fraction without a whole-number part, it is the least number. Two of the mixed numbers have a 3 as their whole-number part. Since $3 < 4$ and $3 < 6$, the numbers with a 3 as their whole-number part are next on the list. Find the least common multiple of 12 and 2. Multiples of 12: 12, 24, 36, 48, . . . Multiples of 2: 2, 4, 6, 8, 10, 12, 14, . . . The least common multiple is 12. Use 12 as the common denominator. Find a fraction that is equivalent to $\frac{1}{2}$ and has a denominator of 12. Since $2 \times 6 = 12$, multiply by the fraction $\frac{6}{6}$: $\frac{1 \times 6}{2 \times 6} = \frac{6}{12}$. The fraction $\frac{1}{2}$ is equivalent to $\frac{6}{12}$. Compare $\frac{5}{12}$ and $\frac{6}{12}$. Since $5 < 6$, the fraction $\frac{5}{12} < \frac{6}{12}$. So the mixed number $3\frac{5}{12} < 3\frac{6}{12}$, or $3\frac{5}{12} < 3\frac{1}{2}$. Since $4 < 6$, the numbers written in order are $\frac{7}{12}$, $3\frac{5}{12}$, $3\frac{1}{2}$, $4\frac{3}{10}$, and $6\frac{1}{2}$.

How Can You Change a Fraction into Its Decimal Equivalent?

One way to change a fraction into its decimal equivalent is to divide the numerator of the fraction by the denominator.

Suppose you want to write the fraction $\frac{3}{8}$ as a decimal. Divide the numerator, 3, by the denominator, 8.

In a decimal number you can place zeros at the end of the number without changing its value. Continue to place zeros at the end of the number until the division yields a remainder of zero.

$$
\begin{array}{r}
0.375 \\
8\overline{)3.000} \\
\underline{-\,2\,4} \\
60 \\
\underline{-\,56} \\
40 \\
\underline{-\,40} \\
0
\end{array}
$$

The fraction $\frac{3}{8}$ expressed as a decimal is 0.375, so $\frac{3}{8} = 0.375$.

Do you see that . . .

You can also change a fraction into its decimal equivalent by rewriting it as a fraction with a denominator of 10, 100, or 1,000, and so on. Then write it as its decimal equivalent.

Write the fraction $\frac{1}{2}$ as a decimal.

- First write the fraction $\frac{1}{2}$ as an equivalent fraction with a denominator of 10.

$$\frac{1 \cdot 5}{2 \cdot 5} = \frac{5}{10}$$

- The fraction $\frac{1}{2}$ is equivalent to $\frac{5}{10}$.
- The fraction $\frac{5}{10}$ is read as *five tenths.*
- The decimal 0.5 is read as *five tenths.*
- These two numbers have the same value; they are equivalent.

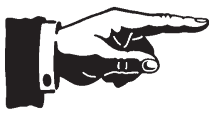
The fraction $\frac{1}{2}$ is equivalent to the decimal 0.5.

Objective 1

How Do You Compare and Order Different Types of Numbers?

One way to compare and order a set of different types of numbers (whole numbers, decimals, fractions, and mixed numbers) is to plot them on a number line.

Do you see that . . .

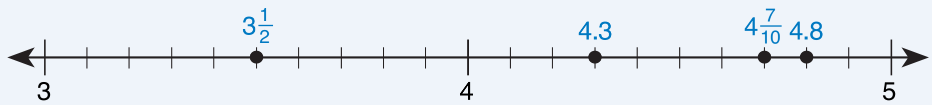


Write these numbers in order from least to greatest.

$4\frac{7}{10}$ $\quad 3\frac{1}{2}$ $\quad 4.3$ $\quad 4.8$

Plot each number on a number line. The marks on the number line below separate each unit into 10 smaller divisions.

Each smaller division represents $\frac{1}{10}$, or 0.10.



- The point for $4\frac{7}{10}$ is 7 one-tenth marks past the whole number 4.
- The point for $3\frac{1}{2}$ is halfway between the 3 and the 4. It is $\frac{5}{10}$ of the way between the 3 and the 4. It is 5 one-tenth marks past the whole number 3.
- The point for 4.3 is 3 one-tenth marks past the whole number 4.
- The point for 4.8 is 8 one-tenth marks past the whole number 4.

Now use the number line to put the numbers in order. The numbers in order from least to greatest is are $3\frac{1}{2}$, 4.3, $4\frac{7}{10}$, and 4.8.

Another way to compare and order different types of numbers is to rewrite the numbers as either all fractions or all decimals. The format you choose depends on the set of numbers you wish to order.

Write these numbers in order from least to greatest.

$$2.9 \qquad 1\frac{1}{5} \qquad 2\frac{1}{2} \qquad 2.3$$

- To compare these numbers, rewrite them as their decimal equivalents.

Original Number	Equivalent Decimal
2.9 is already a decimal.	2.9
$1\frac{1}{5} = 1\frac{2}{10} = 1.2$	1.2
$2\frac{1}{2} = 2\frac{5}{10} = 2.5$	2.5
2.3 is already a decimal.	2.3

- Compare 2.9, 1.2, 2.5, and 2.3.

  Look at the ones place: $\underline{2}.9 \quad \underline{1}.2 \quad \underline{2}.5 \quad \underline{2}.3$

  Three of the numbers have a 2 in the ones place, and one number has a 1 in the ones place. Since $1 < 2$, the decimal 1.2 is the least number. It should be written first.

  Now look at the tenths place: $2.\underline{9} \quad 2.\underline{5} \quad 2.\underline{3}$

  Since $3 < 5$ and $5 < 9$, the number $2.3 < 2.5$ and $2.5 < 2.9$.

The decimals written in order from least to greatest are as follows:

$$1.2 \qquad 2.3 \qquad 2.5 \qquad 2.9$$

The original numbers written in order are as follows:

$$1\frac{1}{5} \qquad 2.3 \qquad 2\frac{1}{2} \qquad 2.9$$

Try It

Which is the greatest number: 3.42, $3\frac{4}{8}$, or 3.67?

Since two of the numbers are already in decimal form, one way to compare them is to write all three numbers as decimals.

Find the decimal equivalent of the mixed number _______ .

To convert $\frac{4}{8}$ into a decimal, find an equivalent fraction that can easily be converted to a decimal.

$$\frac{4}{8} = \frac{\square}{2} = \frac{\square}{10}.$$

The fraction $\frac{4}{8}$ is equivalent to the fraction $\frac{5}{10}$. The fraction $\frac{5}{10}$ is equal to the decimal _______ .

So, $3\frac{4}{8}$ is equivalent to ___________ .

Compare the three decimals: 3.42, 3.5, 3.67. They all have a ______ in the ones place.

Look at the _____________ place. ______ $<$ 5 $<$ ______ .

So the decimal ___________ is the least, ___________ is next, and ___________ is the greatest number.

Find the decimal equivalent of the mixed number $3\frac{4}{8}$. To convert $\frac{4}{8}$ into a decimal, find an equivalent fraction that can easily be converted to a decimal.

$$\frac{4}{8} = \frac{1}{2} = \frac{5}{10}$$

The fraction $\frac{4}{8}$ is equivalent to the fraction $\frac{5}{10}$. The fraction $\frac{5}{10}$ is equal to the decimal 0.5

So, $3\frac{4}{8}$ is equivalent to 3.5.

The decimals all have a 3 in the ones place.
Look at the tenths place. $4 < 5 < 6$
So, the decimal 3.42 is the least, 3.5 is next, and 3.67 is the greatest number.

You can also compare a group of fractions and decimals by changing each decimal number into an equivalent fraction or mixed number. Then compare the fractions or mixed numbers.

To change a decimal into an equivalent fraction or mixed number, follow these steps:

- Use the digits to the right of the decimal point as the numerator of the fractional part of the number.
- The last place value of the decimal will be the denominator of the fraction.
- If there is a digit to the left of the decimal point, it will be the whole-number part of the mixed number.

Suppose you want to compare the mixed number $5\frac{1}{4}$ and the decimal 5.43.

One way would be to write them both as mixed numbers.

- The decimal 5.43 is read as *5 and 43 hundredths.*

$$5.43 \qquad 5\tfrac{43}{100}$$

Whole-number part — Decimal part — Since 3 is in the hundredths place, 100 is the denominator of the fraction.

The decimal 5.43 is equivalent to the mixed number $5\frac{43}{100}$.

- Compare $5\frac{1}{4}$ and $5\frac{43}{100}$.

Compare the whole-number parts. They both are 5. Look at the fractional parts. The fractional parts have different denominators.

Rewrite $\frac{1}{4}$ as an equivalent fraction with a denominator of 100.

$$\frac{1 \cdot 25}{4 \cdot 25} = \frac{25}{100}$$

The fraction $5\frac{1}{4}$ is equivalent to the fraction $5\frac{25}{100}$.

- Compare $5\frac{25}{100}$ and $5\frac{43}{100}$.

The denominators are equal. Compare the numerators of the fractional parts. Since $25 < 43$, the mixed number

$5\frac{25}{100} < 5\frac{43}{100}$.

- Rewrite the numbers in their original forms.

$$5\frac{1}{4} < 5.43$$

The mixed number $5\frac{1}{4} < 5.43$.

Try It

Order these numbers from least to greatest.

$$4\frac{3}{4} \qquad 4\frac{9}{10} \qquad 5.01 \qquad 4.6$$

Compare the whole-number parts.

Since _______ < _______ , the decimal 5.01 will be last on the list.

Compare the three numbers that have a 4 as their whole-number part. Since two of the numbers are already mixed numbers, one way to compare them is to write all three numbers as mixed numbers.

Convert the decimal _______ into a mixed number. The decimal 4.6 is read as *4 and 6 tenths.*

Objective 1

The whole-number part of the mixed number is ______ .

The numerator of the fractional part is ______ .

The denominator of the fractional part is ______ .

The decimal 4.6 is equivalent to the mixed number ______ .

The numbers $4\frac{3}{4}$, $4\frac{9}{10}$, and $4\frac{6}{10}$ need to be rewritten as fractions that have a common denominator.

The least common multiple of 4 and 10 is ______ . Use ______ as the least common denominator. Change each fraction into an equivalent fraction that has the common denominator of 20.

$$\frac{3 \times \square}{4 \times \square} = \frac{\square}{20} \qquad 4\frac{3}{4} = 4\frac{\square}{20}$$

$$\frac{9 \times \square}{10 \times \square} = \frac{\square}{20} \qquad 4\frac{9}{10} = 4\frac{\square}{20}$$

$$\frac{6 \times \square}{10 \times \square} = \frac{\square}{20} \qquad 4\frac{6}{10} = 4\frac{\square}{20}$$

Since 12 is the least numerator, the mixed number ______ should be listed first.

The numbers in order from least to greatest are as follows:

$$4\frac{12}{20} \quad 4\frac{15}{20} \quad 4\frac{18}{20} \quad 5.01$$

The original numbers in order from least to greatest are ________ , ________ , ________ , and ________ .

Since $4 < 5$, the decimal 5.01 will be last on the list. Convert the decimal 4.6 into a mixed number. The whole-number part of the mixed number is 4. The numerator of the fractional part is 6. The denominator of the fractional part is 10. The decimal 4.6 is equivalent to the mixed number $4\frac{6}{10}$. The least common multiple of 4 and 10 is 20. Use 20 as the least common denominator.

$$\frac{3 \times 5}{4 \times 5} = \frac{15}{20}, 4\frac{3}{4} = 4\frac{15}{20} \qquad \frac{9 \times 2}{10 \times 2} = \frac{18}{20}, 4\frac{9}{10} = 4\frac{18}{20} \qquad \frac{6 \times 2}{10 \times 2} = \frac{12}{20}, 4\frac{6}{10} = 4\frac{12}{20}$$

Since 12 is the least numerator, $4\frac{12}{20}$ should be listed first.

The original numbers in order from least to greatest are as follows:

$$4.6 \quad 4\frac{3}{4} \quad 4\frac{9}{10} \quad 5.01$$

How Do You Add or Subtract Fractions and Mixed Numbers?

To add or subtract fractions with a common denominator, add or subtract their numerators. The denominator remains the same. If necessary, simplify the answer.

Add $\frac{3}{7} + \frac{2}{7}$.

The fractions have the same denominator, so add their numerators.

$$\frac{3}{7} + \frac{2}{7} = \frac{(3 + 2)}{7} = \frac{5}{7}$$

Therefore, $\frac{3}{7} + \frac{2}{7} = \frac{5}{7}$.

Add $\frac{5}{12} + \frac{11}{12}$.

- The fractions have a common denominator, so add their numerators.

$$\frac{5}{12} + \frac{11}{12} = \frac{(5+11)}{12} = \frac{16}{12}$$

- The answer has a numerator that is greater than its denominator. This is sometimes referred to as an improper fraction. Rewrite the improper fraction as a mixed number.
- To rewrite an improper fraction as a mixed number, divide the numerator by the denominator and write the remainder as a fraction. The remainder is the numerator, and the divisor is the denominator.

$$12\overline{)16} = 1 \text{ R4} = 1\frac{4}{12}$$

- Simplify the fractional part of $1\frac{4}{12}$.

$$\frac{4 \div 4}{12 \div 4} = \frac{1}{3}$$

$$1\frac{4}{12} = 1\frac{1}{3}$$

Therefore, $\frac{5}{12} + \frac{11}{12} = 1\frac{1}{3}$.

Objective 1

Subtract $\frac{5}{8} - \frac{3}{8}$.

- The fractions have a common denominator, so subtract their numerators.

$$\frac{5}{8} - \frac{3}{8} = \frac{2}{8}$$

- Simplify the fraction: $\frac{2}{8} = \frac{1}{4}$.

Therefore, $\frac{5}{8} - \frac{3}{8} = \frac{1}{4}$.

To add or subtract fractions or mixed numbers that have different denominators, first find a common denominator for the fractions.

Add $3\frac{2}{3} + 4\frac{1}{8}$.

- These mixed numbers have different denominators. Rewrite them using a common denominator. Find the least common multiple of 3 and 8. The least common multiple is 24.

$$\frac{2 \cdot 8}{3 \cdot 8} = \frac{16}{24} \qquad \frac{1 \cdot 3}{8 \cdot 3} = \frac{3}{24}$$

The mixed numbers now have a common denominator.

$$3\frac{2}{3} = 3\frac{16}{24} \qquad 4\frac{1}{8} = 4\frac{3}{24}$$

- Add the mixed numbers.

$$\begin{array}{rl} 3\,\frac{16}{24} & \text{Add the numerators: } 16 + 3 = 19. \\ +\ 4\,\frac{3}{24} & \text{The denominators stay the same.} \\ \hline 7\,\frac{19}{24} & \text{Add the whole numbers: } 3 + 4 = 7. \end{array}$$

Therefore, $3\frac{2}{3} + 4\frac{1}{8} = 7\frac{19}{24}$.

Objective 1

When subtracting mixed numbers, you sometimes need to find a common denominator and regroup the whole-number and fractional parts.

Subtract $3\frac{1}{4} - 1\frac{1}{2}$.

- These mixed numbers have different denominators. Rewrite them using a common denominator. Find the least common multiple of 4 and 2. The least common multiple is 4. The fraction $\frac{1}{4}$ already has a denominator of 4.

  Find an equivalent fraction for $1\frac{1}{2}$ that has a denominator of 4.

$$\frac{1 \cdot 2}{2 \cdot 2} = \frac{2}{4}$$

  The fractions now have a common denominator.

$$3\frac{1}{4} \qquad 1\frac{1}{2} = 1\frac{2}{4}$$

- Since $\frac{1}{4}$ is less than $\frac{2}{4}$, $3\frac{1}{4}$ must be regrouped.

$$3\frac{1}{4} = 2 + \frac{4}{4} + \frac{1}{4} = 2\frac{5}{4}$$

- Subtract the mixed numbers.

$2\frac{5}{4}$	Subtract the numerators: $5 - 2 = 3$.
$-\ 1\frac{2}{4}$	The denominators stay the same.
$1\frac{3}{4}$	Subtract the whole numbers: $2 - 1 = 1$.

Therefore, $3\frac{1}{4} - 1\frac{1}{2} = 1\frac{3}{4}$.

Objective 1

Jean is cutting strips of paper for a decorating project. One strip of paper is $3\frac{2}{3}$ inches long, and another strip of paper is 8 inches long. How much longer is the second strip than the first strip?

- To find the difference, subtract the mixed number $3\frac{2}{3}$ from the whole number 8.

$$\begin{array}{r} 8 \\ -\ 3\frac{2}{3} \\ \hline \end{array}$$

- Since the whole number 8 does not have a fractional part, it must be regrouped to form a mixed number. Use 3 as the denominator because the mixed number $3\frac{2}{3}$ has a denominator of 3.

$$8 = 7 + \frac{3}{3} = 7\frac{3}{3}$$

The mixed numbers now have a common denominator.

$$7\frac{3}{3} \quad 3\frac{2}{3}$$

- Subtract the mixed numbers.

$$\begin{array}{rl} 7\frac{3}{3} & \text{Subtract the numerators: } 3 - 2 = 1. \\ -\ 3\frac{2}{3} & \text{The denominators stay the same.} \\ \hline 4\frac{1}{3} & \text{Subtract the whole numbers: } 7 - 3 = 4. \end{array}$$

The second strip is $4\frac{1}{3}$ inches longer than the first strip.

Try It

Terry received $\frac{3}{5}$ of the votes for class president. Missy received $\frac{1}{4}$ of the votes. What fraction of the votes did Terry and Missy receive altogether?

Use the operation of ________________ to find the fraction of votes they received altogether.

$$\frac{\square}{\square} + \frac{\square}{\square}$$

Express both fractions as equivalent fractions with a common denominator.

The least common multiple of 4 and 5 is ______ . Use ______ as the common denominator.

$$\frac{3 \cdot \square}{5 \cdot \square} = \frac{12}{20} \qquad \frac{1 \cdot 5}{4 \cdot 5} = \frac{\square}{\square}$$

The fractions now have a common denominator, so add their numerators.

$$\frac{\square}{\square} + \frac{\square}{\square} = \frac{\square}{\square}$$

Altogether, Terry and Missy received $\frac{\square}{\square}$ of the votes for class president.

Use the operation of addition to find the fraction of votes they received altogether: $\frac{3}{5} + \frac{1}{4}$. The least common multiple of 4 and 5 is 20. Use 20 as the common denominator.

$$\frac{3 \cdot 4}{5 \cdot 4} = \frac{12}{20} \qquad \frac{1 \cdot 5}{4 \cdot 5} = \frac{5}{20}$$

The fractions now have a common denominator, so add their numerators: $\frac{12}{20} + \frac{5}{20} = \frac{17}{20}$. Altogether, Terry and Missy received $\frac{17}{20}$ of the votes for class president.

Objective 1

How Can You Model Problems Involving Fractions?

You can model problems involving fractions by writing expressions that represent the problem situation.

Mario has a plate of cookies. Mario gives $\frac{1}{4}$ of the cookies to his brother, $\frac{1}{3}$ of the cookies to a friend, and $\frac{1}{5}$ of the cookies to his mother. What expression represents the fraction of the plate of cookies that Mario has left?

The plate of cookies represents one whole. Mario starts with one whole plate of cookies. He gives away $\frac{1}{4}$, then $\frac{1}{3}$, and then $\frac{1}{5}$ of the cookies. The operation of subtraction can be used to find the fraction of cookies that Mario has left.

$$1 - \left(\frac{1}{4} + \frac{1}{3} + \frac{1}{5}\right) = 1 - \frac{1}{4} - \frac{1}{3} - \frac{1}{5}$$

Try It

Hal used $\frac{1}{2}$ gallon of paint for one part of a room, $\frac{1}{3}$ gallon of paint for another part of the room, $1\frac{1}{3}$ gallons of paint for a patio room, and $\frac{1}{4}$ gallon of paint for a kitchen cabinet. Write an expression that represents the total number of gallons of paint that Hal used.

Use the operation of ____________ to find the total.

______ + ______ + ______ + ______

Use the operation of addition to find the total: $\frac{1}{2} + \frac{1}{3} + 1\frac{1}{3} + \frac{1}{4}$.

Try It

Ralph has $2\frac{1}{3}$ loaves of bread. He uses $1\frac{3}{4}$ loaves to make stuffing. How much bread does Ralph have left?

These mixed numbers have different denominators, so rewrite them using a common denominator. The least common multiple of 3 and 4 is ______.

$$\frac{1 \cdot \square}{3 \cdot \square} = \frac{\square}{12} \qquad \frac{3 \cdot \square}{4 \cdot \square} = \frac{\square}{12}$$

The mixed numbers now have a common denominator.

$$2\frac{1}{3} = \_\_\_\_\_\_\_\_ \qquad 1\frac{3}{4} = \_\_\_\_\_\_\_\_$$

Since $\frac{4}{12}$ is less than $\frac{9}{12}$, the mixed number ________ must be regrouped.

$$2\frac{4}{12} = 1 + \frac{12}{12} + \_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_$$

Subtract the mixed numbers.

$$1\frac{16}{12} - 1\frac{9}{12} = \frac{\square}{\square}$$

Ralph has $\frac{\square}{\square}$ of a loaf of bread left.

The least common multiple of 3 and 4 is 12.

$$\frac{1 \cdot 4}{3 \cdot 4} = \frac{4}{12} \qquad \frac{3 \cdot 3}{4 \cdot 3} = \frac{9}{12}$$

The mixed numbers now have a common denominator.

$$2\frac{1}{3} = 2\frac{4}{12} \qquad 1\frac{3}{4} = 1\frac{9}{12}$$

Since $\frac{4}{12}$ is less than $\frac{9}{12}$, the mixed number $2\frac{4}{12}$ must be regrouped.

$$2\frac{4}{12} = 1 + \frac{12}{12} + \frac{4}{12} = 1\frac{16}{12}$$

Subtract the mixed numbers.

$$1\frac{16}{12} - 1\frac{9}{12} = \frac{7}{12}$$

Ralph has $\frac{7}{12}$ of a loaf of bread left.

Objective 1

How Do You Determine Whether a Solution to a Problem Is Reasonable?

One way to determine whether an answer to a problem is reasonable (makes sense) is to make an **estimate**. The estimate tells you about how big or small the exact answer should be. It is always a good idea to estimate first; then you will know whether your exact answer is reasonable.

One estimation strategy is to round the numbers in the problem before you do the arithmetic. Then solve the problem using the rounded numbers.

Mrs. Gupta places a check mark on the board for each day a student orders lunch. Of the students in Mrs. Gupta's classes, 18 have ordered lunch 22 times, 12 have ordered lunch 29 times, and 11 have ordered lunch 42 times. What would be a reasonable estimate of the number of lunches these students have ordered altogether?

- Look at the pairs of numbers of students and numbers of lunches.

  18 and 22 12 and 29 11 and 42

- One way to estimate the answer is to round each number to the nearest ten. To round to the nearest ten, look at the ones place.

  Round 18 to 20

  Round 22 to 20

  Round 12 to 10

  Round 29 to 30

  Round 11 to 10

  Round 42 to 40

- Multiply to estimate the number of lunches.

  18×22 becomes $20 \times 20 = 400$

  12×29 becomes $10 \times 30 = 300$

  11×42 becomes $10 \times 40 = 400$

- Add to find an estimate of the total number of lunches.

  $400 + 300 + 400 = 1{,}100$

Mrs. Gupta's students have ordered about 1,100 lunches altogether.

Another estimation strategy is to use numbers that make computation easier. Numbers like these are called compatible numbers. When estimating a total from a list of numbers, you sometimes can pair numbers that add up to an easier number. For example, $7 + 3 = 10$, $8 + 2 = 10$, and so on.

Jeff is estimating his total grocery bill for 6 items.

$4 $5 $1 $2 $3 $4

Jeff pairs numbers that add up to 5, and he quickly estimates that the total is about $20.

- $4 + 1 = 5$
- $3 + 2 = 5$
- One item costs $5.
- Another item costs $4, which is close to 5.
- $5 + 5 + 5 + 5 = 20$

A total of $20 is a good estimate.

You can also estimate when you do not need an exact answer to a problem. For example, some problems ask *about how many* or *approximately how much*. Use estimation to solve such problems.

Try It

All 98 students in the sixth-grade class at Acme School went on a field trip. Each student walked 4.7 miles on a guided sightseeing tour. About how many miles did the students walk altogether?

Estimate to find about how many miles they walked altogether.

Round 98 to _______ .

Round 4.7 to _______ .

Use the operation of ____________________ to find the total number of miles walked.

_______ × _______ = _______

Altogether, the students walked about _______ miles.

Round 98 to 100. Round 4.7 to 5. Use the operation of multiplication to find the total number of miles walked: $100 \times 5 = 500$. Altogether, the students walked about 500 miles.

Now practice what you've learned.

Question 1

Harry was conducting a science experiment. He measured the lengths of four insects in centimeters. The first insect was 1.81 cm long, the second was 2.134 cm long, the third was 2.9 cm long, and the fourth was 1.88 cm long. Which list shows these numbers in order from greatest to least?

A	2.134	2.9	1.88	1.81
B	2.9	2.134	1.88	1.81
C	2.134	1.88	1.81	2.9
D	1.81	1.88	2.134	2.9

Answer Key: page 145

Question 2

Which operation should be performed first to simplify this expression?

$$4 + 6 \cdot 3 \div 9 - 2$$

A $6 \cdot 3$

B $9 - 2$

C $3 \div 9$

D $4 + 6$

Answer Key: page 145

Question 3

Karl has a collection of colored marbles. Some of the marbles are polished, and others are not. The table below shows the fraction of marbles that are polished for each color.

Karl's Marble Collection

Color	Fraction Polished
Red	$\frac{1}{3}$
Blue	$\frac{5}{12}$
Green	$\frac{2}{3}$
White	$\frac{1}{6}$

For which color are the greatest fraction of marbles polished?

A Red

B Blue

C Green

D White

Answer Key: page 145

Question 4

At basketball practice John attempted 30 free throws and made 25 of them. What fraction represents the ratio of free throws John made to the free throws he attempted?

A $\frac{6}{5}$

B $\frac{5}{11}$

C $\frac{5}{6}$

D $\frac{1}{6}$

Answer Key: page 145

Question 5

Victoria surveyed all the students in her sixth-grade class to find her classmates' favorite type of pet. The table below shows the results of her survey.

Favorite Pets

Type of Pet	Number of Students
Dog	15
Cat	7
Fish	3

How is the fraction of students whose favorite pet is a dog expressed as a decimal?

A 0.15

B 0.06

C 3.5

D 0.6

Answer Key: page 145

Question 6

At 6 A.M. the thermometer outside Tim's door showed a temperature of 52°F. At noon the temperature had risen 26°F, and at 9 P.M. the temperature had dropped 19°F. Which pair of integers best represents the change in temperature from 6 A.M. to noon and from noon to 9 P.M.?

A $+26, -19$

B $+26, +19$

C $-26, -19$

D $-26, +19$

Answer Key: page 146

Question 7

Find the prime factorization of 360.

A $2 \times 3 \times 5$

B $2^2 \times 3^2 \times 5$

C $2^3 \times 3^2 \times 5$

D 10×36

Answer Key: page 146

Question 8

Earl has 36 red jelly beans, 48 blue jelly beans, and 72 yellow jelly beans. He wants to divide his jelly beans evenly among his friends. What is the greatest number Earl can use to divide the jelly beans evenly?

A 6

B 8

C 12

D 18

Answer Key: page 146

Question 9

Cheryl buys a sheet of 60 stamps to mail her party invitations. She uses $\frac{1}{3}$ of the stamps to mail invitations to her friends. She uses $\frac{1}{5}$ of the stamps to mail invitations to her family. Which expression represents the fraction of the sheet of stamps she has left after mailing these invitations?

A $1 - \left(\frac{1}{3} + \frac{1}{5}\right)$

B $1 - \left(\frac{1}{60} + \frac{1}{5}\right)$

C $\frac{1}{3} + \frac{1}{5}$

D $\frac{1}{60} + \frac{1}{5}$

Answer Key: page 146

Question 10

Louis has a board that is 7 feet long. He cuts off two pieces to use in a building project. One piece is $1\frac{3}{4}$ feet long, and the other piece is $3\frac{3}{4}$ feet long. What mixed number shows the length of board left after Louis cuts off these two pieces?

A $4\frac{5}{8}$ ft

B $4\frac{3}{4}$ ft

C $1\frac{1}{2}$ ft

D $2\frac{1}{2}$ ft

Answer Key: page 146

Question 11

Vince had $138.45 in his bank account. He took out $13.92 to buy a CD. The next week he earned $27.23 and put that money in his bank account. How much money is in Vince's bank account now?

A $142.76

B $151.76

C $145.76

D $152.76

Answer Key: page 147

Question 12

Joe's father drives a truck 8 hours per day. His average speed is 40 miles per hour. At this rate, how many miles will Joe's father drive in 5 days?

A 1,600 mi

B 2,400 mi

C 64 mi

D 520 mi

Answer Key: page 147

Question 13

Doug's school is selling 5,000 bumper stickers for a fund-raiser. The stickers have been divided equally among each of the 5 grades. Each grade has 125 students. If all the bumper stickers must be sold, how many bumper stickers will each student have to sell?

A 40

B 10

C 8

D 4

Answer Key: page 147

Question 14

Mike is using small tiles to cover the floors in his bathroom and kitchen. He needs about 600 tiles for the bathroom. His kitchen will need 48 rows of 32 tiles each. Which is a reasonable estimate of the total number of tiles Mike will need to cover the floors in his bathroom and kitchen?

A 1,500

B 2,100

C 700

D 1,800

Answer Key: page 147

Objective 2

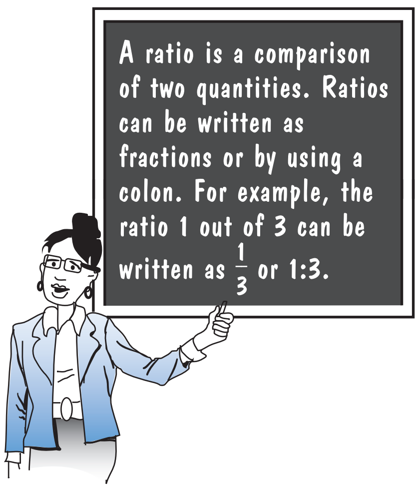
The student will demonstrate an understanding of patterns, relationships, and algebraic reasoning.

For this objective you should be able to

- solve problems involving proportional relationships;
- use letters as variables in mathematical expressions to describe how one quantity changes when a related quantity changes; and
- use letters to represent an unknown in an equation.

How Can You Simplify a Ratio?

A ratio can be written as a fraction. You can simplify the ratio by simplifying the fraction.



A game has 4 red squares and 10 blue squares. The ratio of the number of red squares to the number of blue squares is 4:10.

Written as a fraction, the ratio is $\frac{4}{10}$. An equivalent ratio can be found by simplifying this fraction.

Simplify the fraction by dividing the numerator and denominator by 2, which is the greatest common factor of 4 and 10.

$$\frac{4 \div 2}{10 \div 2} = \frac{2}{5}$$

An equivalent ratio that compares the number of red squares to the number of blue squares is 2:5.

There are many different ways to compare numbers in real-life problems. Sometimes different ratios can be formed. You must be careful to compare the correct numbers in the order the problem requires.

Rita attends a family reunion. There are 60 people at the reunion: 24 adults and 36 children. What ratio compares the number of adults at the reunion to the number of children at the reunion?

Look at the different ratios that can be used to compare the numbers of people at the reunion.

- One ratio compares the number of children at the reunion to the total number of people at the reunion.

  There are 36 children at the reunion. There are 60 people at the reunion.

  The ratio $\frac{36}{60}$ compares the number of children at the reunion to the total number of people at the reunion.

$$\frac{36 \div 12}{60 \div 12} = \frac{3}{5}$$

The ratio $\frac{3}{5}$ compares the number of children at the reunion to the total number of people at the reunion. This is not the ratio the problem requires.

- Another ratio compares the number of children at the reunion to the number of adults at the reunion.

  There are 36 children at the reunion. There are 24 adults at the reunion.

  The ratio $\frac{36}{24}$ compares the number of children at the reunion to the number of adults at the reunion.

$$\frac{36 \div 12}{24 \div 12} = \frac{3}{2}$$

  The ratio $\frac{3}{2}$ compares the number of children at the reunion to the number of adults at the reunion. This is not the ratio the problem requires. It compares the right quantities, but in the wrong order.

- Another ratio compares the number of adults at the reunion to the number of children at the reunion.

  There are 24 adults at the reunion. There are 36 children at the reunion.

  The ratio $\frac{24}{36}$ compares the number of adults at the reunion to the number of children at the reunion.

$$\frac{24 \div 12}{36 \div 12} = \frac{2}{3}$$

The ratio $\frac{2}{3}$ compares the number of adults at the reunion to the number of children at the reunion. This is the ratio the problem requires.

Objective 2

Try It

Mr. Jones has 120 cows, 20 horses, and 50 chickens on his farm. These are the only animals on the farm. What is the ratio of the number of cows on the farm to the total number of animals on the farm?

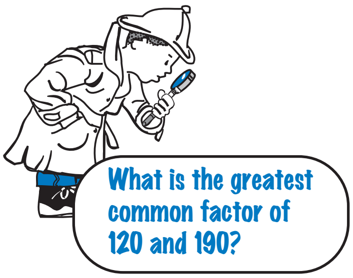
There are _______ cows on the farm.

Use the operation of ____________________ to find the total number of animals on the farm.

The equation _______ + _______ + _______ = _______ represents the total number of animals on the farm.

The ratio _______:_______ compares the number of cows on the farm to the total number of animals on the farm. This ratio can be simplified by dividing the numerator and denominator by _______ .

The ratio of the number of cows on the farm to the total number of animals on the farm is $\frac{\square}{\square}$.



There are 120 cows on the farm. Use addition to find the total number of animals on the farm. The equation 120 + 20 + 50 = 190 represents the total number of animals on the farm. The ratio 120:190 compares the number of cows on the farm to the total number of animals on the farm. This ratio can be simplified by dividing the numerator and denominator by 10. The ratio of the number of cows on the farm to the total number of animals on the farm is $\frac{12}{19}$.

What Is a Proportion?

A **proportion** is a statement that two ratios are equal.

Compare the ratio 4:10 to the ratio 8:20. Do they form a proportion?

- Compare the two ratios.
  Does $\frac{4}{10} = \frac{8}{20}$?
- Simplify both fractions.

$$\frac{4 \div 2}{10 \div 2} = \frac{2}{5} \qquad \frac{8 \div 4}{20 \div 4} = \frac{2}{5}$$

- Since both fractions can be simplified to the same fraction, $\frac{2}{5}$, the ratios are equal.
- Since $\frac{4}{10}$ is equal to $\frac{8}{20}$, the ratios form a proportion.
- Therefore, $\frac{4}{10} = \frac{8}{20}$ is a proportion.

The proportion is read as *4 is to 10 as 8 is to 20*.

John was purchasing special food to feed his sheep. He needed to purchase 3 pounds of food for each sheep. Based on the ratio of 3 pounds of food for 1 sheep, John decides that he needs 60 pounds of the special food to feed 20 sheep. What proportions represent this relationship?

There are several different ways that a proportion can be written for this situation.

- One way to set up a proportion is to compare sheep to food. For 1 sheep there needs to be 3 pounds of food. This can be represented as 1:3, or $\frac{1}{3}$. For 20 sheep there needs to be 60 pounds of food. This can be represented as 20:60, or $\frac{20}{60}$. The proportion can be written as follows:

$$\frac{\text{sheep}}{\text{food}} \quad \frac{1}{3} = \frac{20}{60}$$

  This is a proportion because $\frac{20}{60}$ simplifies to $\frac{1}{3}$.

- Another way to set up a proportion is to compare food to sheep. Every 3 pounds of food will feed 1 sheep. This can be represented as 3:1, or $\frac{3}{1}$. Every 60 pounds of food will feed 20 sheep. This can be represented as $\frac{60}{20}$. The proportion can be written as follows:

$$\frac{\text{food}}{\text{sheep}} \quad \frac{3}{1} = \frac{60}{20}$$

  This is a proportion because $\frac{60}{20}$ simplifies to $\frac{3}{1}$.

- Another way to set up a proportion is to use one ratio to represent the food and another ratio to represent the sheep. The food ratio is 3 pounds to 60 pounds, which is 3:60, or $\frac{3}{60}$. The sheep ratio is 1 sheep to 20 sheep, which is 1:20, or $\frac{1}{20}$. The proportion can be written as follows:

$$\frac{3}{60} = \frac{1}{20}$$

  This is a proportion because $\frac{3}{60}$ simplifies to $\frac{1}{20}$.

All three of these proportions can be used to represent the relationship between pounds of food and number of sheep.

Objective 2

How Do You Use Ratios to Make Predictions?

In some situations you can use a ratio describing one event to predict how often a related event will happen. You can describe the related event with an equivalent ratio.

When you compare ratios in this way, set up a proportion. A proportion is a statement that two ratios are equal.

Walter has 1 limestone rock in his rock collection for every 2 granite rocks. If Walter has 5 limestone rocks in his collection, how many granite rocks does he have?

- Set up a proportion to solve the problem. Walter has 1 limestone rock for every 2 granite rocks. This ratio is 1:2, or $\frac{1}{2}$.
- There are 5 limestone rocks in Walter's collection. The question asks how many granite rocks he has. This ratio is 5:?, or $\frac{5}{?}$.
- One way to set up this proportion is

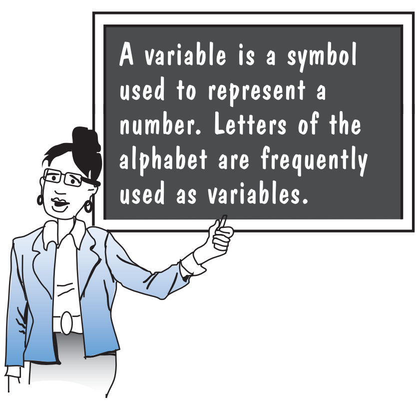
$$\frac{\text{limestone}}{\text{granite}} \quad \frac{1}{2} = \frac{5}{?}$$

- To change 1 to 5 in the proportion, multiply by 5. Since you multiply the numerator by 5, you must also multiply the denominator by 5: $2 \times 5 = 10$.

  The proportion that represents the problem is as follows:

$$\frac{1}{2} = \frac{5}{10}$$

Therefore, Walter has 10 granite rocks.



If 3 apples cost 29¢, how much do 45 apples cost?

- Describe *3 apples cost 29¢* using a ratio.

$$\frac{\text{apples}}{\text{cost}} = \frac{3}{29}$$

- Write a ratio that compares 45 apples to c, the cost of 45 apples. You do not know how much 45 apples cost, so use the variable c to represent the cost of 45 apples in cents.

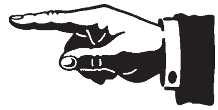
$$\frac{45}{c}$$

- Write a proportion to show that these two ratios are equal.

$$\frac{3}{29} = \frac{45}{c}$$

- Solve this proportion by using cross products.

$$\frac{3}{29} = \frac{45}{c}$$



Do you see that . . .

To find the cross products, multiply the numbers that are diagonally across from each other.

$$3c = 29 \cdot 45$$

$$3c = 1{,}305$$

Divide both sides of the equation by 3. This will leave c by itself on one side of the equation.

$$\frac{3c}{3} = \frac{1{,}305}{3}$$

$$c = 435$$

The cost of 45 apples is 435¢, or $4.35.

Beverly asks her fellow sixth-grade students to name their favorite type of book. She finds that 3 out of every 8 students prefer to read mysteries. If there are 240 sixth-grade students, how many prefer to read mysteries?

- Describe *3 out of every 8 students prefer to read mysteries* using a ratio.

$$\frac{3}{8}$$

- Write a ratio that compares m students who prefer mysteries to 240 students in all.

$$\frac{m}{240}$$

- Write a proportion to show that these two ratios are equal. Solve this proportion by using cross products. To use cross products, multiply the numbers that are diagonally across from each other.

$$\frac{3}{8} = \frac{m}{240}$$

$$3 \cdot 240 = 8m$$

$$720 = 8m$$

Divide both sides of the equation by 8. This will leave m by itself on one side of the equation.

$$\frac{720}{8} = \frac{8m}{8}$$

$$90 = m$$

Out of 240 sixth-grade students, 90 prefer to read mysteries.

Objective 2

Try It

A seed company says that 4 out of every 5 of its seeds will grow. If Melissa plants 40 of these seeds, how many seeds can she expect to grow? Use a proportion to find the answer.

Describe *4 out of every 5 of its seeds will grow* using a ratio.

$$\frac{\square}{\square}$$

Write a ratio that compares s, the number of seeds expected to grow, to 40 seeds planted.

$$\frac{\square}{\square}$$

Write a proportion.

$$\frac{\square}{\square} = \frac{\square}{\square}$$

Solve this proportion by using cross products.

$$\_\_\_\_ \cdot \_\_\_\_ = \_\_\_\_ s$$

$$\_\_\_\_ = \_\_\_\_ s$$

$$\frac{\square}{5} = \frac{\square s}{5}$$

$$\_\_\_\_ = s$$

Melissa can expect _______ seeds to grow.

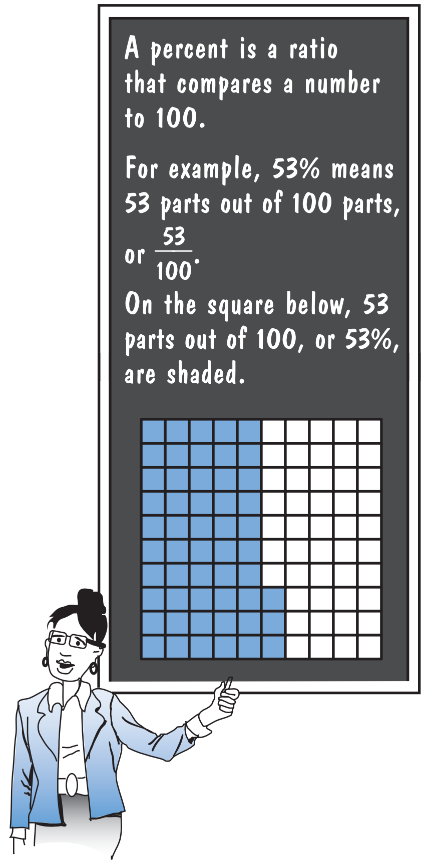
The ratio $\frac{4}{5}$ describes the company's statement. The ratio $\frac{s}{40}$ describes the number of seeds expected to grow if 40 are planted. The proportion is $\frac{4}{5} = \frac{s}{40}$. Solve this proportion: $4 \cdot 40 = 5s$; $160 = 5s$; $\frac{160}{5} = \frac{5s}{5}$; and $32 = s$. Melissa can expect 32 seeds to grow.

How Can You Compare Fractions, Decimals, and Percents?

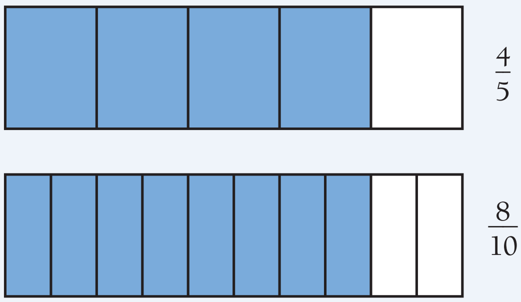
To compare fractions, decimals, and percents, you sometimes need to convert all of them into the same forms of the numbers.

A decimal can be changed into an equivalent fraction by expressing it as a ratio. A decimal compares a number to 10, 100, or 1,000, and so on. Look at the decimal 0.45. It is read as *forty-five hundredths*. It compares 45 to 100. The decimal 0.45 is equivalent to the fraction $\frac{45}{100}$.

A fraction can be changed into an equivalent decimal by finding an equivalent fraction with a denominator of 10 or 100.



Change the fraction $\frac{4}{5}$ into an equivalent decimal.



The fraction $\frac{4}{5}$ is equivalent to the fraction $\frac{8}{10}$.

The fraction $\frac{8}{10}$ is equal to the decimal 0.8. They are both read as *eight-tenths*.

The numbers $\frac{8}{10}$, $\frac{4}{5}$, and 0.8 are all equivalent.

Ken got a score of 75% on a science test. What fraction of the questions did he answer correctly?

The ratio 75% compares 75 questions answered correctly to a total of 100 questions. Simplify the ratio. An equivalent ratio can be found by dividing both the numerator and the denominator by 25.

$$\frac{75 \div 25}{100 \div 25} = \frac{3}{4}$$

The ratio 75% is equivalent to the ratio $\frac{3}{4}$, so Ken answered $\frac{3}{4}$ of the questions correctly.

Objective 2

Try It

There are 25 birds in Robin's backyard. Of these birds, 10 are eating at the bird feeder. What percent of the birds are eating at the feeder?

Find the ratio that compares the number of birds eating at the feeder to the total number of birds in the yard.

There are _______ birds eating at the feeder.

There are _______ birds in the yard altogether.

The ratio $\frac{\square}{\square}$ compares the number of birds eating at the feeder to the number of birds in the yard altogether.

Write $\frac{10}{25}$ as an equivalent ratio with a denominator of 100.

$$\frac{10 \cdot \square}{25 \cdot \square} = \frac{\square}{100}$$

The ratio $\frac{\square}{100}$ is equivalent to $\frac{10}{25}$.

Therefore, _______% is equivalent to $\frac{10}{25}$.

Of the birds in the yard, _______ % are eating at the feeder.

There are 10 birds eating at the feeder. There are 25 birds in the yard altogether. The ratio $\frac{10}{25}$ compares the number of birds eating at the feeder to the number of birds in the yard altogether. Multiply: $\frac{10 \cdot 4}{25 \cdot 4} = \frac{40}{100}$. The ratio $\frac{40}{100} = \frac{10}{25}$, and $40\% = \frac{10}{25}$. Of the birds in the yard, 40% are eating at the feeder.

How Can You Change a Percent into a Decimal?

Change a percent into a decimal by finding an equivalent ratio with a denominator of 100.

Pablo decided not to carry all his books home. He took 40% of them home. Which decimal best represents the percent of his books that Pablo took home?

- Pablo took 40% of his books home. A percent compares a number to 100.
- Write 40% as an equivalent ratio with a denominator of 100.

$$40\% = \frac{40}{100}$$

  Pablo took $\frac{40}{100}$ of his books home.
- The fraction $\frac{40}{100}$ is equivalent to the decimal 0.40.

$$40\% = 0.40$$

  Pablo took 0.40 of his books home.
- A percent can also be converted to a decimal by dividing by 100. This moves the decimal point two places to the left.

$$0.40\cancel{\%} = 0.40$$

Pablo took 0.40 of his books home.

How Can You Change a Decimal into a Fraction?

Change a decimal into a fraction by finding an equivalent fraction with a denominator such as 10, 100, or 1,000. Read the decimal to find the numerator and the correct denominator.

Gloria has an insect collection. She found that 0.15 of the insects are moths. What fraction of her insects are moths?

- The decimal 0.15 is read as *fifteen hundredths*. The decimal 0.15 compares 15 to 100.
- Write 0.15 as a fraction. The numerator is 15, and the denominator is 100.

$$0.15 = \frac{15}{100}$$

  Of Gloria's insects, $\frac{15}{100}$ are moths.
- Simplify the fraction by dividing both its numerator and its denominator by 5.

$$\frac{15 \div 5}{100 \div 5} = \frac{3}{20}$$

Of Gloria's insects, $\frac{3}{20}$ are moths. This means that 3 out of every 20 insects in Gloria's collection are moths.

Objective 2

How Can You Change a Decimal into a Percent?

Change a decimal into a percent by finding an equivalent ratio with a denominator of 100.

Paula is measuring the temperature of some samples in her science lab. If 0.6 of the samples have a temperature above 100°C, what percent of the samples have a temperature above 100°C?

- The decimal 0.6 is read as *six tenths*. Write this ratio as a fraction.

$$0.6 = \frac{6}{10}$$

- Write $\frac{6}{10}$ as an equivalent fraction with a denominator of 100.

$$\frac{6 \cdot 10}{10 \cdot 10} = \frac{60}{100}$$

$$0.6 = \frac{60}{100}$$

- A percent compares a number to 100. The ratio $\frac{60}{100}$ compares 60 to 100.

$$\frac{60}{100} = 60\%$$

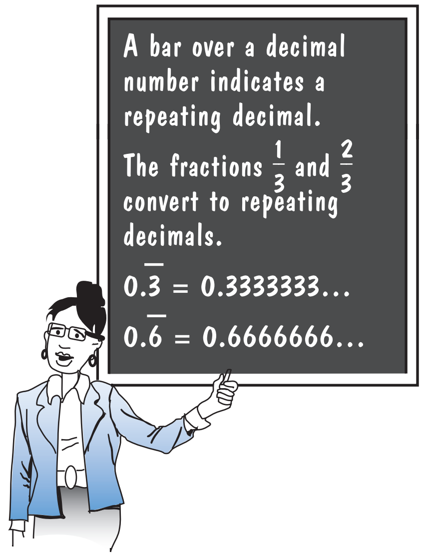
Of Paula's samples, 60% have a temperature above 100°C.

- You can also find the equivalent percent by multiplying by 100. This moves the decimal point in 0.6 two places to the right.

$$0.6 = 0.60 = 60\%$$

Here are some equivalent fractions, decimals, and percents:

Fraction	Decimal	Percent	Fraction	Decimal	Percent
$\frac{1}{2}$	= 0.5	= 50%	$\frac{3}{5}$	= 0.6	= 60%
$\frac{2}{2}$	= 1.0	= 100%	$\frac{4}{5}$	= 0.8	= 80%
$\frac{1}{3}$	= $0.\overline{3}$	= $33\frac{1}{3}\%$	$\frac{5}{5}$	= 1.0	= 100%
$\frac{2}{3}$	= $0.\overline{6}$	= $66\frac{2}{3}\%$	$\frac{1}{8}$	= 0.125	= 12.5%
$\frac{3}{3}$	= 1.0	= 100%	$\frac{2}{8}$	= 0.25	= 25%
$\frac{1}{4}$	= 0.25	= 25%	$\frac{3}{8}$	= 0.375	= 37.5%
$\frac{2}{4}$	= 0.5	= 50%	$\frac{4}{8}$	= 0.5	= 50%
$\frac{3}{4}$	= 0.75	= 75%	$\frac{5}{8}$	= 0.625	= 62.5%
$\frac{4}{4}$	= 1.0	= 100%	$\frac{6}{8}$	= 0.75	= 75%
$\frac{1}{5}$	= 0.2	= 20%	$\frac{7}{8}$	= 0.875	= 87.5%
$\frac{2}{5}$	= 0.4	= 40%	$\frac{8}{8}$	= 1.0	= 100%



Try It

John tosses a number cube. The decimal 0.5 represents the fraction of tosses that land showing an even number. What percent of the tosses land showing an even number?

$$0.5 = \frac{\square}{10} = \frac{\square}{100}$$

$$\frac{\square}{100} = \underline{\qquad}\%$$

The number cube lands showing an even number ______% of the times it is tossed.

The decimal 0.5 $= \frac{5}{10} = \frac{50}{100}$, and the fraction $\frac{50}{100} = 50\%$. The number cube lands showing an even number 50% of the times it is tossed.

How Can You Use Variables to Represent Relationships Between Numbers in a Table?

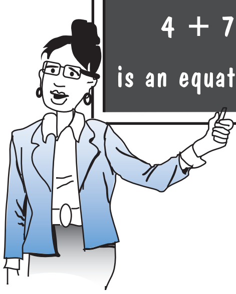
Relationships between numbers are usually represented with an expression or equation that uses a variable, such as x, y, or some other letter.

An expression can consist of a variable or a combination of variables, numbers, and symbols. For example, x is an expression, and 4x + 7 is also an expression.

An equation consists of numbers and mathematical symbols. It tells what happens to the numbers and what the results are. For example,

4 + 7 − 3 = 8

is an equation.



Rialdo is 4 years older than Sara. Write an expression that can be used to represent Rialdo's age in terms of Sara's age.

- Sara's age is not known.
  Let the variable s represent Sara's age.
- Rialdo is 4 years older than Sara.
  Represent Rialdo's age in terms of s, Sara's age.
  Rialdo's age can be represented by $s + 4$ years.

The expression $s + 4$ can be used to represent Rialdo's age in terms of Sara's age.

When information is organized in a table, it is often easier to see relationships between the quantities.

Use the data in the table to find an expression that represents the y-values in terms of the x-values.

x	y
2	5
3	7
7	15
11	23

- Look for a relationship between the x-values and the y-values.

x	Process	y
2	$2(2) + 1 = 5$	5
3	$2(3) + 1 = 7$	7

  To find the y-value, the rule might be to multiply the x-value by 2 and then add 1.

- Check this rule to determine whether it satisfies the remaining pairs of numbers.

x	Process	y	
7	$2(7) + 1 = 15$	15	True
11	$2(11) + 1 = 23$	23	True

  The rule describes the relationship between x and y for all the number pairs.

- Use variables to represent this relationship.
  The y-value equals two times the x-value plus 1.

$$y = 2x + 1$$

The expression $2x + 1$ represents the y-values in terms of the x-values.

Try It

Use the data in the table to find an expression that represents the y-values in terms of the x-values.

x	y
4	12
5	15
8	24
10	30

Find a relationship between 4 and 12 based on multiplication.

$$4 \cdot \_\_\_\_\_\_\_ = 12$$

Determine whether this relationship is true for 5 and 15 and for 8 and 24.

$$5 \cdot \_\_\_\_\_\_\_ = 15$$

$$8 \cdot \_\_\_\_\_\_\_ = \_\_\_\_\_\_\_$$

Determine whether this relationship is true for 10 and 30.

$$10 \cdot \_\_\_\_\_\_ = \_\_\_\_\_\_$$

The expression ____________ represents the y-values in terms of the x-values.

$4 \cdot 3 = 12$; $5 \cdot 3 = 15$; $8 \cdot 3 = 24$; $10 \cdot 3 = 30$. The expression $x \cdot 3$ or $3x$ represents the y-values in terms of the x-values.

How Can You Use Variables When Working with Perimeter, Area, and Volume?

Many relationships between numbers, such as relationships that describe perimeter, area, and volume, are represented by formulas that contain variables.

The side lengths and volumes of four cubes are shown in the table below.

Cube Measurements

Side Length (units)	Volume (cubic units)
1	1
2	8
4	64
5	125

- Notice the relationship between the number pairs in the table.

$$1 \times 1 \times 1 = 1 \qquad 1^3 = 1$$
$$2 \times 2 \times 2 = 8 \quad \text{or} \quad 2^3 = 8$$
$$4 \times 4 \times 4 = 64 \qquad 4^3 = 64$$
$$5 \times 5 \times 5 = 125 \qquad 5^3 = 125$$

- The volume of a cube is equal to its side length to the third power.

If the side length is equal to s, the expression s^3 can be used to represent the volume of a cube.

Try It

The lengths, widths, and perimeters of four rectangles are shown in the table below.

Rectangle Measurements

Length (l)	Width (w)	Perimeter
2	1	6
4	2	12
8	5	26
40	20	120

What expression can be used to find the perimeter of a rectangle that is l units long and w units wide?

Look for the relationship between the numbers in the table.

2(______ + ______) = 6

2(______ + ______) = 12

2(______ + ______) = 26

2(______ + ______) = 120

The perimeter of a rectangle is ______ times the sum of its

____________ and ____________ .

The expression ______________________ can be used to find the perimeter of a rectangle with a length of l and a width of w.

Look for the relationship between the numbers in the table: $2(2 + 1) = 6$; $2(4 + 2) = 12$; $2(8 + 5) = 26$; $2(40 + 20) = 120$. The perimeter of a rectangle is 2 times the sum of its length and width. The expression $2(l + w)$ can be used to find the perimeter of a rectangle with a length of l and a width of w.

How Can You Write an Equation to Represent a Relationship Between Numbers in a Problem?

To write an equation that represents a relationship between numbers in a problem, take the information given in everyday language and rewrite it using mathematical symbols. Look for the relationship between the quantities in the problem. It may be necessary to use a variable to represent an unknown quantity.

A jeweler makes bracelets and rings. Each ring requires 7 pieces of gold wire. Each bracelet requires 5 pieces of gold wire. Write an equation that can be used to find w, the total number of pieces of wire needed to make 3 rings and 2 bracelets.

- Each ring requires 7 pieces of gold wire.
  The jeweler makes 3 rings.
  The jeweler uses $(7 \cdot 3)$ pieces of wire to make the rings.
- Each bracelet requires 5 pieces of gold wire.
  The jeweler makes 2 bracelets.
  The jeweler uses $(5 \cdot 2)$ pieces of wire to make the bracelets.
- The jeweler uses $(7 \cdot 3) + (5 \cdot 2)$ pieces of wire to make 3 rings and 2 bracelets.

The equation $w = (7 \cdot 3) + (5 \cdot 2)$ can be used to find the total number of pieces of wire needed to make 3 rings and 2 bracelets.

Todd is determining the relationship between his age and his cousin's age. He finds that his cousin's age multiplied by 2 is the same as his own age, 12, minus his cousin's age. If a represents the age of Todd's cousin, what equation represents this relationship?

- One side of the equation will be an expression representing Todd's cousin's age multiplied by 2.

$$2a$$

- The other side of the equation will be an expression representing the difference between Todd's age and his cousin's age.

$$12 - a$$

- The problem states that these two quantities are equal. The equation $2a = 12 - a$ represents this relationship.

Objective 2

Try It

Trina collects postage stamps. The first two pages of her stamp album hold 5 stamps per page. All the remaining pages in the album hold 12 stamps per page. Write an equation that can be used to find n, the total number of stamps that can fit on 20 pages.

Represent the number of stamps that can fit on the first two pages.

The number of stamps that can fit on the first two pages is

represented by ______ • ______.

Represent the number of stamps on the remaining pages. There are

______ pages in all. Of these pages, ______ have already been

counted.

There are ______ − ______ = ______ pages remaining.

The number of stamps that can fit on the remaining pages is

represented by ______ • ______.

The number of stamps that can fit on all 20 pages is represented by

n = (______ • ______) + (______ • ______).

The number of stamps that can fit on the first two pages is represented by 2 • 5. There are 20 pages in all. Of these pages, 2 have already been counted. There are 20 − 2 = 18 pages remaining. The number of stamps that can fit on the remaining pages is represented by 18 • 12. The number of stamps that can fit on all 20 pages is represented by $n = (2 \cdot 5) + (18 \cdot 12)$.

Now practice what you've learned.

Question 15

Mark can hit the bull's-eye 3 out of every 15 times he throws a dart. Which ratio compares the number of throws that hit the bull's-eye to the number of throws that do not hit the bull's-eye?

A 1:5

B 4:1

C 1:4

D 5:1

Answer Key: page 147

Question 16

In the first grading period, Janet either walked or rode the bus to school. She walked 36 days and rode the bus 6 days. Which fraction is equivalent to the ratio of the number of days Janet walked to school to the total number of days in the first grading period?

A $\frac{1}{6}$

B $\frac{1}{7}$

C $\frac{7}{6}$

D $\frac{6}{7}$

Answer Key: page 147

Question 17

George answered 76% of the questions on a test correctly. Which fraction is equivalent to 76%?

A $\frac{1}{76}$

B $\frac{24}{76}$

C $\frac{19}{25}$

D $\frac{100}{76}$

Answer Key: page 148

Question 18

Marie had several pencils on her desk. Ted borrowed 25% of the pencils. What decimal represents the percent of Marie's pencils that Ted borrowed?

A 0.025

B 0.25

C 0.312

D 25.0

Answer Key: page 148

Question 19

José has two volunteer jobs, one as an assistant at a nursing home and another as a math tutor. José spends 45% of his volunteer time at the nursing home. Which fraction is equivalent to the percent of volunteer time José spends tutoring?

A $\frac{9}{20}$

B $\frac{11}{20}$

C $\frac{45}{100}$

D $\frac{1}{2}$

Answer Key: page 148

Question 20

Lynn paints small ceramic figures. She can paint 6 figures in 45 minutes. If she continues to paint at this rate, how many figures can she paint in $1\frac{1}{2}$ hours?

Record your answer and fill in the bubbles. Be sure to use the correct place value.

				.		
0	0	0	0		0	0
1	1	1	1		1	1
2	2	2	2		2	2
3	3	3	3		3	3
4	4	4	4		4	4
5	5	5	5		5	5
6	6	6	6		6	6
7	7	7	7		7	7
8	8	8	8		8	8
9	9	9	9		9	9

Answer Key: page 148

Question 21

There are 24 vanilla cookies in a cookie jar. There are 4 chocolate cookies in the jar for every 3 vanilla cookies. Which proportion can be used to find y, the total number of chocolate cookies in the jar?

A $\frac{3}{4} = \frac{y}{24}$

B $\frac{20}{4} = \frac{y}{3}$

C $\frac{4}{3} = \frac{y}{24}$

D $\frac{4}{7} = \frac{y}{24}$

Answer Key: page 149

Question 22

Which equation represents the y-values in terms of the x-values in the table below?

x	y
4	12
13	21
22	30
51	59

A $y = 3x$

B $y = x - 8$

C $y = x + 8$

D $y = 2x + 4$

Answer Key: page 149

Question 23

The table below shows the relationship between the age of a tree and its height in feet.

Age (years)	Height (feet)
1	5
3	9
6	15
10	23
m	

Which expression can be used to find the height of the tree when it is m years old?

A $m + 4$

B $2m + 3$

C $5m$

D $3m$

Answer Key: page 149

Question 24

Michelle has 25 CDs. She gives 2 of her friends 4 CDs each. Then she gets 3 new CDs for her birthday. Which equation can be used to find x, the number of CDs Michelle has now?

A $x = 25 - 4 + 3$

B $x = 25 + 4 - 3$

C $x = 25 - (2 \cdot 4) + 3$

D $x = 25 + (2 \cdot 4) - 3$

Answer Key: page 149

Objective 3

The student will demonstrate an understanding of geometry and spatial reasoning.

For this objective you should be able to

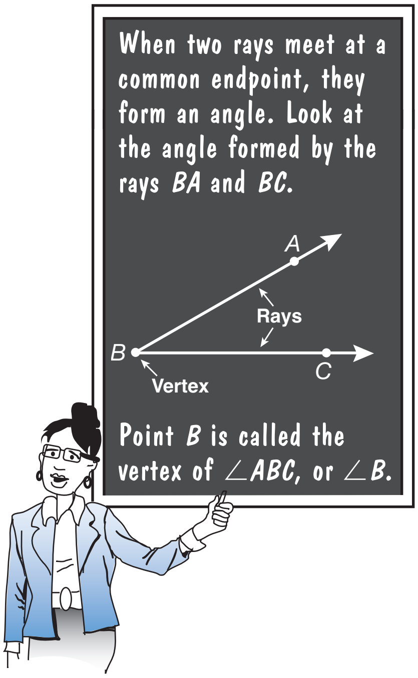
- use geometric vocabulary to describe angles, polygons, and circles; and
- use coordinate geometry to identify a location in two dimensions.

How Do You Classify Angles?

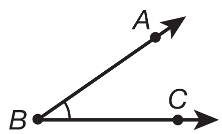
Angles are classified according to their measurement.

Angles are measured in degrees. The symbol ° stands for degrees. You can write the measure of an angle using notation such as $m\angle T = 40°$. The equation $m\angle T = 40°$ is read as "the measure of angle T equals 40 degrees."

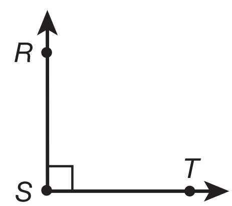
If two angles have an equal measure, they are congruent. For example, if $m\angle R = 40°$ and $m\angle S = 40°$, then $\angle R$ is congruent to $\angle S$.



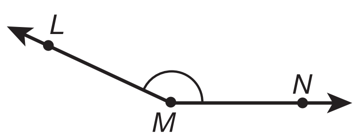
Look at the angles below and their measurements in degrees.



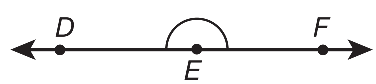
The measure of ∠ABC = 35°.



The measure of ∠RST = 90°.



The measure of ∠LMN = 155°.

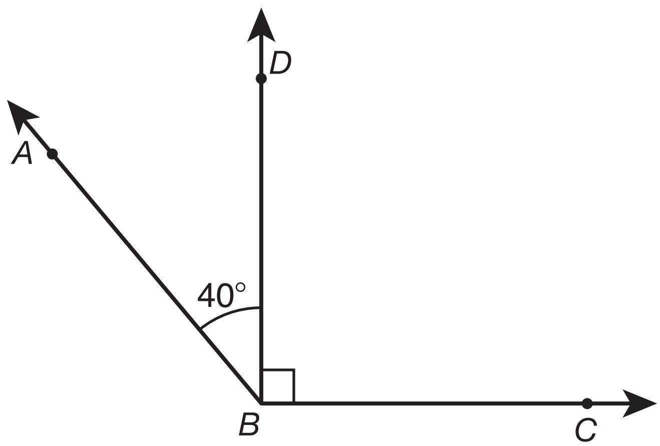


The measure of ∠DEF = 180°.

- An **acute angle** measures more than 0° but less than 90°. Angle *ABC* above is an acute angle. Its measure is 35°, a value between 0° and 90°.
- A **right angle** measures exactly 90°. Right angles are formed by perpendicular lines. Angle *RST* above is a right angle. Its measure is 90°. A small ⊾ is placed at the vertex of an angle to show that it is a right angle.
- An **obtuse angle** measures more than 90° but less than 180°. Angle *LMN* above is an obtuse angle. Its measure is 155°, a value between 90° and 180°.
- A **straight angle** measures 180°. Straight angles are formed by rays that lie on a line. Angle *DEF* above is a straight angle. Its measure is 180°.

Try It

Classify the angles shown below as acute, right, obtuse, or straight.



The measure of ∠*ABC* is _______°.

∠*ABC* is an ______________ angle.

The measure of ∠*ABD* is _______°.

∠*ABD* is an ______________ angle.

The measure of ∠*DBC* is _______°.

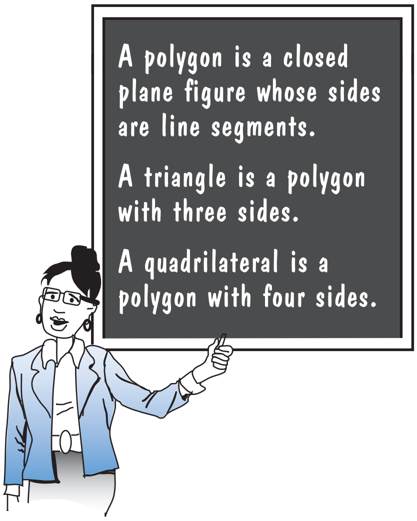
∠*DBC* is a ______________ angle.

The measure of ∠*ABC* is 130°. It is an obtuse angle. The measure of ∠*ABD* is 40°. It is an acute angle. The measure of ∠*DBC* is 90°. It is a right angle.

Objective 3

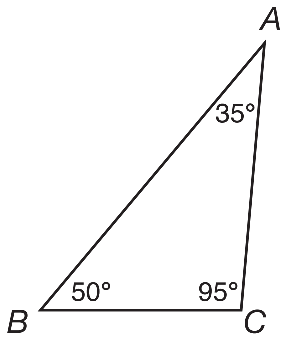
How Do You Use Relationships Between Angles in a Figure?

Knowing the relationships between pairs of angles in a polygon can help you classify the polygon and determine the measures of other angles in the figure.



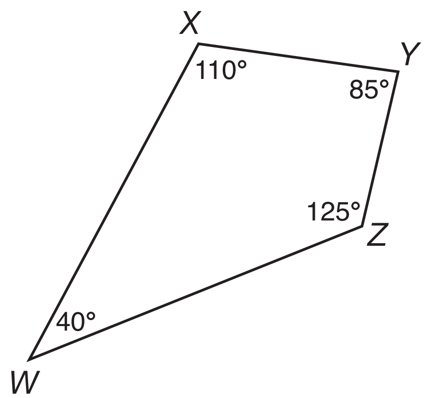
Here are some special relationships among angles in polygons that you should know:

- The sum of the measures of the three angles of a triangle always equals 180°. Look at the triangle below.



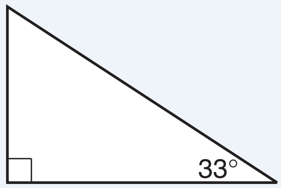
The sum of the measures of the angles of triangle *ABC* is 35° + 50° + 95°, or 180°.

- The sum of the measures of the four angles of a quadrilateral always equals 360°. Look at the quadrilateral below.



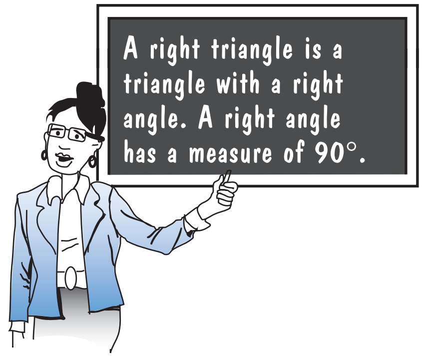
The sum of the measures of the angles of quadrilateral *WXYZ* is 40° + 110° + 85° + 125°, or 360°.

The right triangle shown below has an acute angle that measures 33°. What is the measure of the other acute angle?



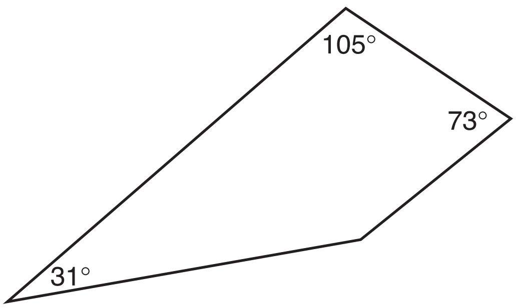
- You know the measures of two angles of the triangle. Find their sum: 90° + 33° = 123°.
- The sum of the measures of the three angles of a triangle is 180°.
- Subtract 123° from 180° to find the measure of the third angle: 180° − 123° = 57°.

The measure of the third angle of the triangle is 57°.



Try It

A quadrilateral has three angles that measure 31°, 105°, and 73°. What is the measure of the fourth angle?



You know the measures of three angles in the quadrilateral. Find their sum.

_______° + _______° + _______° = _______°

The sum of the measures of the four angles of a quadrilateral

is _______°.

Subtract _______° from _______° to find the measure of the fourth angle.

_______° − _______° = _______°

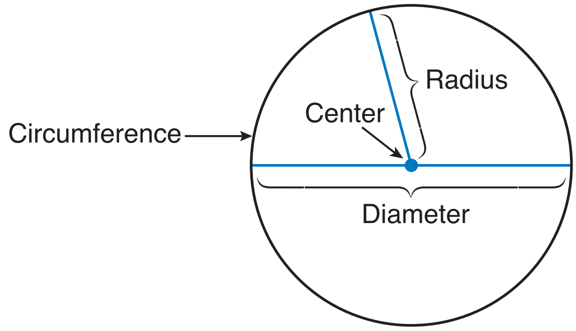
The measure of the fourth angle of the quadrilateral is _______°.

Find their sum: 31° + 105° + 73° = 209°. The sum of the measures of the four angles of a quadrilateral is 360°. Subtract 209° from 360° to find the measure of the fourth angle: 360° − 209° = 151°. The measure of the fourth angle of the quadrilateral is 151°.

Objective 3

How Do You Describe the Relationships Between the Parts of a Circle?

A **circle** is the set of all points that are the same distance from a given point called the **center.** Look at the parts of the circle below.



- A **radius** (r) of a circle is a line segment joining the center of the circle and any point on the circle.

  The radius of a circle is half the diameter, or $r = \frac{1}{2}d$.

- A **diameter** (d) of a circle is a line segment that joins any two points on the circle and passes through the center of the circle.

  The diameter of a circle is twice the radius, or $d = 2r$.

- The **circumference** (C) is the distance around the circle.

One of the most important relationships in a circle is the ratio of the circumference to the diameter. For any circle, no matter how big or small, this ratio is always the same value. It is represented by pi (π), which is approximately 3.14, or $\frac{22}{7}$.

$$\frac{\text{Circumference}}{\text{Diameter}} = \frac{C}{d} = \pi$$

This relationship provides the formula for the circumference of a circle: $C = \pi d$. The circumference of any circle is equal to π times the diameter.

Since the diameter of any circle is equal to twice the radius, you can also find the circumference with this formula: $C = \pi \cdot 2 \cdot r$. You can arrange the factors in any order: $C = 2\pi r$.

A circle has a radius of 9 cm. What expression describes the circumference of the circle in centimeters?

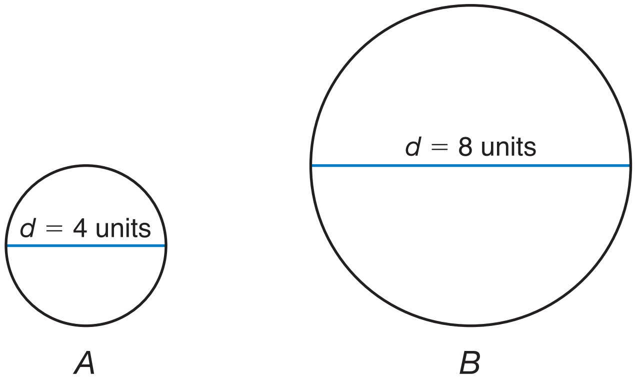
Apply the formula $C = 2\pi r$ to find the circumference of the circle.

$$C = 2\pi r$$
$$C = 2\pi 9$$
$$C = 18\pi$$

An expression that describes the circumference of a circle with a radius of 9 cm is 18π.

Try It

How many times greater is the circumference of circle *B* than the circumference of circle *A*?



Look at the Mathematics Chart. The formula that uses the diameter to find the circumference of a circle is ____________ .

Circle *A* has a diameter of ______ units. Its circumference can be expressed as follows:

$$C = \_\_\_\_\_\_ \pi$$

Circle *B* has a diameter of ______ units. Its circumference can be expressed as follows:

$$C = \_\_\_\_\_\_ \pi$$

Since $8 = 2 \times 4$, the circumference of circle *B* is ______ times the circumference of circle *A*.

Circle *B* has a circumference that is ______ the circumference of circle *A*.

The formula that uses the diameter to find the circumference of a circle is $C = \pi d$. Circle *A* has a diameter of 4 units. The circumference can be expressed as $C = 4\pi$. Circle *B* has a diameter of 8 units. The circumference can be expressed as $C = 8\pi$. Since $8 = 2 \times 4$, the circumference of circle *B* is 2 times the circumference of circle *A*. Circle *B* has a circumference that is twice the circumference of circle *A*.

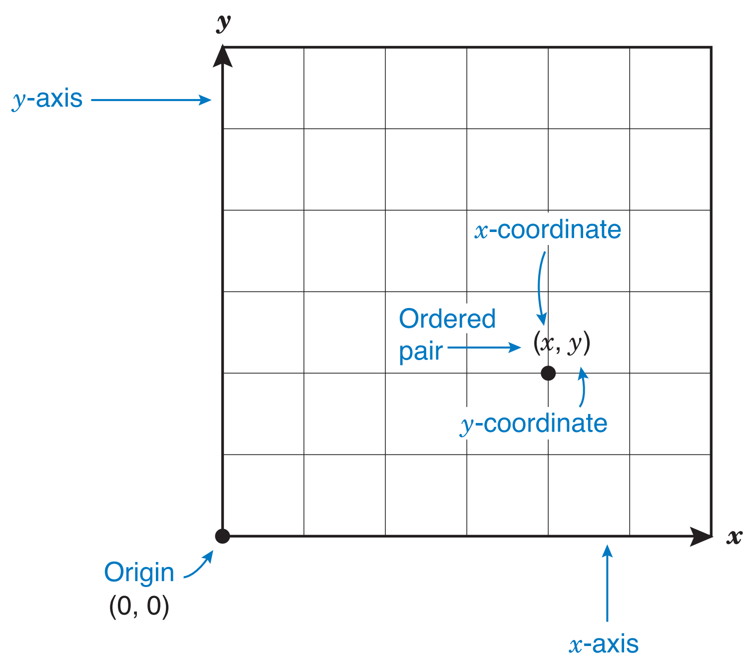
Objective 3

How Can You Locate and Name Points on a Coordinate Plane?

A coordinate grid is used to locate and name points on a plane. A point is located by using an **ordered pair** of numbers. The two numbers that form the ordered pair are called the **coordinates** of the point.

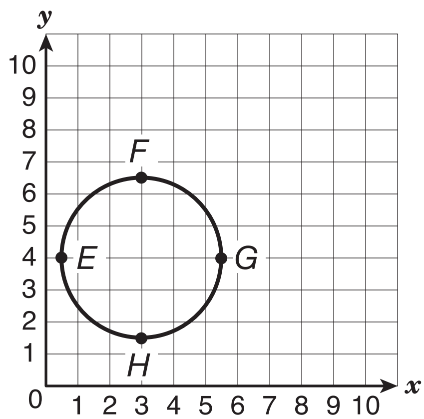
Look at the coordinate grid below.

- The point on every coordinate grid where the two axes cross is called the **origin.** The coordinates of the origin are (0, 0). All points on a coordinate grid are assigned coordinates based on their distance from the origin.
- The horizontal line that crosses the origin is called the ***x*-axis.** The first coordinate of an ordered pair is called the ***x*-coordinate.** It tells how many units the point lies to the right or the left of the origin.
- The vertical line that crosses the origin is called the ***y*-axis.** The second coordinate of an ordered pair is called the ***y*-coordinate.** It tells how many units the point lies above or below the origin.



Try It

A circle on a coordinate plane has its center at (3, 4). The radius of the circle is 2.5 units. Name the coordinates of points *F* and *G* on the circle.



Point *F* is _______ units to the right of the origin. Its *x*-coordinate is _______ .

Point *F* is _______ units above the origin. Its *y*-coordinate is _______ .

The coordinates of point *F* are (_______ , _______).

Point *G* is _______ units to the right of the origin. Its *x*-coordinate is _______ .

Point *G* is _______ units above the origin. Its *y*-coordinate is _______ .

The coordinates of point *G* are (_______ , _______).

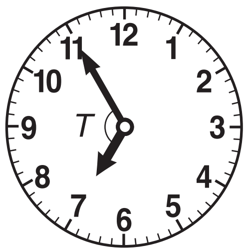
Point *F* is 3 units to the right of the origin. Its *x*-coordinate is 3. Point *F* is 6.5 units above the origin. Its *y*-coordinate is 6.5. The coordinates of point *F* are (3, 6.5).

Point *G* is 5.5 units to the right of the origin. Its *x*-coordinate is 5.5. Point *G* is 4 units above the origin. Its *y*-coordinate is 4. The coordinates of point *G* are (5.5, 4).

Now practice what you've learned.

Question 25

Angle T is formed by the hands of the clock below. Each minute represents 6°.



What type of angle is $\angle T$?

A Obtuse

B Right

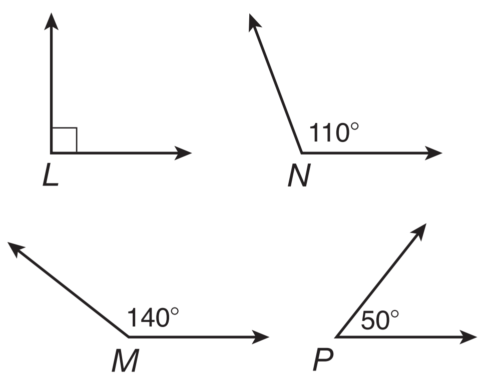
C Acute

D Straight

Answer Key: page 149

Question 26

Which angle below is acute?



A $\angle L$

B $\angle M$

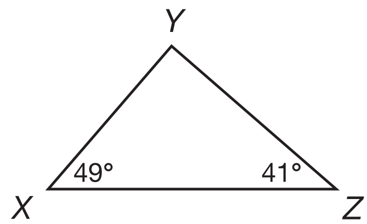
C $\angle N$

D $\angle P$

Answer Key: page 149

Question 27

What type of angle is $\angle Y$?



A Acute

B Right

C Obtuse

D Straight

Answer Key: page 149

Question 28

Which of the following could be the measures of the angles of a triangle?

A 120°, 50°, 20°

B 100°, 200°, 60°

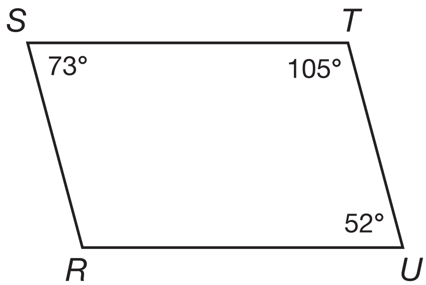
C 30°, 50°, 80°

D 40°, 50°, 90°

Answer Key: page 149

Question 29

What is the measure of $\angle R$ in the quadrilateral below?



A 75°

B 130°

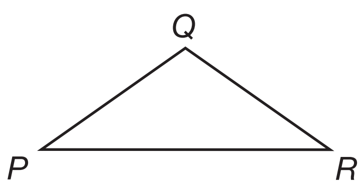
C 180°

D 360°

Answer Key: page 149

Question 30

In triangle PQR, $\angle P$ is congruent to $\angle R$.



If $m\angle P = 35°$, what is $m\angle Q$?

A 35°

B 90°

C 110°

D 180°

Answer Key: page 150

Question 31

Which expression can be used to find the radius of a circle with a diameter of 48 inches?

A 48×2

B $48 + 2$

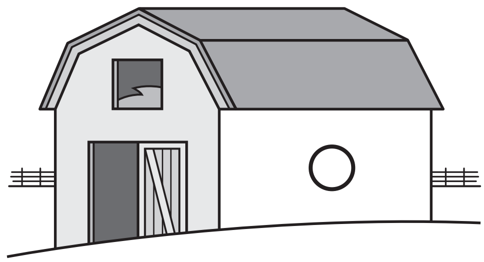
C $48 \div 2$

D $48 - 2$

Answer Key: page 150

Question 32

Roy wants to draw a circle on the side of a barn to use for pitching practice. He wants the circle to have a radius of 3 feet.



Which expression will help Roy find the circumference of the circle?

A 9π

B 2π

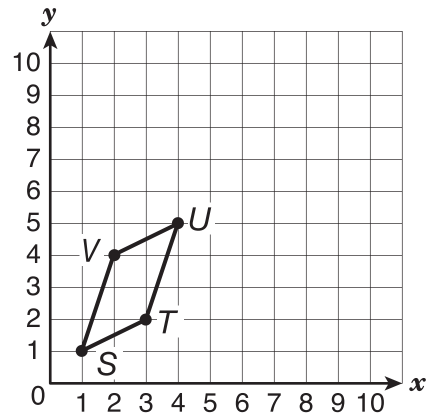
C 6π

D 3π

Answer Key: page 150

Question 33

What ordered pair shows the coordinates of point T on the coordinate grid below?



A (2, 3)

B $(2\frac{2}{3}, 3\frac{1}{3})$

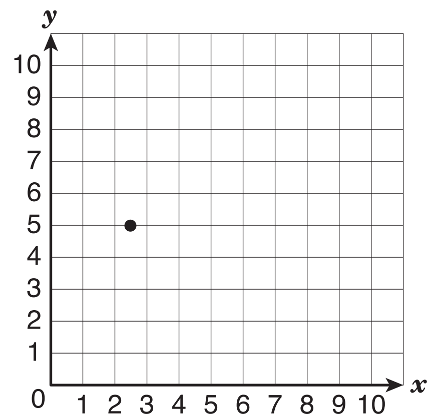
C (3, 2)

D $(3\frac{1}{3}, 2\frac{2}{3})$

Answer Key: page 150

Question 34

Alejandro is drawing a rectangle on a coordinate grid. He wants the rectangle to have one pair of sides 4 units long and the other pair of sides 3 units long. He has drawn one vertex of the rectangle at $(2\frac{1}{2}, 5)$.



Which group of coordinates can Alejandro use for the other three vertices of the rectangle?

A (5, 6), (8, 6), $(8, 2\frac{1}{2})$

B $(6\frac{1}{2}, 5)$, $(6\frac{1}{2}, 8)$, $(2\frac{1}{2}, 8)$

C $(5\frac{1}{2}, 5)$, $(5\frac{1}{2}, 8)$, $(1\frac{1}{2}, 9)$

D $(5, 2\frac{1}{2})$, $(3, 4\frac{1}{2})$, $(4, 3\frac{1}{2})$

Answer Key: page 150

Objective 4

The student will demonstrate an understanding of the concepts and uses of measurement.

For this objective you should be able to solve problems involving estimation and measurement of length, area, time, temperature, capacity, weight, and angles.

How Can You Use Estimation in Measurement Problems?

In some problems you may be given only approximate values for measurements. In these cases you must estimate an answer. For example, some measurement problems ask *about how many* or *approximately how long*. Use estimation when solving such problems.

You can also estimate the answer to any problem before you find the exact answer. One way to estimate is to round the numbers in a problem before working it out. The estimate tells you approximately what the answer will be. If you estimate first, you will know whether the answer you calculate is reasonable. For example, some problems ask whether a certain number is a *reasonable answer* to a problem. Use estimation to answer such questions.

Mr. and Mrs. Watson want to build a small rectangular toolshed. The shed's floor will measure $2\frac{1}{4}$ feet wide by $3\frac{3}{4}$ feet long. What is a reasonable estimate of the area of the shed's floor in square feet?

- The problem asks for a reasonable estimate, so you can round the measurements to find an estimate of the answer.
- Round the dimensions of the floor of the toolshed.

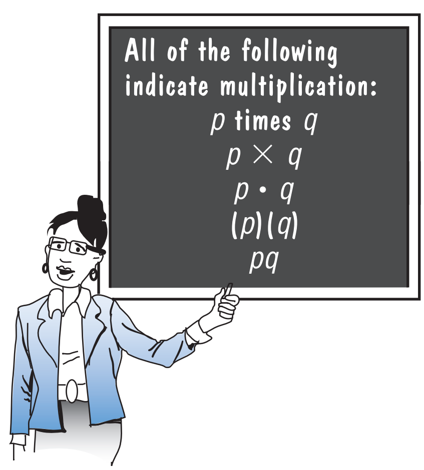
  Length: $3\frac{3}{4}$ ft rounds to 4 ft.

  Width: $2\frac{1}{4}$ ft rounds to 2 ft.

- To find the area of the rectangular floor, use the formula for the area of a rectangle in the Mathematics Chart.

$$A = lw$$
$$A = (4)(2)$$
$$A = 8 \text{ ft}^2$$

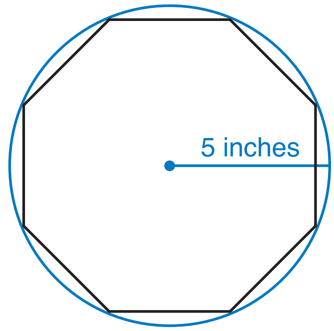
The area of the toolshed's floor is approximately 8 ft^2, or 8 square feet.



Objective 4

Try It

Gary is painting a sign in the shape of an octagon. The sign just fits inside a circle with a radius of 5 inches.



What is a reasonable estimate of the area of the sign?

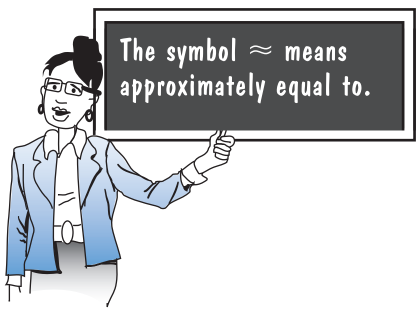
In the Mathematics Chart the formula for the area of a circle is

$A =$ ______ .

The value of r is ______ .

Replace the variables in the formula with the values given in the problem.

Since only a reasonable estimate is needed, a whole-number estimate of π is acceptable. Use ______ as an estimate of π.



$A \approx$ ______ $\times$ ______^{2}

$A \approx$ ______ $\times$ ______ $\times$ ______

$A \approx$ ______ in.^{2}

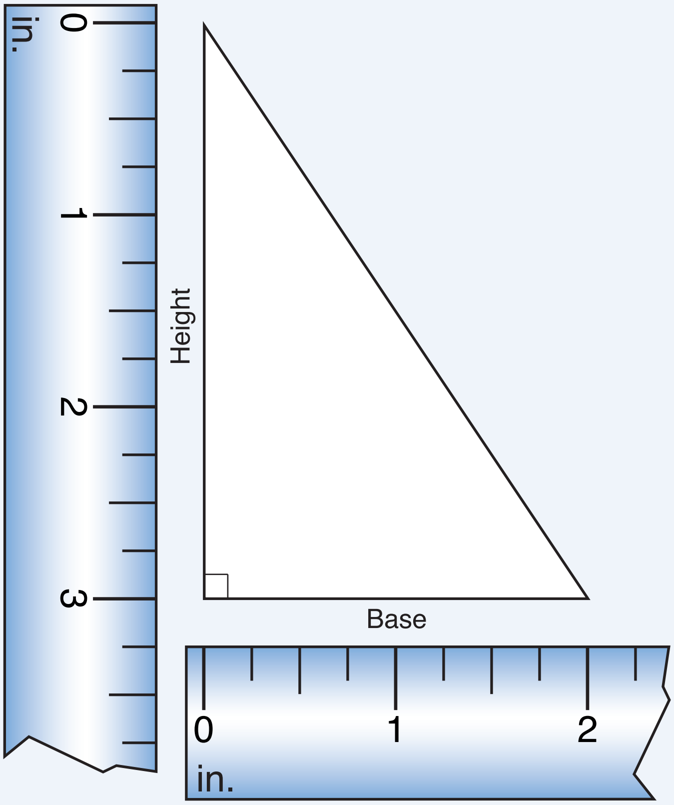
A reasonable estimate of the area of the sign is ______ square inches.

In the Mathematics Chart the formula for the area of a circle is $A = \pi r^2$. The value of r is 5. Use 3 as an estimate of π. $A \approx 3 \times 5^2$; $A \approx 3 \times 5 \times 5$; $A \approx 75$ in.^{2} A reasonable estimate of the area of the sign is 75 square inches.

How Do You Use a Ruler to Find Area?

To find the area of an object, measure the dimensions of the object and then use the appropriate area formula.

What is the area of the right triangle shown below?



- In the Mathematics Chart the formula for finding the area of a triangle is $A = \frac{bh}{2}$. In the formula, b represents the base of the triangle, and h represents the height of the triangle. In a right triangle the base and height are the legs that form the right angle.
- The rulers show that the base of the triangle measures 2 inches and the height of the triangle measures 3 inches. Substituting these numbers for b and h in the formula results in the following equation:

$$A = \frac{bh}{2}$$

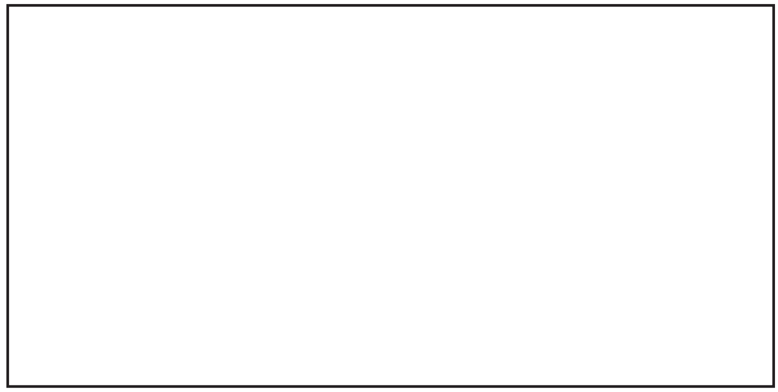
$$A = \frac{(2)(3)}{2} = \frac{6}{2}$$

$$A = 3 \text{ in.}^2$$

The area of the triangle is 3 square inches.

Try It

Use the inch ruler on the Mathematics Chart to measure the sides of the rectangle below. Then find the area of the rectangle in square inches.



Place the 0-inch mark of the ruler at one end of a longer side of the rectangle. Read the number of inches at the other end of the side.

The length of the rectangle is _______ inches.

Place the 0-inch mark of the ruler at one end of a shorter side of the rectangle. Read the number of inches at the other end of the side.

The width of the rectangle is _______ inches.

The formula for the area of a rectangle is $A = lw$.

$$A = (\ \_\_\_\_\_\_\_\ )(\ \_\_\_\_\_\_\_\ )$$

$$A = \_\_\_\_\_\_\_ \text{ in.}^2$$

The area of the rectangle is _______ square inches.

The length of the rectangle is 4 inches. The width of the rectangle is 2 inches. $A = (4)(2)$. $A = 8$ in.^{2} The area of the rectangle is 8 square inches.

How Can You Select and Use Appropriate Formulas to Solve Problems?

The Mathematics Chart lists formulas for perimeter, circumference, area, and volume.

To select and use a formula, follow these steps:

- Identify what you are being asked.
- Identify the type of figure you are working with.
- Identify the quantities in the problem.
- Substitute the variables in the formula.
- Solve the problem.

Will built a rectangular dog run that was 20 feet by 7 feet. Find the perimeter of the dog run in feet.

Use the formula in the Mathematics Chart for the perimeter of a rectangle.

$$P = 2(l + w)$$

- Identify the quantities in the problem.
  The length (l) of the dog run is 20 feet.
  The width (w) of the dog run is 7 feet.
- Replace the variables in the formula with their values from the problem.

$$P = 2(l + w)$$
$$P = 2(20 + 7)$$
$$P = 2 \cdot 27$$
$$P = 54 \text{ ft}$$

The perimeter of the dog run is 54 feet.

A farmer wants to replace the wire fencing around a circular pen. The pen has a diameter of 24 feet. How many feet of wire fencing will the farmer need?

To solve this problem, calculate the pen's circumference, which is the distance around a circle. Use the formula in the Mathematics Chart for the circumference of a circle.

$$C = \pi d$$

The diameter, d, of the circular pen is 24 feet.

Replace the variable in the formula with the diameter given in the problem.

$$C = \pi(24)$$
$$C = 24\pi \text{ ft}$$

The farmer will need 24π feet of wire fencing.

Objective 4

Nora is buying fertilizer for her rectangular vegetable garden. The garden measures 40 feet by 20 feet. Each bag of fertilizer covers 200 square feet. How many bags of fertilizer does Nora need?

- First find the area of Nora's garden. Use the formula for the area of a rectangle.

$$A = lw$$

- Replace the variables in the formula with the values given in the problem.
  The length, l, of the garden is 40 feet.
  The width, w, of the garden is 20 feet.

$$A = (40)(20)$$
$$A = 800$$

The area of Nora's garden is 800 ft^2.

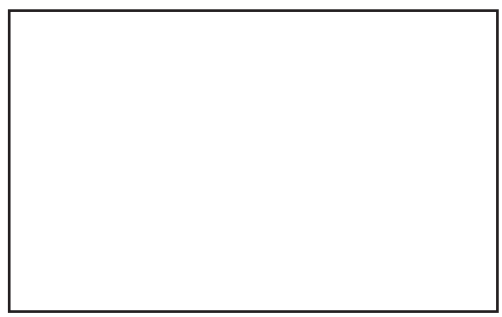
- Each bag of fertilizer covers 200 ft^2.
  Divide 800 ft^2 by 200 ft^2 per bag to find the number of bags needed.

$$800 \div 200 = 4$$

Nora needs 4 bags of fertilizer.

Try It

Use the centimeter ruler on the Mathematics Chart to find the perimeter of this rectangle.



The length of the rectangle is _______ cm.

The width of the rectangle is _______ cm.

One way to find the perimeter of a rectangle is to add all 4 sides.

$P =$ _______ + _______ + _______ + _______

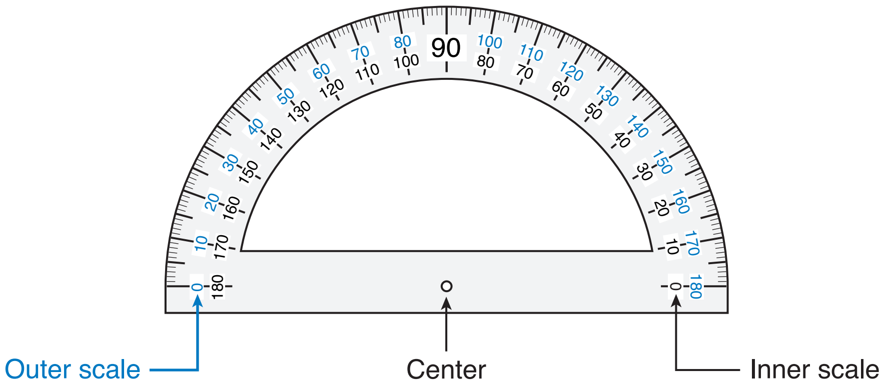
$P =$ _______

The perimeter of the rectangle is _______ cm.

The length of the rectangle is 6.5 cm. The width of the rectangle is 4 cm.
$P = 6.5 + 4 + 6.5 + 4$; $P = 21$. The perimeter of the rectangle is 21 cm.

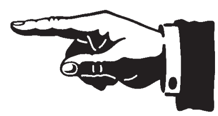
How Do You Measure Angles with a Protractor?

A **protractor** is a tool for measuring the number of degrees in an angle. Most protractors look like the one shown below.



A protractor has two scales.

- The **outer scale** starts at 0° on the left and increases clockwise to 180° on the right.
- The **inner scale** starts at 0° on the right and increases counterclockwise to 180° on the left.



Do you see that . . .

To measure an angle with a protractor, follow these steps:

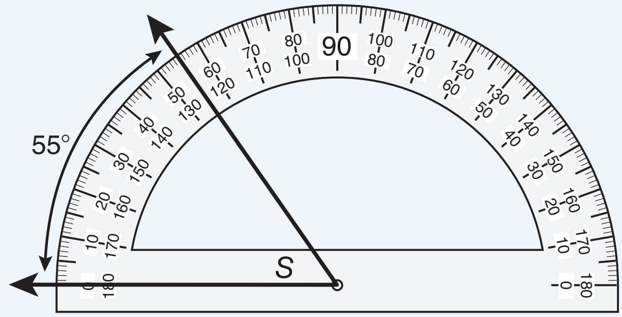
- Place the center of the protractor on the vertex of the angle.
- Line up one ray of the angle with a 0-degree mark on either the outer scale or the inner scale.
- Read the angle measure where the second ray crosses the scale. Be sure to look at the same scale that you used in the previous step.
- You can write the measure of an angle in two ways. For example, you can write the measure of angle R is 35° or $m\angle R = 35°$. Both expressions are read as *the measure of angle R is 35 degrees.*
- Check to make sure that your angle measurement makes sense.

  If the angle is larger than a right angle, it should measure more than 90°.

  If the angle is smaller than a right angle, it should measure less than 90°.

Objective 4

Use the protractor to find $m\angle S$ to the nearest degree.



- The center of the protractor is on the vertex of the angle.
- One ray is lined up with the 0-degree mark on the outer scale.
- The other ray crosses the protractor at 55° on the outer scale and at 125° on the inner scale.
- The angle measures 55° because that measure uses the same scale as was used in the previous step, the outer scale.

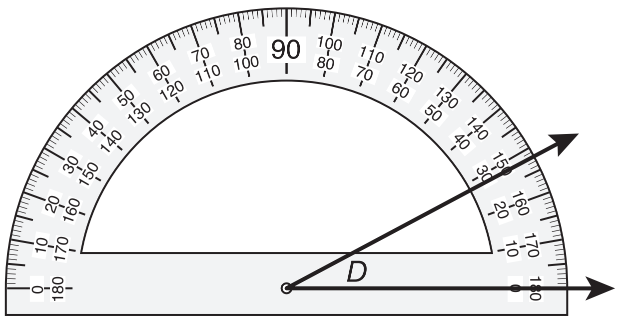
$$m\angle S = 55°$$

This answer makes sense because $\angle S$ is smaller than a right angle, so its measure should be less than 90°.

If you had chosen 125°, the measure on the inner scale, the answer would not have been reasonable.

Try It

Find $m\angle D$ to the nearest degree.



The center of the protractor is on the ______________ of the angle.

One ray is lined up with the 0-degree mark on the ___________ scale.

The other ray crosses the protractor at _______° on the inner scale.

The angle measures _______° because that measure uses the same scale, the inner scale.

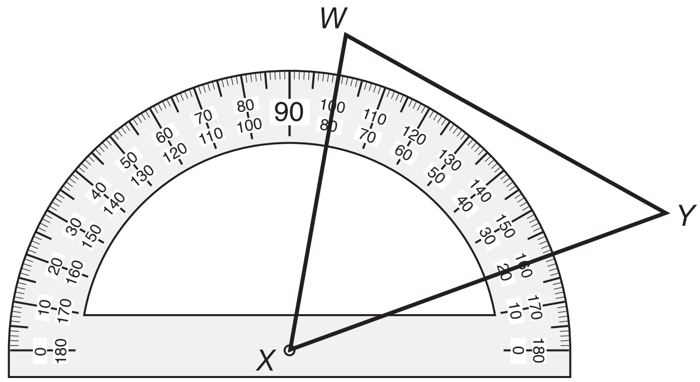
Angle D measures _______° to the nearest degree.

This answer is reasonable because $\angle D$ is ________________________ than a right angle.

The center of the protractor is on the vertex of the angle. One ray is lined up with the 0-degree mark on the inner scale. The other ray crosses the protractor at 28° on the inner scale. The angle measures 28° because that measure uses the same scale, the inner scale. Angle D measures 28° to the nearest degree. This answer is reasonable because $\angle D$ is smaller than a right angle.

Try It

In triangle WXY shown below, $m\angle Y = 50°$.



Find the measure of $\angle W$ to the nearest degree.

The center of the protractor is on the ____________ of $\angle X$.

One ray of $\angle X$ is lined up with ______° on the inner scale.

The other ray crosses the protractor at ______° on the inner scale.

______° − ______° = ______°

Angle X measures ______°.

The sum of the measures of the angles of a triangle is ___________ ,

Since $m\angle X + m\angle Y =$ ______ + ______ = ______ ,

then 180° − ______ = ______ .

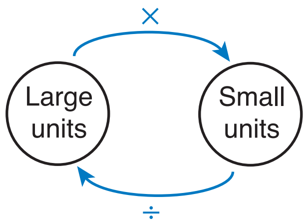
Angle W measures ______°.

The center of the protractor is on the vertex of $\angle X$. One ray of $\angle X$ is lined up with 20° on the inner scale. The other ray crosses the protractor at 80° on the inner scale. 80° − 20° = 60°. Angle X measures 60°. The sum of the measures of the angles of a triangle is 180°. Since $m\angle X + m\angle Y = 60° + 50° = 110°$, then 180° − 110° = 70°. Angle W measures 70°.

How Do You Convert Measurements from One Unit to Another?

Some problems involve more than one measurement unit. To solve these problems, you may need to change from one unit of measurement to another. The Mathematics Chart lists units of measure for the metric and customary systems.

- To convert a smaller unit to a larger unit, divide by the number of smaller units there are in one of the larger units.
- To convert a larger unit to a smaller unit, multiply by the number of smaller units there are in one of the larger units.



A table is 60 inches long. How long is the table in feet?

- Use the Mathematics Chart to find the measurement fact that relates feet to inches.

$$1 \text{ foot} = 12 \text{ inches}$$

- Change from a smaller unit (inches) to a larger unit (feet).

$$60 \text{ inches} = ? \text{ feet}$$

$$\text{smaller unit} \longrightarrow \text{larger unit}$$

- Divide 60 by 12.

$$60 \div 12 = 5$$

The table is 5 feet long.

Lr. Tanako bought 5 pounds of ground turkey. How many ounces of turkey did he buy?

- Use the Mathematics Chart to find the measurement fact that relates pounds to ounces.

$$1 \text{ pound} = 16 \text{ ounces}$$

- Change from a larger unit (pounds) to a smaller unit (ounces).

$$5 \text{ pounds} = ? \text{ ounces}$$

$$\text{larger unit} \longrightarrow \text{smaller unit}$$

- Multiply 5 by 16.

$$5 \cdot 16 = 80$$

Mr. Tanako bought 80 ounces of turkey.

Try It

One day Joley ran 6.7 kilometers, swam 1.9 kilometers, and biked 15.4 kilometers. What is the total distance Joley traveled in meters?

The total distance Joley traveled in kilometers is

______ + ______ + ______ = ______ km.

Joley traveled ______ kilometers in all.

The measurement fact that relates kilometers to meters is

______ kilometer = ______ meters.

Change from a __________ unit to a __________ unit.

Use the operation of _______________ to change from kilometers to meters.

______ × ______ = __________

Joley traveled a total of __________ meters.

Joley traveled 6.7 + 1.9 + 15.4 = 24 km. Joley traveled 24 kilometers in all. According to the Mathematics Chart, 1 kilometer = 1,000 meters. Change from a larger unit to a smaller unit. Use the operation of multiplication to change from kilometers to meters: 24 × 1,000 = 24,000. Joley traveled a total of 24,000 meters.

Try It

Otto delivers newspapers. The table below shows the number of minutes it took him to deliver papers each weekday last week.

Otto's Newspaper Route

Day	Delivery Time (min)
Monday	55
Tuesday	45
Wednesday	65
Thursday	50
Friday	55

How many hours did Otto spend delivering papers last week?

Use the operation of ____________ to find the total time in minutes.

______ minutes

______ minutes

______ minutes

______ minutes

+ ______ minutes

______ minutes

Otto spent a total of ______ minutes delivering newspapers last week.

The problem asks for the total number of ___________ he spent delivering papers.

Change from a ___________ unit to a ___________ unit.

Use the operation of ___________ to change from minutes to hours.

______ ÷ ______ = ______

Otto spent a total of ______ hours delivering newspapers last week.

Use the operation of addition to find the total time in minutes: 55 + 45 + 65 + 50 + 55 = 270 minutes. Otto spent 270 minutes delivering newspapers. The problem asks for the total number of hours he spent delivering papers. Change from a smaller unit to a larger unit. Use the operation of division to change from minutes to hours: 270 ÷ 60 = 4.5. Otto spent a total of 4.5 hours delivering newspapers last week.

Now practice what you've learned.

Question 35

A basketball hoop is 120 inches above the court. A player is 62 inches tall. Find the approximate distance in feet between the top of the player's head and the basketball hoop.

A 4 ft

B 5 ft

C 6 ft

D 7 ft

Answer Key: page 150

Question 36

At 10:00 A.M. the temperature is 51°F. If the temperature rises at an average rate of 4°F per hour, what will the temperature be at 3:00 P.M.?

A 71°F

B 70°F

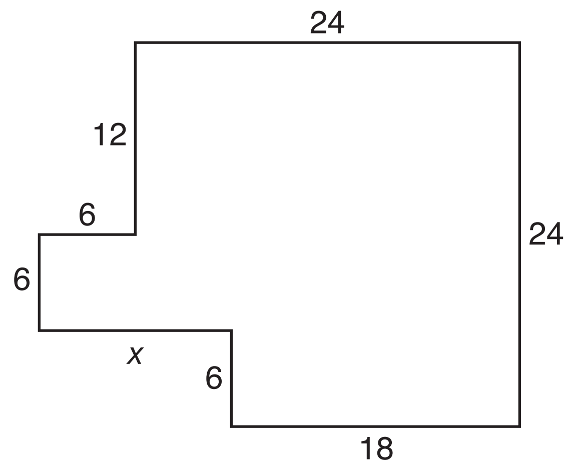
C 63°F

D 55°F

Answer Key: page 150

Question 37

The polygon below has a perimeter of 108 units.



What is the length of x?

A 6 units

B 18 units

C 12 units

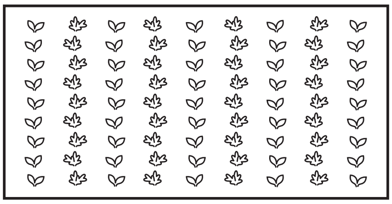
D 10 units

Answer Key: page 151

Question 38

Look at the scale drawing below. Use the ruler on the Mathematics Chart to find the perimeter of the scale drawing in inches.

Class Garden



Scale
1 inch = 10 feet

What is the perimeter of the actual garden in feet?

A 25 ft

B 70 ft

C 60 ft

D 35 ft

Answer Key: page 151

Question 39

Michael kept track of the time he spent doing his chores last weekend.

Michael's Chores

Chore	Time (min)
Cleaning room	53
Doing dishes	27
Taking care of pets	36

What is the total amount of time Michael spent doing chores?

A 2 hours 16 minutes

B 1 hour 30 minutes

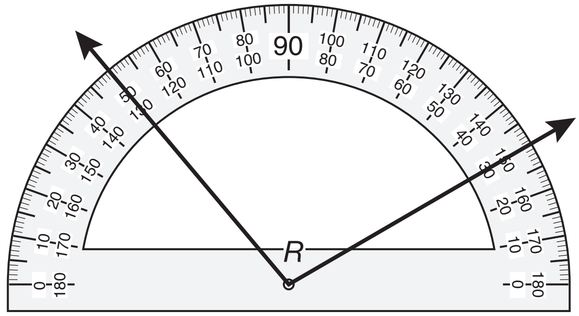
C 1 hour 56 minutes

D 1 hour

Answer Key: page 151

Question 40

Find the measure of $\angle R$ to the nearest degree.



A 160°

B 100°

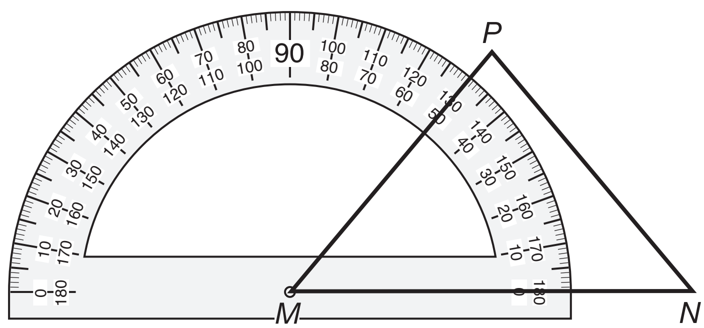
C 130°

D 30°

Answer Key: page 151

Question 41

In triangle *MNP* shown below, the measure of $\angle M$ is equal to the measure of $\angle N$.



Find $m\angle P$.

A 30°

B 50°

C 100°

D 80°

Answer Key: page 151

Question 42

A school softball team has a 5-gallon container of water. How many cups of water are equivalent to 5 gallons?

A 20 c

B 40 c

C 80 c

D 60 c

Answer Key: page 151

Question 43

The table shows the number of yards Miguel carried the ball during his first three football games.

Miguel's Football Records

Game	Number of Yards
First	34
Second	28
Third	41

How many feet in all did he carry the ball during these three games?

A 103 ft

B 34 ft

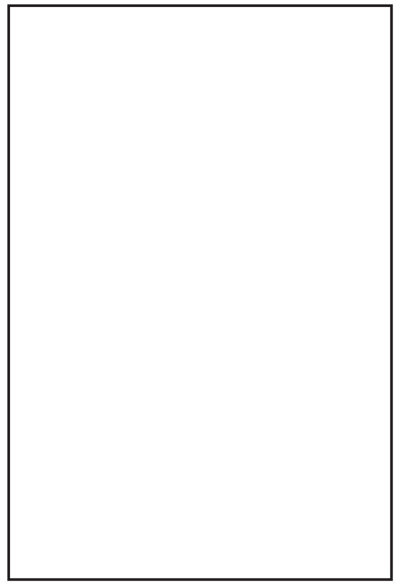
C 309 ft

D 1,240 ft

Answer Key: page 151

Question 44

Use the ruler on the Mathematics Chart to measure the lengths of the sides of the rectangle below in inches.



What is the area of the rectangle?

A 5 in.^{2}

B 6 in.^{2}

C 10 in.^{2}

D 12 in.^{2}

Answer Key: page 152

Objective 5

The student will demonstrate an understanding of probability and statistics.

For this objective you should be able to

- use experimental and theoretical probability to make predictions; and
- use statistical representations to analyze data.

What Is a Sample Space?

A **sample space** is the set of all possible outcomes of an experiment. For example, if you flip a coin, it will land either heads up or tails up. One way to display the sample space for this experiment is to list all the possible outcomes: heads or tails.

You can also show a sample space in a list or a tree diagram.

Juan has several choices of items to take in his lunch. He can choose either a cheese sandwich or a ham sandwich. He can also choose to take an apple, an orange, or a pear.

What are all the possible outcomes if Juan chooses 1 sandwich and 1 piece of fruit?

- You can use a list to show all the possible outcomes.

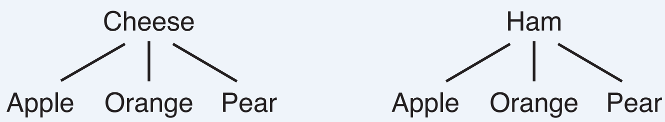
Juan's Lunch

Cheese, Apple
Cheese, Orange
Cheese, Pear
Ham, Apple
Ham, Orange
Ham, Pear

First list a cheese sandwich with each of the pieces of fruit Juan can choose. Then list a ham sandwich with each of the pieces of fruit Juan can choose.

The list shows that there are 6 different outcomes if Juan chooses 1 sandwich and 1 piece of fruit.

- You can also use a tree diagram to display the sample space.

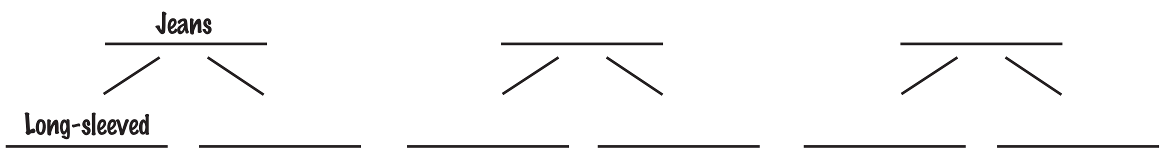


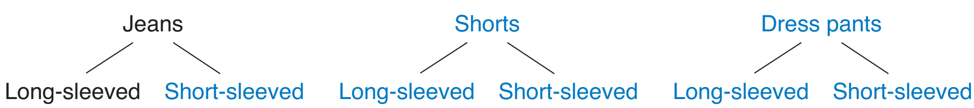
There are 6 branches in the tree diagram. This shows that Juan can choose a total of 6 possible outcomes of 1 sandwich and 1 piece of fruit.

Try It

Quinlan is selecting clothes to wear to school. He has three pairs of pants to choose from: jeans, shorts, or dress pants. He has two shirts to choose from: a long-sleeved shirt or a short-sleeved shirt.

Complete the tree diagram below, listing all the different outcomes of pants and a shirt Quinlan could choose.





Objective 5

Try It

Hillary is wrapping a gift. She can choose from 4 different kinds of wrapping paper: solid-color paper, polka-dot paper, striped paper, or picture paper. She can also choose from 2 different colors of ribbon: red or blue. Complete the table below, listing all the different outcomes when choosing 1 kind of wrapping paper and 1 color of ribbon.

Gift Wrapping

Wrapping Paper	Ribbon Color
Solid-color	

Gift Wrapping

Wrapping Paper	Ribbon Color
Solid-color	Red
Solid-color	Blue
Polka-dot	Red
Polka-dot	Blue
Striped	Red
Striped	Blue
Picture	Red
Picture	Blue

How Do You Find the Probability of an Event?

Probability is a way of describing how likely it is that a particular outcome will occur. A fraction can be used to describe the results of a probability experiment.

- The numerator of the fraction is the number of favorable outcomes for the experiment.
- The denominator of the fraction is the number of all the possible outcomes for the experiment.

$$\frac{\text{Number of favorable outcomes}}{\text{Total number of possible outcomes}}$$

Kim is randomly choosing a marble from a bag containing 1 red marble, 1 blue marble, and 1 green marble. What is the probability that she will choose a green marble?

- There is 1 green marble in the bag. There is 1 favorable outcome.
- There are $1 + 1 + 1 = 3$ marbles in the bag. There are 3 possible outcomes.

$$\text{Probability of choosing a green marble} = \frac{\text{Number of favorable outcomes}}{\text{Total number of possible outcomes}} = \frac{1}{3}$$

The probability that Kim will choose a green marble is $\frac{1}{3}$, or 1 out of 3.

Consider Kim and the marbles again. The bag contains 1 red marble, 1 blue marble, and 1 green marble. What is the probability of Kim not choosing a green marble at random?

Think of the question this way. If choosing a green marble is the favorable outcome, what is the probability that the outcome will not be favorable? An unfavorable outcome is not choosing a green marble. So choosing a red or a blue marble is not a favorable outcome.

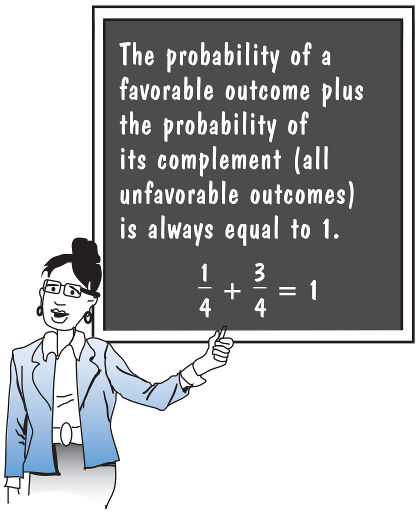
- There is 1 red marble and 1 blue marble in the bag. There are $1 + 1 = 2$ outcomes that are not favorable.
- There are $1 + 1 + 1 = 3$ marbles in the bag. There are 3 possible outcomes.

$$\text{Probability of not choosing a green marble} = \frac{\text{Number of outcomes that are not favorable}}{\text{Total number of possible outcomes}} = \frac{2}{3}$$

The probability of Kim not choosing a green marble is $\frac{2}{3}$, or 2 out of 3.

Objective 5

You just saw that the probability of Kim not choosing a green marble is $\frac{2}{3}$, or 2 out of 3. There is another way to express this answer. Not choosing a green marble is called the complement of choosing a green marble. The **complement** of an event is the set of all the possible outcomes that are not favorable. So you could say that the probability of the complement of choosing a green marble is $\frac{2}{3}$, or 2 out of 3.



Michelle has 10 quarters, 5 dimes, 3 nickels, and 2 pennies in her coat pocket. If Michelle selects a coin from her pocket at random, what is the probability that the coin is a dime?

- Michelle has 5 dimes in her pocket. There are 5 favorable outcomes.
- She has $10 + 5 + 3 + 2 = 20$ coins in her coat pocket. There are 20 possible outcomes.

$$\text{Probability of selecting a dime} = \frac{\text{Number of favorable outcomes}}{\text{Total number of possible outcomes}} = \frac{5}{20} = \frac{1}{4}$$

The probability that Michelle will select a dime is $\frac{1}{4}$.

Consider the experiment above in which Michelle has 10 quarters, 5 dimes, 3 nickels, and 2 pennies in her coat pocket. If Michelle selects a coin from her pocket at random, what is the probability that the coin selected is not a dime?

The probability of not selecting a dime is the same as selecting a quarter, a nickel, or a penny.

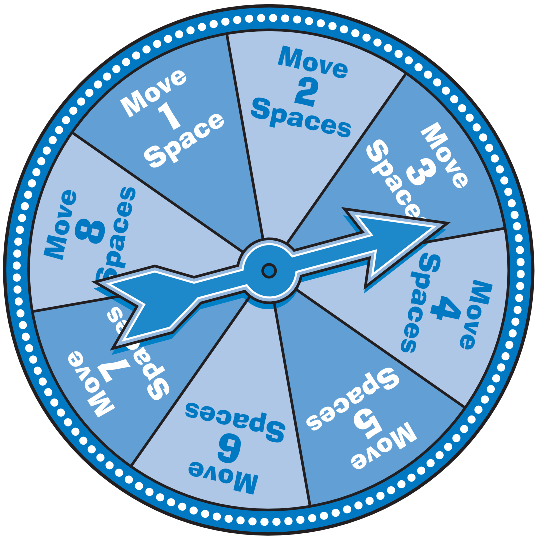
- Michelle has 10 quarters, 3 nickels, and 2 pennies in her coat pocket. There are $10 + 3 + 2 = 15$ favorable outcomes.
- She has $10 + 5 + 3 + 2 = 20$ coins in her coat pocket. There are 20 possible outcomes.

$$\text{Probability of not selecting a dime} = \frac{\text{Number of favorable outcomes}}{\text{Total number of possible outcomes}} = \frac{15}{20} = \frac{3}{4}$$

The probability of Michelle not selecting a dime is $\frac{3}{4}$.

Try It

While playing a board game, Tyra uses a spinner to determine how many spaces to move her game piece each turn. The spinner is divided evenly into 8 sections, labeled 1 through 8. What is the probability that Tyra will move her game piece at least 5 spaces on her next turn?



The favorable outcomes are to move ______ , ______ , ______ , or ______ spaces.

The number of favorable outcomes is ______ .

There are ______ possible outcomes.

The probability that Tyra will move her game piece at least 5 spaces on her next turn is $\frac{\square}{\square}$, or $\frac{\square}{\square}$.

The favorable outcomes are to move 5, 6, 7, or 8 spaces. The number of favorable outcomes is 4. There are 8 possible outcomes. The probability that Tyra will move her game piece at least 5 spaces on her next turn is $\frac{4}{8}$, or $\frac{1}{2}$.

Try It

A bag contains 20 marbles, 8 of which are blue. If you randomly take a marble from the bag, what is the probability that it will not be blue?

The probability of not selecting a _______ marble is the same as selecting any color marble other than blue.

There are _______ blue marbles in the bag.

There are a total of _______ marbles in the bag.

There are $20 - 8 =$ _______ other color marbles in the bag.

The number of favorable outcomes is _______.

The total number of possible outcomes is _______.

The probability of not selecting a blue marble is $\frac{\square}{\square}$, or $\frac{\square}{\square}$.

The probability of not selecting a blue marble is the same as selecting any color marble other than blue. There are 8 blue marbles in the bag. There are a total of 20 marbles in the bag. There are $20 - 8 = 12$ other color marbles in the bag. The number of favorable outcomes is 12. The total number of possible outcomes is 20. The probability of not selecting a blue marble is $\frac{12}{20}$, or $\frac{3}{5}$.

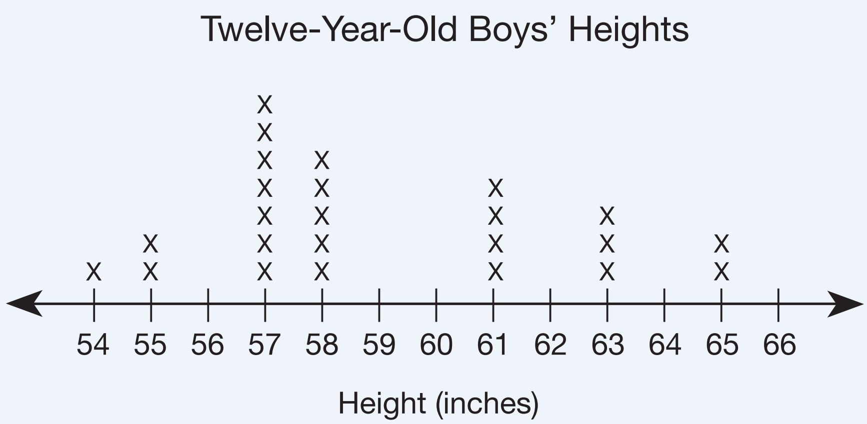
How Can You Organize and Display Data?

You can use tables, line graphs, bar graphs, circle graphs, line plots, and pictographs to organize and display data. When data are organized and displayed in a graph or diagram, it is easier to see relationships between the pieces of data. This can be helpful in problem solving.

A **line plot** represents a set of data by showing how often a piece of data appears in that set. It consists of a number line that includes the values of the data set. An X is placed above the corresponding value each time that value appears in the data set.

The heights of 24 twelve-year-old boys at a school were measured to the nearest inch and recorded in the table. A line plot was then made of the data set. Look at the example of the line plot below the table. Notice that one boy was 54 inches tall and there is one X above the 54 on the line plot. In the same way seven boys were 57 inches tall and there are seven Xs above the 57 on the line plot.

Boys' Heights (in.)	54	55	57	58	61	63	65
Number of Boys	1	2	7	5	4	3	2



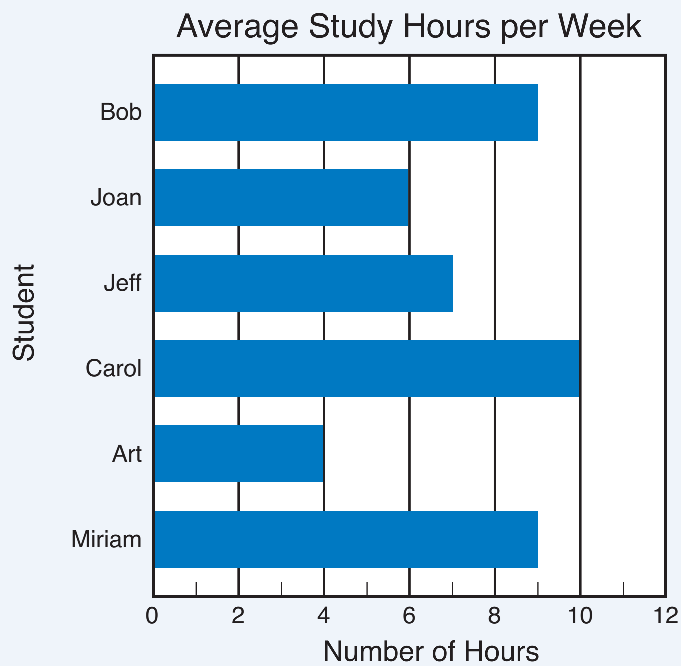
You can use this line plot to make the following observations.

- The boys vary in height from 54 to 65 inches.
- The height recorded the least was 54 inches.
- The height recorded the most was 57 inches.

Objective 5

A **bar graph** uses either vertical or horizontal bars of different heights or lengths to display data. A bar graph has a scale and labels to tell the reader what the bars represent. Bar graphs are useful for analyzing and comparing data.

The bar graph below shows the average number of hours six students study each week.



How many more hours each week does Bob study than Jeff studies?

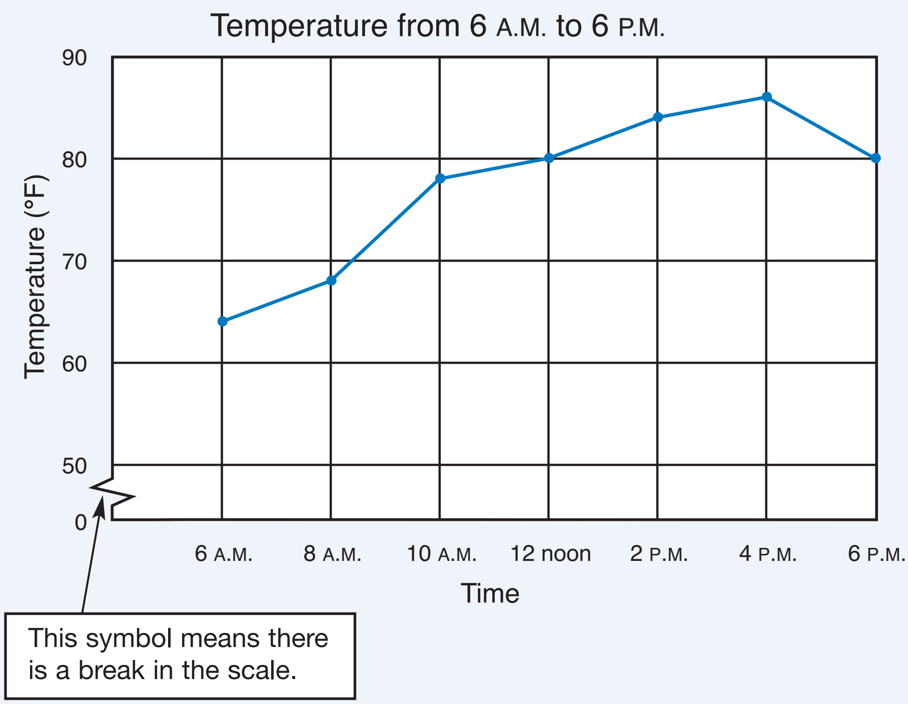
- The scale on the bottom shows the average number of hours the students study.
- The bar for Jeff ends halfway between the 6 and the 8 on the scale, so Jeff studies 7 hours per week.
- The bar for Bob ends halfway between the 8 and the 10 on the scale, so Bob studies 9 hours per week.
- Use subtraction to find how many more hours Bob studies.

$$9 - 7 = 2$$

Bob studies 2 hours more than Jeff studies each week.

A **line graph** shows points plotted on a coordinate grid. The points are connected by line segments. The plotted points represent data presented as pairs of numbers. Line graphs are particularly useful for showing trends, or changes in data over a period of time.

The line graph below shows the temperature at different times during the day.



Use the graph to find the four-hour period during which the temperature increased and then decreased.

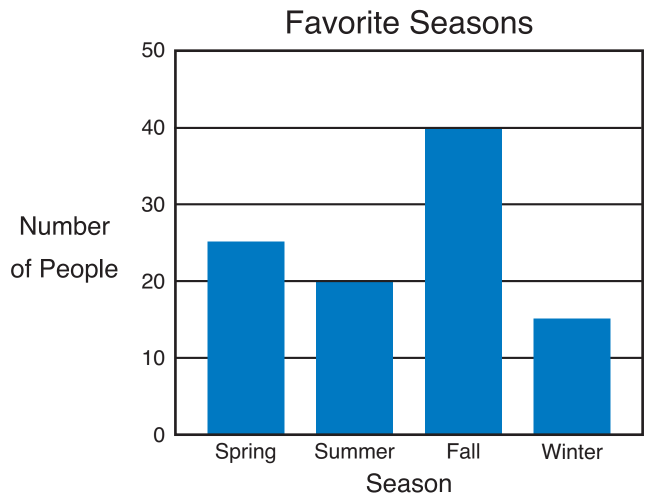
- From 6 A.M. to 8 A.M., the temperature increased from 64°F to 68°F.
- From 8 A.M. to 10 A.M., the temperature increased from 68°F to 78°F.
- From 10 A.M. to 12 noon, the temperature increased from 78°F to 80°F.
- From 12 noon to 2 P.M., the temperature increased from 80°F to 84°F.
- From 2 P.M. to 4 P.M., the temperature increased from 84°F to 86°F.
- From 4 P.M. to 6 P.M., the temperature decreased from 86°F to 80°F.

During the four-hour time period from 2 P.M. to 6 P.M., the temperature increased and then decreased.

Objective 5

Try It

The bar graph below shows the results of a survey about people's favorite season.



What is the difference between the total number of people who prefer cool seasons, fall and winter, and the total number of people who prefer warm seasons, spring and summer?

The number of people who prefer fall is ________ .

The number of people who prefer winter is ________ .

The total number of people who prefer cool seasons is

________ + ________ = ________ .

The number of people who prefer spring is ________ .

The number of people who prefer summer is ________ .

The total number of people who prefer warm seasons is

________ + ________ = ________ .

The difference between the number of people who prefer cool seasons and the number of people who prefer warm seasons is

________ – ________ = ________.

The number of people who prefer fall is 40. The number of people who prefer winter is 15. The total number of people who prefer cool seasons is 40 + 15 = 55. The number of people who prefer spring is 25. The number of people who prefer summer is 20. The total number of people who prefer warm seasons is 25 + 20 = 45. The difference between the number of people who prefer cool seasons and the number of people who prefer warm seasons is 55 – 45 = 10.

How Can You Describe Data?

A set of data can be described by its range, mean, median, or mode.

The **range** of a set of data is the difference between the greatest and the least numbers in the data set. Subtract to find the difference.

What is the range for this set of data?

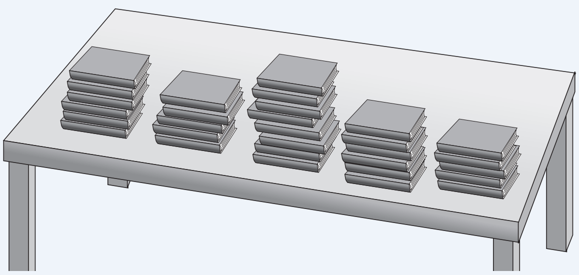
99, 92, 89, 84, 79, 77, 68, 66, 64

- The largest number is 99.
- The smallest number is 64.
- Subtract: 99 – 64 = 35.

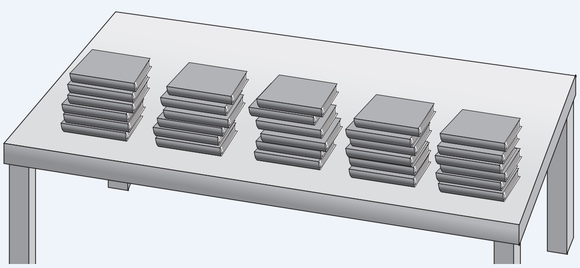
The range for this data set is 35.

The **mean** of a set of data is the average of the data values. To find the mean, add all the data values and then divide this sum by the number of values in the set.

A math teacher had 5 of her students each carry a stack of math books to the book room and place them on a table. As shown below, the stacks contained 6, 5, 8, 6, and 5 books.



The teacher asked the 5 students how many books each student would have carried if they had each carried the same number of books. The students were asked to answer this question in two ways. First the teacher had the students move books from stack to stack until each stack contained an equal number of books. As shown below, each stack now contained 6 books.



Then the teacher asked the students to calculate the mean of the stacks of books by adding the number of books in each of the original 5 stacks (6 + 5 + 8 + 6 + 5 = 30) and dividing this total by the number of stacks (30 ÷ 5 = 6).

The students concluded that the mean of a set of data can be used to describe that set of data, because the mean tells you how large each value in the set would be if all of the values were made equal but still totaled the same amount.

Do you see that . . .

The **median** of a set of data is the middle value of all the numbers. To find the middle value, list the numbers in order from least to greatest or from greatest to least. Cross out one value on each end of the list until you reach the middle. If there are two values in the middle, find the number halfway between the two values by adding them together and dividing their sum by 2.

What is the median for this set of data?

45, 71, 55, 13, 22, 88, 91, 18

- Write the numbers in order.

13, 18, 22, 45, 55, 71, 88, 91

- Cross out the numbers on the ends until you reach the middle.

~~13~~, ~~18~~, ~~22~~, 45, 55, ~~71~~, ~~88~~, ~~91~~

- The numbers in the middle are 45 and 55.
- Find the number halfway between 45 and 55.

45 + 55 = 100

100 ÷ 2 = 50

The number 50 is exactly halfway between these numbers.

The median for this data set is 50.

The **mode** is the value (or values) that appears in a set of data more frequently than any other value. If all the values in a set of data appear the same number of times, the set does not have a mode.

What is the mode of this set of data?

70, 83, 90, 70, 83, 83, 90, 100

- The value 83 appears three times.
- No other value appears more than twice.

The mode is 83.

What is the mode of this set of data?

3, 6, 2, 3, 12, 2, 6, 12

There is no mode of this data set because each value appears twice.

Try It

The table below shows the number of sunny days in a city for each month of the year. Find the range, the median, and the mode of this data set.

Month	Number of Sunny Days
Jan.	13
Feb.	12
Mar.	18
Apr.	19
May	22
June	27
July	26
Aug.	28
Sept.	24
Oct.	18
Nov.	16
Dec.	11

- Find the range of the set of data.

  The greatest number is _______ , and the least number is _______ .

  Use the operation of ____________________ to find the range of this set of data.

  _______ – _______ = _______

  The range of the set of data is _______ .

- Find the median of the set of data.

  Place the numbers in order from least to greatest.

  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

  The numbers in the middle of the list are _______ and _______ .

  The median is exactly halfway between _______ and _______ .

  The median of the set of data is _______ .

- Find the mode of the set of data.

  The only value that appears more than once is _______ .

  The mode of the set of data is _______ .

The greatest number is 28, and the least number is 11. Use the operation of subtraction to find the range: 28 − 11 = 17. The range is 17. Ordered from least to greatest, the numbers are 11, 12, 13, 16, 18, 18, 19, 22, 24, 26, 27, and 28. The numbers in the middle of the list are 18 and 19. The median is exactly halfway between 18 and 19. The median is 18.5. The only value that appears more than once is 18. The mode is 18.

Try It

There is a value missing in the set of data below. The mode of the complete set of data is 74.

88, 91, 74, 90, 67, 88, 73, 74, 70, 75, ?

Find the missing value.

The mode of a set of data is the number in the data set that

____ .

The number _______ appears twice in the set of data.

The number _______ also appears twice in the set of data.

If _______ is the mode of the set of data, it must appear more often than any other number in the data set.

The missing value is _______ .

The mode is the number in the data set that appears most frequently. The number 88 appears twice in the set of data. The number 74 also appears twice in the set of data. If 74 is the mode of the set of data, it must appear more often than any other number in the data set. The missing value is 74.

How Do You Use a Circle Graph to Display Data?

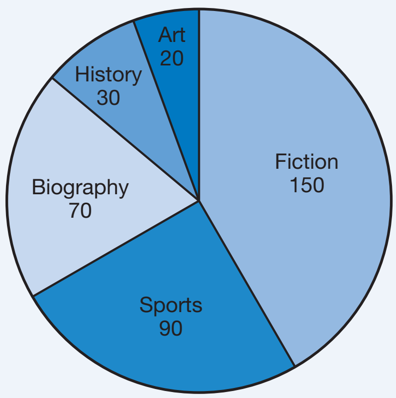
A **circle graph** compares the numbers in a set of data by showing the relative size of the parts that make up a whole. The circle represents the whole, which is made up of all the data elements. Each section of the circle represents a part of the whole.

The table below shows the number of each type of book checked out from a library one day.

Books Checked Out from a Library

Type of Book	Number of Books
Art	20
Biography	70
Fiction	150
History	30
Sports	90

The circle graph also represents the number of each type of book checked out from the library one day.



Does the graph accurately reflect the data in the table?

- In this circle graph the whole is the total number of books checked out.

$$150 + 90 + 70 + 30 + 20 = 360$$

- Determine what fraction of the books checked out belong to a particular category. For example, 90 of the 360 books checked out were sports books.

$$\frac{90 \div 90}{360 \div 90} = \frac{1}{4}$$

Of the books checked out, $\frac{1}{4}$ were about sports. Therefore, $\frac{1}{4}$ of the circle graph should represent sports books. Look at the graph. It appears that $\frac{1}{4}$ of the circle represents sports books.

- Compare the sizes of the other sections of the circle graph. The size of each section should be proportional to the number of books represented by that section.
- Compare 150 fiction books to 70 biographies. The number 150 is more than twice 70. Therefore, the section of the circle graph representing the number of fiction books should be a little more than twice the size of the section representing biographies. Look at the graph. The section for fiction books is a little more than twice the section for biographies.
- Only 20 art books were checked out. This represents the least number of books checked out compared to the numbers of other types of books. The section of the circle graph representing the number of art books should be the smallest. Look at the graph. That section is the smallest.

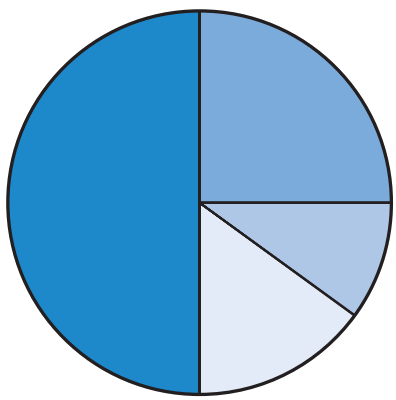
The graph accurately reflects the data in the table.

Try It

Mitch owns a number of music CDs: 50 country, 25 rock, 10 rap, and 15 miscellaneous types of music.

Use this information to label the sections of the circle graph shown below.

Mitch's CD Collection



The total number of CDs Mitch owns is ______ .

Mitch owns ______ country CDs.

The fraction of his collection that is country music is $\frac{\square}{\square}$.

The fraction of the circle that should represent country music is $\frac{\square}{\square}$.

Mitch owns _______ rock CDs.

The fraction of his collection that is rock music is $\frac{\square}{\square}$.

The fraction of the circle that should represent rock music is $\frac{\square}{\square}$.

Mitch owns _______ rap CDs.

The fraction of his collection that is rap music is $\frac{\square}{\square}$.

The fraction of the circle that should represent rap music is $\frac{\square}{\square}$.

Mitch owns _______ miscellaneous CDs.

The fraction of his collection that is miscellaneous music is $\frac{\square}{\square}$.

The fraction of the circle that should represent miscellaneous music is $\frac{\square}{\square}$.

The total number of CDs Mitch owns is 100. Mitch owns 50 country CDs. The fraction of his collection that is country music is $\frac{50}{100}$. The fraction of the circle that should represent country music is $\frac{1}{2}$. Mitch owns 25 rock CDs. The fraction of his collection that is rock music is $\frac{25}{100}$. The fraction of the circle that should represent rock music is $\frac{1}{4}$. Mitch owns 10 rap CDs. The fraction of his collection that is rap music is $\frac{10}{100}$. The fraction of the circle that should represent rap music is $\frac{1}{10}$. Mitch owns 15 miscellaneous CDs. The fraction of his collection that is miscellaneous music is $\frac{15}{100}$. The fraction of the circle that should represent miscellaneous music is $\frac{3}{20}$. The largest section of the graph should be labeled "Country." Going clockwise from that section, the other sections should be labeled "Rock," "Rap," and "Miscellaneous."

Now practice what you've learned.

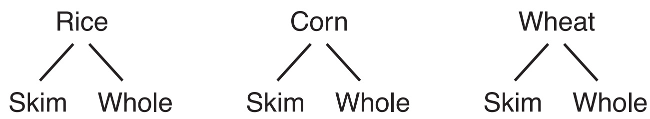
Objective 5

Question 45

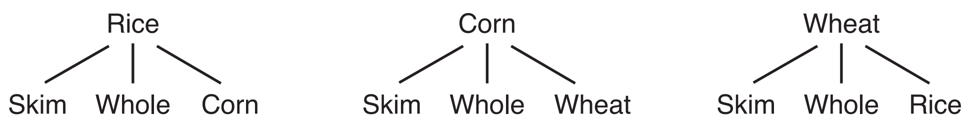
In the cafeteria Barry can choose from 3 different cereals: rice, corn, or wheat. He can also choose between skim milk and whole milk. Which diagram best displays all the different outcomes if Barry chooses 1 type of cereal and 1 type of milk?

A

B



C



D

Answer Key: page 152

Question 46

A school store sells school T-shirts in 3 sizes and 2 colors. The 3 sizes available are small, medium, and large. The 2 colors available are yellow and orange. Which list shows all the possible outcomes when a student chooses 1 size and 1 color of T-shirt?

A Large and yellow
Medium and orange
Small and yellow

B Large and yellow
Large and orange
Medium and yellow
Medium and orange
Small and yellow
Small and orange

C Large and yellow
Large and orange
Medium and yellow
Medium and orange
Small and orange

D Small and blue
Large and orange
Medium and orange
Small and orange

Answer Key: page 152

Question 47

A bag contains 11 tiles numbered 1 through 11. What is the probability that a tile selected at random from the bag will be marked with an even number?

A $\frac{1}{5}$

B $\frac{5}{6}$

C $\frac{1}{2}$

D $\frac{5}{11}$

Answer Key: page 152

Question 48

A gumball machine contains 6 blue gumballs, 3 pink gumballs, and 1 white gumball. If Marcus buys a gumball from the machine, what is the probability that he will NOT get a blue gumball?

A $\frac{3}{10}$

B $\frac{3}{5}$

C $\frac{2}{3}$

D $\frac{2}{5}$

Answer Key: page 152

Question 49

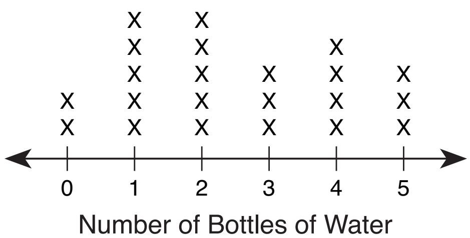
Rosaura surveyed some of her classmates about the number of bottles of water they drink each day. The results of her survey are shown in the table below.

Bottles of Water per Day

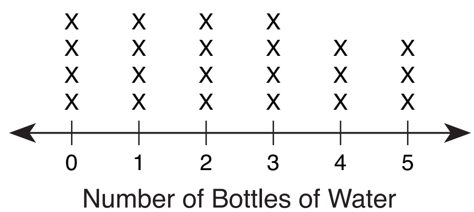
Number of Bottles of Water	Number of Students
0	2
1	5
2	5
3	3
4	4
5	3

Which line plot best represents the information in the table?

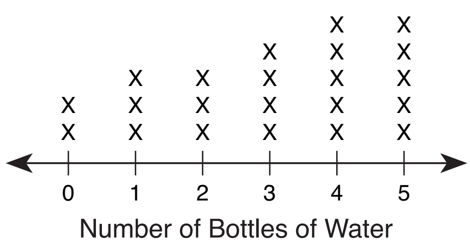
A



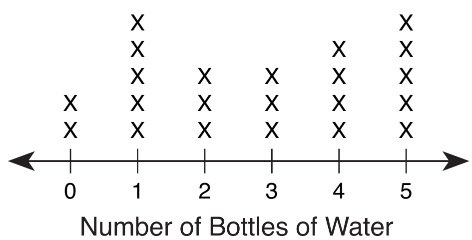
C



B



D



Answer Key: page 152

Question 50

The table below shows the number of turkey sandwiches made last week at a school cafeteria.

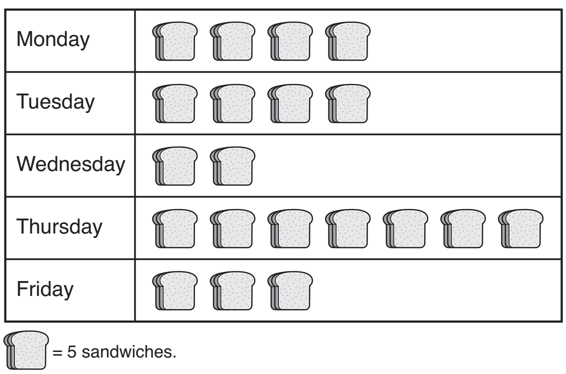
Turkey Sandwiches

Day	Number of Sandwiches
Monday	20
Tuesday	20
Wednesday	10
Thursday	35
Friday	15

Which of these graphs best represents the same data?

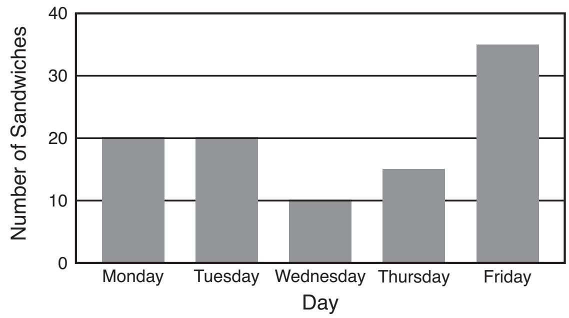
Turkey Sandwiches

A



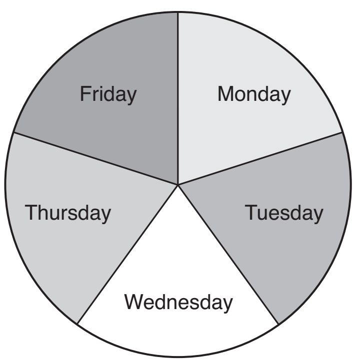
Turkey Sandwiches

C



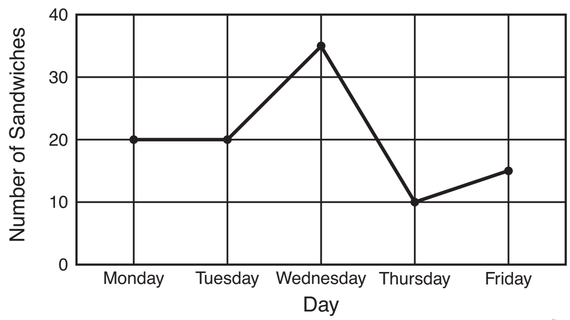
Turkey Sandwiches

B



Turkey Sandwiches

D



Answer Key: page 152

Question 51

Ms. Brown made a list of the ages of all the students in her dance class.

8, 12, 9, 9, 12, 12, 9, 8, 10, 11, 11, 12, 11

What is the median of this set of data?

A 10

B 11

C 12

D 9

Answer Key: page 152

Question 52

The table below shows the high temperatures in Springville for one week.

High Temperatures

Day	Temperature (°F)
Monday	77
Tuesday	68
Wednesday	66
Thursday	73
Friday	77
Saturday	74
Sunday	?

The highest temperature for the week occurred on Sunday. If the range of high temperatures for the week was 13°F, what was the high temperature on Sunday?

A 79°F

B 81°F

C 87°F

D 90°F

Answer Key: page 153

Question 53

Regina conducted a survey about the type of pet people prefer. The table below shows the results of the survey.

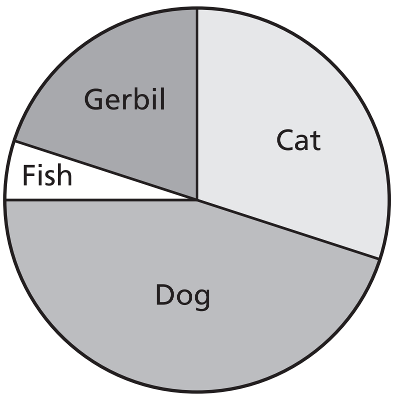
Favorite Pets

Type of Pet	Number of People
Cat	30
Dog	45
Fish	5
Gerbil	20

Which circle graph correctly displays this information?

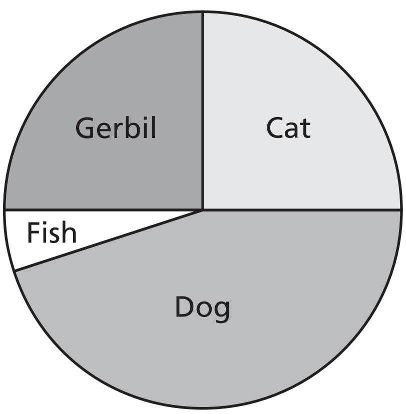
A

Favorite Pets



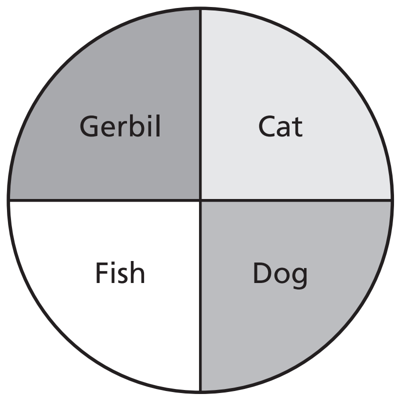
B

Favorite Pets



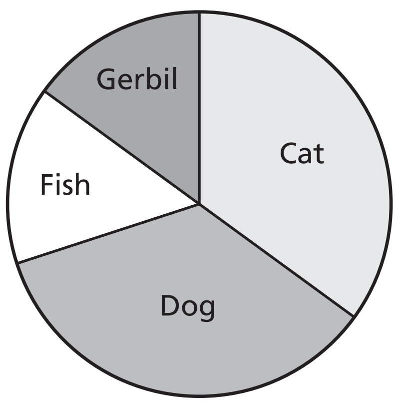
C

Favorite Pets



D

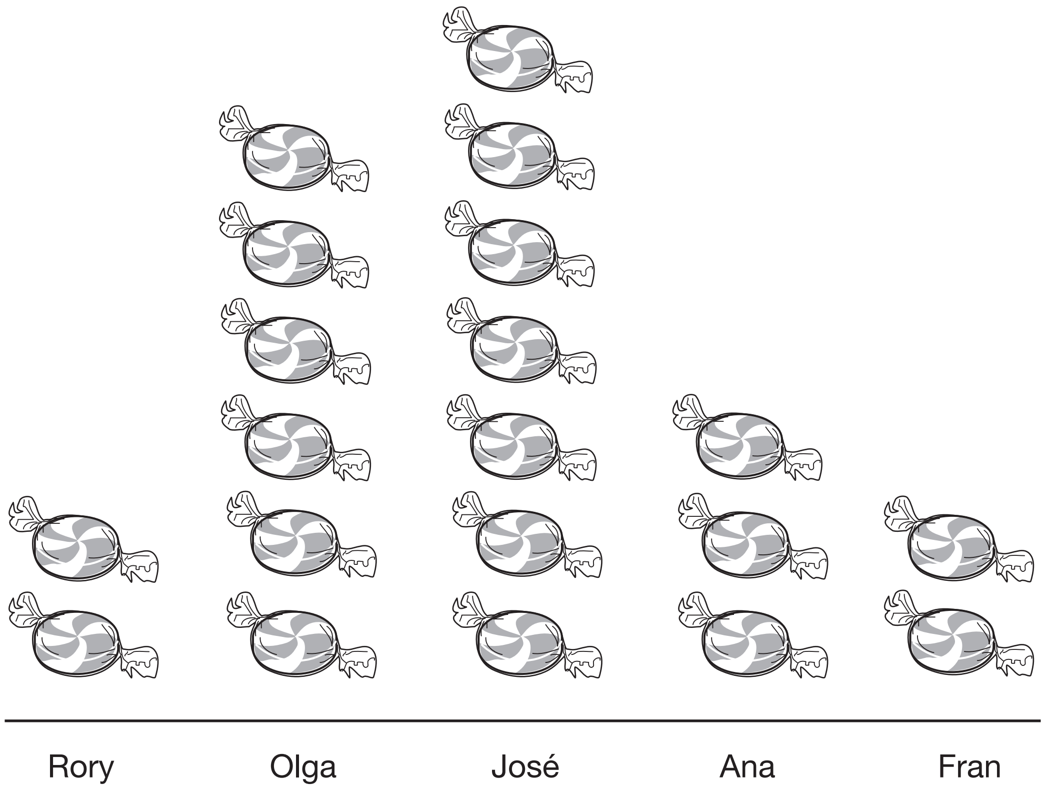
Favorite Pets



Answer Key: page 153

Question 54

The diagram below shows the number of pieces of hard candy that Rory and his 4 friends each had as they left a party.



What is the mean number of pieces of candy that these 5 friends had as they left the party?

A 2

B 4

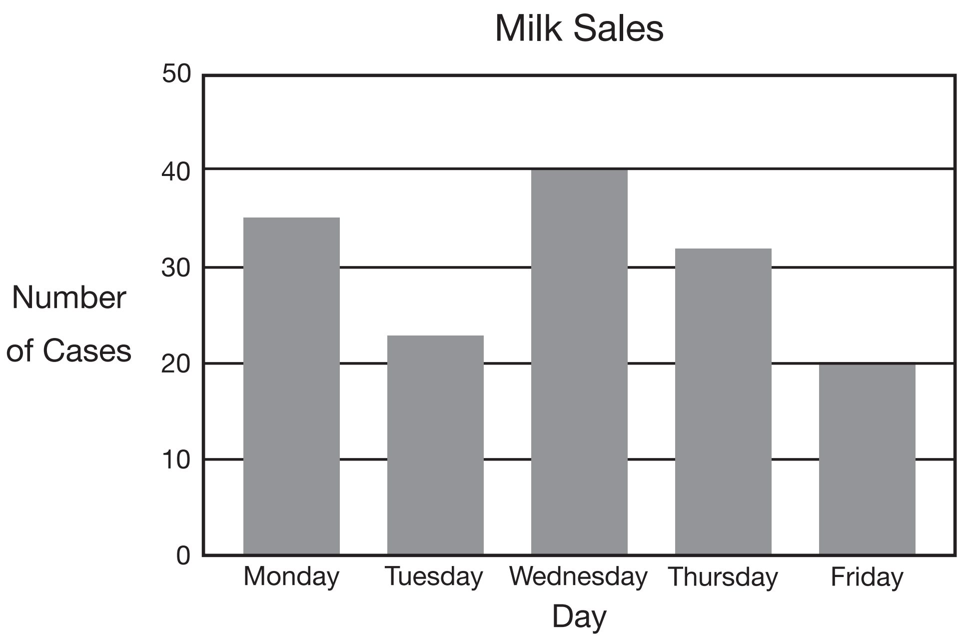
C 3

D 5

Answer Key: page 153

Question 55

The bar graph below shows the number of cases of milk B & B Dairy sold each day for five days.



Between which two days did the numbers of cases of milk sold differ the most?

A Monday and Tuesday

B Wednesday and Friday

C Wednesday and Thursday

D Thursday and Friday

Answer Key: page 153

Objective 6

The student will demonstrate an understanding of the mathematical processes and tools used in problem solving.

For this objective you should be able to

- apply mathematics to everyday experiences and activities;
- communicate about mathematics; and
- use logical reasoning.

How Can You Use Mathematics to Solve Everyday Problems?

Many situations in everyday life involve mathematics. For example, you might use math to determine whether you have enough money to buy several items from a list or to estimate how long it will take you to walk to a movie theater.

Solving problems involves more than just numerical computation; logical reasoning and careful planning also play important roles. Here are some steps to follow when solving problems:

- <u>Understand the problem.</u> Organize the information you are given and identify exactly what you must find. You may need information that is not given in the problem, such as a formula. You may be given information that is not needed in order to solve the problem.
- <u>Make a plan.</u> After you have organized the information, decide how to use this information to find an answer. Think about the math concepts that apply to the situation. Identify the order in which you will find new information and the formulas or equations you will use to find it.
- <u>Carry out the plan.</u> After you have chosen a problem-solving strategy, use the strategy to work toward a solution to the problem. Go step-by-step through your plan, writing down important information at each step.
- <u>Check to see whether your answer is reasonable.</u> Check to see whether your answer makes sense. Does it answer the question asked? Is it stated in the correct units? Is it reasonable? You can estimate the solution and then compare the estimate to your answer. They should be approximately equal.

A ranch worker is building a wooden fence. He needs 24 nails for each fence post, and there are 140 fence posts. If each box of nails holds 250 nails, how many boxes of nails does the ranch worker need to buy?

Understand the problem.

- What do you want to know?

  The number of boxes of nails to buy
- What do you already know?

  24 nails per fence post

  140 fence posts

  250 nails per box

Make a plan.

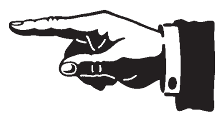
- Multiply the number of fence posts by the number of nails per fence post to find the total number of nails the ranch worker needs.
- Divide the total number of nails by the number of nails per box to find the number of boxes he needs to buy.

Carry out the plan.

- $24 \cdot 140 = 3{,}360$
- $3{,}360 \div 250 = 13$ R110
- The whole-number part of the quotient tells you that the ranch worker will need 13 whole boxes of nails. The remainder tells you that he will also need an additional 110 nails. Since the ranch worker cannot buy part of another box, he will need to buy 14 boxes of nails to have enough.

Check to see whether your answer is reasonable.

- If the ranch worker purchases only 13 whole boxes of nails, he will be short 110 nails. He needs to buy 14 boxes of nails to be sure he has enough.



Do you see that . . .

Try It

Gloria is repainting the walls in her bedroom. Two of the walls are 9 feet long and 8 feet high, and the other two walls are 13 feet long and 8 feet high. One quart of paint will cover about 120 square feet of wall space. Write an equation that can be used to find *p*, the number of quarts of paint Gloria needs to buy.

Gloria is painting _______ walls.

Two walls measure _______ ft by _______ ft.

The other two walls measure _______ ft by _______ ft.

The area of a rectangle is equal to its ______________ multiplied by its ______________ .

One quart of paint will cover _______ square feet of wall space.

Use the operation of __________________ to represent the area of each wall.

Use the operation of __________________ to represent the total area of all four walls. Use the operation of __________________ to find the number of quarts of paint needed.

The area of each smaller wall can be represented by

_______ • _______ .

The total area of the two smaller walls can be represented by

2(_______ • _______).

The area of each larger wall can be represented by

_______ • _______ .

The total area of the two larger walls can be represented by

2(_______ • _______).

The total area of all four walls can be represented by

2(_______ • _______) + 2(_______ • _______).

The number of quarts of paint needed, p, can be found using this equation:

$$p = \frac{2(\square \cdot \square) + 2(\square \cdot \square)}{\square}$$

Gloria is painting 4 walls. Two walls measure 9 ft by 8 ft, and the other two walls measure 13 ft by 8 ft. The area of a rectangle is equal to its length multiplied by its width. One quart of paint will cover 120 square feet of wall space. Use multiplication to represent the area of each wall. Use addition to represent the total area. Use division to find the number of quarts of paint needed. The area of each smaller wall is $9 \cdot 8$. The total area of two of them is $2(9 \cdot 8)$. The area of each larger wall is $13 \cdot 8$. The total area of two of them is $2(13 \cdot 8)$. The total area of all four walls can be represented by $2(9 \cdot 8) + 2(13 \cdot 8)$.

$$p = \frac{2(9 \cdot 8) + 2(13 \cdot 8)}{120}$$

What Is a Problem-Solving Strategy?

A **problem-solving strategy** is a plan for solving a problem. Different strategies work better for different types of problems. Sometimes you can use more than one strategy to solve a problem. As you practice solving problems, you will discover which strategies you prefer and which work best in various situations.

Some problem-solving strategies include

- drawing a picture;
- looking for a pattern;
- guessing and checking;
- acting it out;
- making a table;
- working a simpler problem; and
- working backwards.

One way to solve a problem is to make a table. Organizing data in a table can help you find the information you are looking for. Look for patterns in the data.

A scientist fills a balloon with a gas. As the gas is heated, the balloon expands in proportion to the temperature of the gas. The table below shows the measurements the scientist recorded.

Balloon Measurements

Volume (cm^3)	Temperature (°C)
125	25
150	30
V	35

Write a proportion that can be used to find V, the volume of the balloon when the temperature is 35°C.

- Write a ratio that compares a known volume to a known temperature.

$$\frac{\text{volume}}{\text{temperature}} = \frac{125}{25}$$

- Write a ratio that compares the unknown volume to the temperature 35°C.

$$\frac{\text{volume}}{\text{temperature}} = \frac{V}{35}$$

- The volume of the balloon is proportional to the temperature of the gas. Write a proportion setting these two ratios as equal.

The following proportion can be used to find the value of V, the volume of the balloon when the temperature is 35°C:

$$\frac{125}{25} = \frac{V}{35}$$

Joel is buying hot dogs and hot-dog buns for a school picnic. Hot dogs are sold in packages of 12, and buns are sold in packages of 10. What is the least number of packages Joel can buy in order to have an equal number of hot dogs and hot-dog buns?

- The number of hot dogs Joel buys depends on the number of packages he buys. Make a table to see the pattern.

Hot Dogs

Number of Packages	Number of Hot Dogs
1	12
2	24
3	36

The number of hot dogs Joel buys will be a multiple of 12.

- The number of hot-dog buns Joel buys also depends on the number of packages he buys. Make a table to see the pattern.

Hot-Dog Buns

Number of Packages	Number of Buns
1	10
2	20
3	30

The number of hot-dog buns Joel buys will be a multiple of 10.

- To find an equal number of hot dogs and hot-dog buns, look for a common multiple of 12 and 10.

Multiples of 12: 12, 24, 36, 48, 60, 72, 84, …
Multiples of 10: 10, 20, 30, 40, 50, 60, 70, 80, …

- The least common multiple of 12 and 10 is 60.
- If Joel buys 5 packages of hot dogs, he will have $5 \cdot 12 = 60$ hot dogs.
- If Joel buys 6 packages of buns, he will have $6 \cdot 10 = 60$ buns.

The least numbers of packages Joel can buy in order to have an equal number of hot dogs and buns are 5 packages of hot dogs and 6 packages of buns.

Another problem-solving strategy is to work backwards. Start with what you know and work backwards to find the answer.

Melissa wants to see a movie with her friend Gillian. The movie starts at 3:15 P.M., and they want to get to the theater 10 minutes early to buy tickets. It will take Melissa 10 minutes to ride her bike to Gillian's house and twice that time for the girls to ride from Gillian's house to the movie theater. What time should Melissa leave her house?

Identify the steps you would take to solve this problem logically. Begin with the starting time of the movie, 3:15 P.M., and work backwards.

- Find the time the girls need to arrive at the theater.

  Ten minutes before 3:15 P.M. is 3:05 P.M.

- Find the time they need to leave Gillian's house. Multiply 10 minutes by 2 to find the number of minutes needed to ride from Gillian's house to the theater.

  Twenty minutes before 3:05 P.M. is 2:45 P.M.

- Find the time Melissa needs to leave her house.

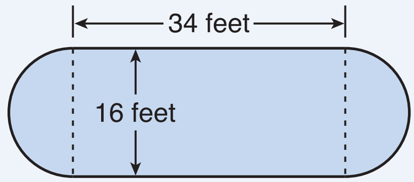
  Ten minutes before 2:45 P.M. is 2:35 P.M.

Melissa needs to leave her house at 2:35 P.M.

Objective 6

Sometimes solving a simpler problem can help you solve a more difficult problem.

The diagram shows a swimming pool in the shape of a rectangle with semicircular ends.

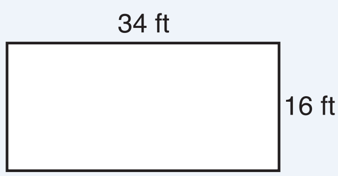


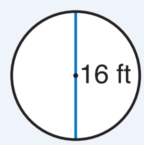
Write an equation that can be used to find A, the approximate area of the pool.

By looking closely at the pool, you can see that it consists of a rectangle and two semicircles of equal size.

One way to find the area of the pool is to solve two simpler problems.

- Find the area of the rectangle.
- Find the area of the circle equal to the sum of the areas of the two semicircles.
- Add the area of the rectangle and the area of the circle to represent the total area of the pool.





Area of rectangle $= lw$

Area of rectangle $= 34 \cdot 16$

Area of circle $= \pi r^2$

The radius is equal to the diameter divided by 2.

$r = 16 \div 2 = 8$

Use 3 to approximate the value of π.

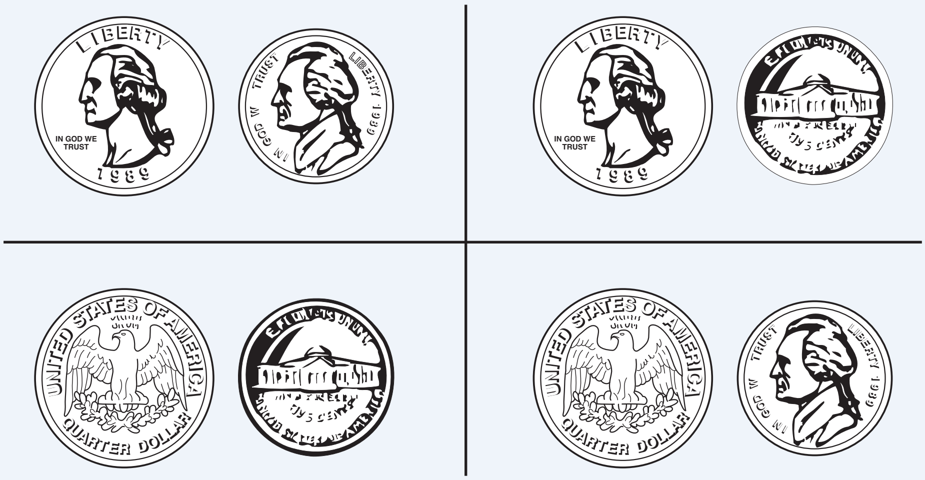
Area of circle $\approx 3 \cdot 8^2$

The equation $A \approx (34 \cdot 16) + (3 \cdot 8^2)$ can be used to find the approximate area of the pool.

Some problems can be solved by acting them out. To act out a problem means to perform or model the actions in the problem.

Marco tosses two coins, a quarter and a nickel. Write a proportion that can be used to find p, the percent of times Marco can expect both coins to land heads up.

- You can act out this problem by using two actual coins. Take a quarter and a nickel and turn them over one at a time until you have listed all the possible outcomes of tossing both coins.



- There are four possible outcomes to this experiment: both coins land heads up; the quarter lands heads up and the nickel lands tails up; both coins land tails up; or the quarter lands tails up and the nickel lands heads up.
- Only one of these outcomes—both coins land heads up—is a favorable outcome. The probability of both coins landing heads up is the ratio of the number of favorable outcomes to the number of possible outcomes: $\frac{1}{4}$.
- A percent is a ratio that compares a number to 100. Find the number of favorable outcomes for every 100 possible outcomes.
- Represent p, the percent of favorable outcomes, in a ratio.

$$\frac{p}{100}$$

- Write a proportion using these two ratios.

$$\frac{p}{100} = \frac{1}{4}$$

The proportion $\frac{p}{100} = \frac{1}{4}$ can be used to find p, the percent of times Marco can expect both coins to land heads up.

Try It

Ms. Meyer is purchasing tickets for a class trip to an art museum. She has $200 in the class-trip fund. The table below shows the cost of various numbers of tickets.

Museum Tickets

Number of Tickets	Cost (dollars)
3	21
5	35
8	56
n	

Does Ms. Meyer have enough money in the fund to purchase tickets for 20 students?

One way to solve this problem is to look for a pattern in the table. Use that pattern to write an expression for the cost of *n* tickets.

Look at the cost of 3 tickets.

Use the operation of ____________ to find the cost per ticket.

$$\$\_\_\_\_\_\_ \div 3 = \$\_\_\_\_\_\_$$

Use the cost per ticket to find the cost of 5 tickets.

$$\$\_\_\_\_\_\_ \cdot 5 = \$\_\_\_\_\_\_$$

This value is in the table.

Use the cost per ticket to find the cost of 8 tickets.

$$\$\_\_\_\_\_\_ \cdot 8 = \$\_\_\_\_\_\_$$

This value is in the table.

The pattern in the table is to multiply the number of tickets by $______ to find the total cost.

The expression ______ can be used to represent the total cost of *n* museum tickets.

There are 20 students in the class. Write an equation using the expression to find the total amount of money needed to purchase tickets for the class.

$$\$\_\_\_\_\_\_ \cdot \_\_\_\_\_\_ = \$\_\_\_\_\_\_$$

This total is ________ than $200. Ms. Meyer ________ have enough money in the class-trip fund to purchase the museum tickets.

Use division to find the cost per ticket: $21 ÷ 3 = $7. Use the cost per ticket to find the cost of 5 and 8 tickets: $7 • 5 = $35; $7 • 8 = $56. The pattern in the table is to multiply the number of tickets by $7 to find the total cost. The expression 7*n* can be used to represent the total cost of *n* museum tickets. The total amount of money needed is $7 • 20 = $140. This total is less than $200. Ms. Meyer does have enough money in the class-trip fund to purchase the museum tickets.

How Do You Change Words into Math Language and Symbols?

An important part of solving many problems is rewriting them with math language and symbols. The words used in the problem will give you clues about what operations to use.

Paul has 16 quarters, 5 dimes, and 14 nickels. Write an equation that can be used to find m, the total amount of money he has in cents.

- First multiply the number of each type of coin by that coin's value.

  Total value of Paul's quarters = 16(25)

  Total value of Paul's dimes = 5(10)

  Total value of Paul's nickels = 14(5)

- Then add the total values of each type of coin to find the total amount of money.

  m = total value of quarters + total value of dimes + total value of nickels

  $m = 16(25) + 5(10) + 14(5)$

So, the equation $m = 16(25) + 5(10) + 14(5)$ can be used to find the total amount of money Paul has in cents.

Try It

Gina, Marie, and Todd bought their parents a cake, flowers, and a picture frame for their anniversary. The cake cost \$18, the flowers cost \$27, and the picture frame cost \$12. These costs were split equally by the 3 children. Write an equation that can be used to find c, the amount each child spent on the gifts.

Use the operation of ______________ to find the total cost of the gifts.

The expression ________ + _________ + _________ can be used to find the total cost of the gifts.

Use the operation of _______________ to find the amount spent by each child.

The equation that can be used to find c, the amount each child spent on the gifts, is as follows:

c = (______ + ______ + ______) ÷ ______

Use the operation of addition to find the total cost of the gifts. The expression 18 + 27 + 12 can be used to find the total cost of the gifts. Use the operation of division to find the amount spent by each child. The equation that can be used to find c, the amount each child spent on the gifts, is $c = (18 + 27 + 12) \div 3$.

How Can You Use Logical Reasoning as a Problem-Solving Tool?

Logical reasoning is thinking of something in a way that makes sense. Thinking about mathematics problems involves logical reasoning.

You can use logical reasoning to find patterns in a set of data. You can then use those patterns to draw conclusions about the data that can be used to solve problems.

Finding patterns involves identifying characteristics that numbers or objects have in common. Look for the pattern in different ways.

A sequence of geometric objects may have some property in common. For example, they may all be quadrilaterals or all have right angles.

Look at the set of ordered pairs below.

$$\{(1, 1),\ (2, 4),\ (3, 9),\ (4, 16),\ \ldots\}$$

Which of the following would not belong in this set?

$$(9, 81),\ (7, 49),\ (11, 22)$$

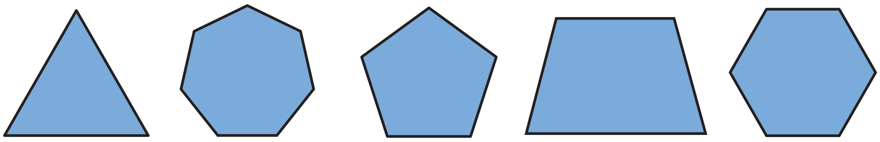
In the given set, the y-coordinate of each ordered pair is the square of the x-coordinate of that ordered pair.

x	Process	y
1	$1^2 = 1 \cdot 1 = 1$	1
2	$2^2 = 2 \cdot 2 = 4$	4
3	$3^2 = 3 \cdot 3 = 9$	9
4	$4^2 = 4 \cdot 4 = 16$	16
9	$9^2 = 9 \cdot 9 = 81$	81
7	$7^2 = 7 \cdot 7 = 49$	49
11	$11^2 = 11 \cdot 11 = 121$	22

The square of 11 is 121, not 22. The ordered pair (11, 22) does not follow this pattern. It does not belong in this set.

Try It

Look at the figures below.



Which figure does not belong in this set?

The figures are all ________________ .

They are all closed plane figures with ______________ sides.

The first figure appears to have 3 ________________ sides.

The second figure appears to have 7 ________________ sides.

The third figure appears to have 5 ________________ sides.

The fourth figure appears to have 4 ________________ sides.

The fifth figure appears to have 6 ________________ sides.

All the figures except the ________________ figure appear to have equal sides.

The ________________ figure does not belong in this set.

The figures are all polygons. They are all closed plane figures with straight sides. The first figure appears to have 3 equal sides. The second figure appears to have 7 equal sides. The third figure appears to have 5 equal sides. The fourth figure appears to have 4 unequal sides. The fifth figure appears to have 6 equal sides. All the figures except the fourth figure appear to have equal sides. The fourth figure does not belong in this set.

Now practice what you've learned.

Question 56

Janet and Martha jogged every day for 10 days. Each day the number of minutes Janet jogged was 1 minute less than the number of minutes Martha jogged. Which piece of information can help you find the total number of minutes Janet jogged in 10 days?

A The distances that the girls jogged

B The speed that each of the girls jogged

C The number of minutes Janet jogged in 1 day

D The number of minutes Martha jogged each of the 10 days

Answer Key: page 153

Question 57

Angela's car gets 25 miles per gallon of gasoline. Which statement is best supported by this information?

A The car can travel 400 miles on a tank of gasoline.

B If the car made a trip of 45 miles and another trip of 180 miles, it would use 9 gallons of gasoline.

C The car will get better mileage on the highway than in the city.

D The car will use 10 gallons of gasoline to travel 200 miles and 16 gallons to travel 400 miles.

Answer Key: page 153

Question 58

Mr. Jones wants to enclose his backyard with a fence. His backyard is rectangular in shape and measures 40 feet by 60 feet. The fencing costs $2 per foot. Which piece of information will NOT help you find the total cost to enclose Mr. Jones's backyard?

A The area of Mr. Jones's backyard

B The cost of the fencing per foot

C The lengths of the four sides of Mr. Jones's backyard

D The perimeter of Mr. Jones's backyard

Answer Key: page 153

Question 59

Henry is one of four students sharing a hotel room on a class trip. The total cost for the hotel room, which is shared equally by the four students, is $200. Henry spends an average of $11 on food each of the 5 days of the trip. He also spends $23 on souvenirs. What is the total amount in dollars and cents Henry spends on the trip?

Record your answer and fill in the bubbles. Be sure to use the correct place value.

				.		
0	0	0	0		0	0
1	1	1	1		1	1
2	2	2	2		2	2
3	3	3	3		3	3
4	4	4	4		4	4
5	5	5	5		5	5
6	6	6	6		6	6
7	7	7	7		7	7
8	8	8	8		8	8
9	9	9	9		9	9

Answer Key: page 153

Question 60

Arlen needs to purchase bags of fertilizer for 3 garden plots. Each bag of fertilizer covers 25 square feet of garden.

Arrange the problem-solving steps in the correct order for Arlen to find the total number of bags he needs to purchase to cover his garden plots.

Step M: Add the areas of the 3 garden plots.

Step N: Divide the total area by 25.

Step O: Find the area of each garden plot in square feet.

What list shows the steps in the correct order?

A M, N, O

B N, O, M

C O, M, N

D N, M, O

Answer Key: page 154

Question 61

At the store Bill buys 3 cans of soup for $1 each, 2 loaves of bread for $2 each, and a roast for $8. Bill pays for the groceries with a $20 bill. Which equation can be used to find *c*, the change in dollars and cents Bill should receive?

A $c = 20 - 1 - 2 - 8$

B $c = 20 - (3 \cdot 1) - (2 \cdot 2) - 8$

C $c = 20 - (3 + 1) - (2 + 2) - 8$

D $c = (12 \cdot 1) + (2 \cdot 2) + 8$

Answer Key: page 154

Question 62

Leah plans to cover the top of a table with small square tiles. The tabletop is a triangle with a base of 18 inches and a height of 24 inches. Which expression can be used to find the area of the tabletop surface?

A $\frac{1}{2}(18 \cdot 24)$

B $\frac{1}{2}(18 + 24)$

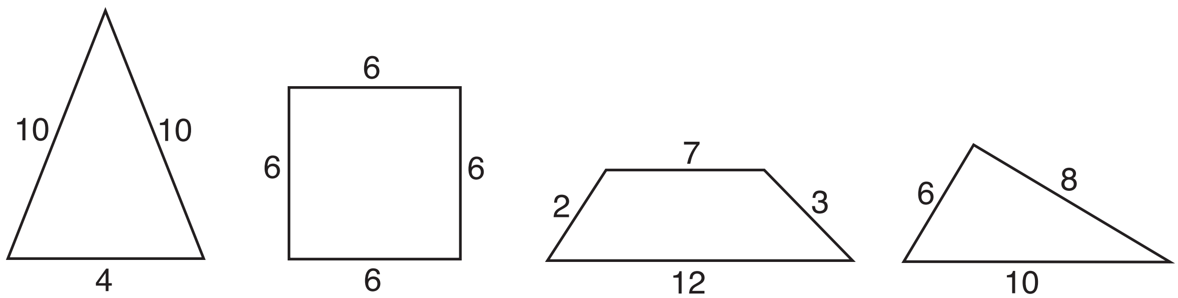
C $\frac{1}{2} + (18 \cdot 24)$

D $\frac{1}{2} + (18 + 24)$

Answer Key: page 154

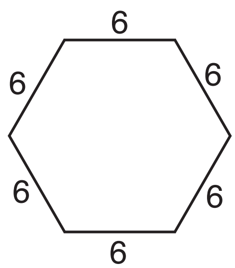
Question 63

The figures below have a common characteristic.

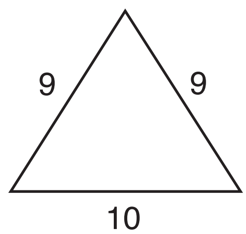


Which figure below could belong to this group?

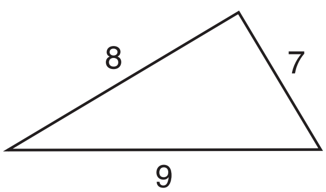
A



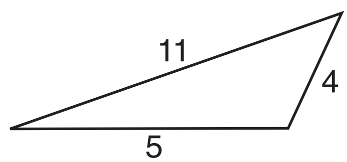
C



B



D



Answer Key: page 154

Question 64

A book is printed on large sheets of paper in such a way that 1 large sheet of paper becomes 8 pages in the book. Which of these could be the number of pages in a book printed in this way?

A 122

B 238

C 416

D 501

Answer Key: page 154

Mathematics Answer Key

Objective 1

Question 1 (page 50)

B Correct. Look at the values of the digits to help you compare and order the decimals. To determine which decimal is greatest, look at the numbers in a place-value chart.

Ones	.	Tenths	Hundredths	Thousandths
1	.	8	1	0
2	.	1	3	4
2	.	9	0	0
1	.	8	8	0

Look at the ones place. Two numbers have a 2 in the ones place. Since $2 > 1$, they are the greatest numbers. For these two numbers, look at the tenths place. Since $9 > 1$, the number 2.9 is greater than 2.134. The greatest number, 2.9, should be listed first, and 2.134 should be listed next.

Compare the remaining two numbers, 1.81 and 1.88. Both numbers have the same digits in the ones and the tenths places. For these two numbers, look to the hundredths place. Since $8 > 1$, the number 1.88 is greater than 1.81. The number 1.88 should be listed next, and 1.81 should be listed last.

Only choice B shows the numbers listed in the correct order.

Question 2 (page 50)

A Correct. According to the order of operations, if there are no parentheses, then the first operations to be performed are multiplication and division, beginning on the left side of the expression and working to the right side.

Question 3 (page 50)

C Correct. To compare fractions with different denominators, rewrite the fractions as equivalent fractions that have a common denominator.

The denominators are 3, 6, and 12. The least common multiple of these numbers is their least common denominator.

Multiples of 3: 3, 6, 9, 12, 18, …

Multiples of 6: 6, 12, 18, 24, 30, …

Multiples of 12: 12, 24, 36, 48, …

The least common multiple is 12.

Rewrite the fractions using 12 as their common denominator.

$$\frac{1 \cdot 4}{3 \cdot 4} = \frac{4}{12} \quad \frac{5}{12} \quad \frac{2 \cdot 4}{3 \cdot 4} = \frac{8}{12} \quad \frac{1 \cdot 2}{6 \cdot 2} = \frac{2}{12}$$

To compare fractions with a common denominator, compare their numerators.

Since $8 > 5 > 4 > 2$, the fractions written in order from greatest to least are as follows:

$$\frac{8}{12} \quad \frac{5}{12} \quad \frac{4}{12} \quad \frac{2}{12}$$

The simplified fractions in order from greatest to least are as follows:

$$\frac{2}{3} \quad \frac{5}{12} \quad \frac{1}{3} \quad \frac{1}{6}$$

The corresponding colors of marbles are green, blue, red, and white.

Green has the greatest fraction of polished marbles.

Question 4 (page 50)

C Correct. John made 25 out of the 30 free throws he attempted. The ratio of free throws made to free throws attempted is 25 to 30. Written as a fraction, this ratio is $\frac{25}{30}$. The answer choices do not include $\frac{25}{30}$.

Simplify the fraction.

To simplify the fraction, divide the numerator and denominator of the fraction by a common factor of 25 and 30.

Factors of 25: 1, 5, and 25

Factors of 30: 1, 2, 3, 5, 6, 10, 15, and 30

The greatest common factor is 5.

$$\frac{25 \div 5}{30 \div 5} = \frac{5}{6}$$

The ratio of free throws made to free throws attempted is $\frac{5}{6}$.

Question 5 (page 51)

D Correct. First find the fraction of students whose favorite pet is a dog. The numerator of the fraction is the number of students whose favorite pet is a dog, 15. The denominator of the fraction is the total number of students in the class, 25.

The fraction of students whose favorite pet is a dog is $\frac{15}{25}$.

Next find the decimal equivalent of this fraction. Rewrite the fraction as an equivalent fraction with a denominator of 100.

$$\frac{15 \cdot 4}{25 \cdot 4} = \frac{60}{100}$$

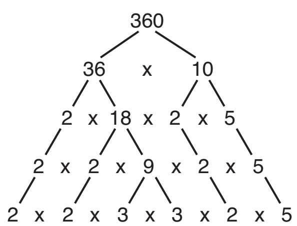
The fraction $\frac{60}{100}$ is equivalent to 0.60, or 0.6, and represents the fraction of students whose favorite pet is a dog.

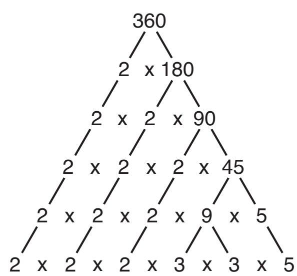
Question 6 (page 51)

A Correct. The temperature increased 26°F between 6 A.M. and noon. Since the temperature increased, use a "+" sign to represent the change: +26. The temperature decreased 19°F between noon and 9 P.M. Since the temperature decreased, use a "−" sign to represent the change: −19.

Question 7 (page 51)

C Correct. To find the prime factors of 360, use a factor tree. Pick a factor pair for 360. Since 360 ends in a zero, 10 is a factor. A good factor pair to begin with would be 36 • 10. A factor tree can also be started by using the first prime factor of the number, in this case 2 • 180. Continue to factor each number in the tree until all the factors are prime numbers. Look at the factor trees below.





The factors 2, 3, and 5 are all prime. Three factors are 2; two factors are 3; and one factor is 5. The prime factorization of 360 is 2 • 2 • 2 • 3 • 3 • 5.

Rewrite the factors using exponents.

$$2 \cdot 2 \cdot 2 = 2^3$$
$$3 \cdot 3 = 3^2$$

The prime factorization of 360 can also be written as $2^3 \cdot 3^2 \cdot 5$.

Question 8 (page 51)

C Correct. Find the greatest common factor of the numbers of jelly beans. List the factors of 36, 48, and 72.

Factors of 36: 1, 2, 3, 4, 6, 9, 12, 18, 36

Factors of 48: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

Factors of 72: 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72

The greatest number that appears in all three lists of factors is 12. The greatest common factor is 12.

The greatest number Earl can use to divide the jelly beans evenly is 12.

Question 9 (page 52)

A Correct. There are 60 stamps, so $\frac{60}{60}$, or 1, represents the whole from which fractional parts will be subtracted. Cheryl uses $\frac{1}{3}$ of the stamps to invite her friends. She uses $\frac{1}{5}$ of the stamps to invite her family. The part of the sheet of stamps Cheryl uses is the sum of the two fractions: $\frac{1}{3} + \frac{1}{5}$. This sum must be subtracted from the whole. Use the expression $1 - \left(\frac{1}{3} + \frac{1}{5}\right)$ to represent the fraction of the sheet of stamps Cheryl has left after mailing her invitations.

Question 10 (page 52)

C Correct. Add to find the total length of the pieces he cuts off.

$$\begin{aligned} 1\tfrac{3}{4} + 3\tfrac{3}{4} &= 4\tfrac{6}{4} \\ &= 4 + \tfrac{4}{4} + \tfrac{2}{4} \\ &= 4 + 1 + \tfrac{2}{4} \\ &= 5\tfrac{2}{4} \\ &= 5\tfrac{1}{2} \end{aligned}$$

Subtract the total length cut from 7 ft to find the length of board remaining. To do this, regroup. Rewrite 7 as $6\frac{2}{2}$ so that you have halves from which to subtract $\frac{1}{2}$.

$$\begin{array}{rcr} 7 & = & 6\tfrac{2}{2} \\ -\,5\tfrac{1}{2} & = & -\,5\tfrac{1}{2} \\ \hline & & 1\tfrac{1}{2} \end{array}$$

Louis has $1\frac{1}{2}$ feet of board left after he cuts off the two pieces.

Question 11 (page 52)

B Correct. Use subtraction to find Vince's bank balance after he took out \$13.92.

$$\begin{array}{r} \$13\overset{7}{\cancel{8}}.\overset{14}{\cancel{4}}5 \\ -\ \ 13.92 \\ \hline \$124.53 \end{array} \qquad \text{Remember to regroup.}$$

Use addition to find his bank balance after he put in \$27.23.

$$\begin{array}{r} \$1\overset{1}{2}4.53 \\ +\ \ 27.23 \\ \hline \$151.76 \end{array} \qquad \text{Remember to regroup.}$$

Vince now has \$151.76 in his bank account.

Question 12 (page 52)

A Correct. Joe's father drives 40 miles each hour. Express this as a rate.

$$\frac{40 \text{ mi}}{1 \text{ h}}$$

Find an equivalent ratio for 8 hours (1 workday). To change 1 workday to 8 hours, multiply by 8. Use the fraction $\frac{8}{8}$ to change the ratio so that 8 is the denominator.

$$\frac{40 \cdot 8}{1 \cdot 8} = \frac{320}{8}$$

Find an equivalent ratio for 5 days. Multiply 8 hours by 5 to find the number of hours in 1 workweek. Use the fraction $\frac{5}{5}$ to change the ratio so that 40 is the denominator.

$$\frac{320 \cdot 5}{8 \cdot 5} = \frac{1{,}600}{40}$$

Joe's father will drive 1,600 miles in 5 days.

Question 13 (page 53)

C Correct. Use division to separate the whole (5,000 stickers) into 5 equal parts.

5,000 stickers ÷ 5 grades = 1,000 stickers per grade

Use division to separate the whole (1,000 stickers per grade) into 125 equal parts.

1,000 stickers per grade ÷ 125 students per grade = 8 stickers per student

Each student will have to sell 8 bumper stickers.

Question 14 (page 53)

B Correct. The problem asks for a reasonable estimate of the total number of tiles needed. Round the numbers in the problem to estimate the answer.

To estimate the number of tiles needed in the kitchen, round the number of rows and the number of tiles in each row to the nearest 10.

Round 48 to the nearest 10. Since $8 > 5$, the number 48 rounds to 50.

Round 32 to the nearest 10. Since $2 < 5$, the number 32 rounds to 30.

Use multiplication to estimate the number of tiles needed in the kitchen.

$$50 \cdot 30 = 1{,}500$$

Bathroom tiles + kitchen tiles = total tiles needed

$$600 + 1{,}500 = 2{,}100$$

Mike will need about 2,100 tiles.

Objective 2

Question 15 (page 73)

A Incorrect. This ratio compares the number of throws that hit the bull's-eye (3) to the total number of throws (15). The ratio has been simplified to 1:5. It is the wrong comparison.

B Incorrect. This ratio compares the number of throws that do not hit the bull's-eye (12) to the number of throws that hit the bull's-eye (3). The ratio has been simplified to 4:1. It is the right comparison, but in the wrong order.

C Correct. The number of throws that hit the bull's-eye is 3. The number of throws that do not hit the bull's-eye is $15 - 3 = 12$. The ratio that compares the number of throws that hit the bull's-eye (3) to the number of throws that do not hit the bull's-eye (12) is 3:12. The ratio has been simplified to 1:4.

D Incorrect. This ratio compares the total number of throws (15) to the number of throws that hit the bull's-eye (3). The ratio has been simplified to 5:1. It is the wrong comparison.

Question 16 (page 73)

D Correct. Janet walked to school 36 school days. The total number of school days in the grading period was $36 + 6 = 42$. The ratio of days walked (36) to total number of days in the grading period (42) is 36 to 42. Written as a fraction, the ratio is $\frac{36}{42}$.

To find an equivalent ratio, simplify the fraction by dividing the numerator and denominator by 6.

$$\frac{36 \div 6}{42 \div 6} = \frac{6}{7}$$

The ratio that compares the number of days Janet walked to the total number of school days is 6:7.

Question 17 (page 73)

C Correct. A percent is a ratio that compares a number to 100. The ratio $\frac{76}{100}$ is equivalent to 76%. This ratio compares 76 questions answered correctly to 100 total questions. Simplify the ratio. An equivalent ratio can be found by dividing the numerator and denominator by 4.

$$\frac{76 \div 4}{100 \div 4} = \frac{19}{25}$$

The fraction $\frac{19}{25}$ is equivalent to 76%.

Question 18 (page 73)

B Correct. Ted borrowed 25% of Marie's pencils. A percent is a ratio that compares a number to 100. The percent 25% is equivalent to the fraction $\frac{25}{100}$.

Ted borrowed $\frac{25}{100}$ of Marie's pencils. The fraction $\frac{25}{100}$ is also equivalent to the decimal 0.25. They both are read as *twenty-five hundredths*. Ted borrowed 0.25 of Marie's pencils. The decimal 0.25 is equivalent to 25%.

Question 19 (page 74)

B Correct. The total amount of time José spends doing volunteer work is equivalent to 100%.

The percent of volunteer time José spends at the nursing home is 45%. The percent of volunteer time José spends tutoring is 100% minus the percent of volunteer time he spends at the nursing home.

$$100\% - 45\% = 55\%$$

The percent of volunteer time he spends tutoring is 55%. A percent is a ratio that compares a number to 100. The fraction $\frac{55}{100}$ is equivalent to 55%. José spends $\frac{55}{100}$ of his volunteer time tutoring. Simplify the ratio $\frac{55}{100}$. An equivalent ratio can be found by dividing both the numerator and denominator by 5.

$$\frac{55 \div 5}{100 \div 5} = \frac{11}{20}$$

The fraction $\frac{11}{20}$ is equivalent to 55%. José spends $\frac{11}{20}$ of his volunteer time tutoring.

Question 20 (page 74)

The correct answer is 12. One time is given in minutes; the other time is given in hours. To compare the times with a ratio, express them in the same unit: minutes.

$$\begin{aligned} 1\tfrac{1}{2} \text{ hours} &= 1 \text{ hour } 30 \text{ minutes} \\ &= 60 \text{ minutes} + 30 \text{ minutes} \\ &= 90 \text{ minutes} \end{aligned}$$

Represent the rate at which Lynn works. Lynn can paint 6 figures in 45 minutes. This ratio is 6 to 45.

Find an equivalent ratio in which the number of minutes is 90.

Let the variable m represent the number of figures Lynn can paint in 90 minutes.

Write a proportion that compares these two equivalent ratios.

$$\frac{6}{45} = \frac{m}{90}$$

To solve the proportion, set the cross products equal to each other.

$$6 \bullet 90 = 45 \bullet m$$

$$540 = 45m$$

Divide both sides of the equation by 45.

$$m = 12$$

Lynn can paint 12 figures in 90 minutes.

		1	2	.		
0	0	0	0		0	0
1	1	1	1		1	1
2	2	2	2		2	2
3	3	3	3		3	3
4	4	4	4		4	4
5	5	5	5		5	5
6	6	6	6		6	6
7	7	7	7		7	7
8	8	8	8		8	8
9	9	9	9		9	9

Question 21 (page 74)

C Correct. The question asks which proportion you can use to find y, the total number of chocolate cookies.

Write a ratio that shows 4 chocolate cookies for every 3 vanilla cookies. This ratio is 4:3, or $\frac{4}{3}$.

Write a ratio that shows y, the total number of chocolate cookies. There are a total of 24 vanilla cookies in the jar. This ratio is y:24, or $\frac{y}{24}$.

To find the proportion, set the two ratios as equal. The proportion $\frac{4}{3} = \frac{y}{24}$ can be used to find the total number of chocolate cookies in the jar.

Question 22 (page 74)

C Correct. Each y-value is 8 more than its corresponding x-value.

x	$x + 8 = y$	y
4	$4 + 8 = 12$	12
13	$13 + 8 = 21$	21
22	$22 + 8 = 30$	30
51	$51 + 8 = 59$	59

The equation that represents the y-values in terms of the x-values is $y = x + 8$.

Question 23 (page 75)

B Correct. Evaluate the expression $2m + 3$ by replacing the variable m with the ages of the tree in the table.

Age	$2m + 3$	Height
1	$2(1) + 3$	5
3	$2(3) + 3$	9
6	$2(6) + 3$	15
10	$2(10) + 3$	23

The expression $2m + 3$ can be used to find the height of the tree in terms of its age.

Question 24 (page 75)

C Correct. Michelle starts with 25 CDs. She gives 2 friends 4 CDs each. This decreases the number of CDs she has.

$$25 - (2 \cdot 4)$$

She gets 3 CDs for her birthday. This increases the number of CDs she has.

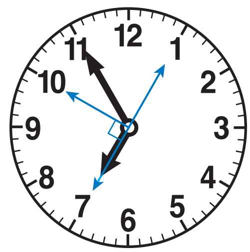
$$25 - (2 \cdot 4) + 3$$

The equation $x = 25 - (2 \cdot 4) + 3$ can be used to find the number of CDs Michelle has now.

Objective 3

Question 25 (page 84)

A Correct. An obtuse angle measures more than 90° but less than 180°. The angle shown on the clock is greater than 90°, but less than 180°. It is obtuse.



Question 26 (page 84)

D Correct. An acute angle measures more than 0° but less than 90°. Angle P is acute.

Question 27 (page 84)

B Correct. The sum of the measures of the three angles of a triangle always equals 180°. Add the measures of angles X and Z.

$$49^\circ + 41^\circ = 90^\circ$$

To find the measure of $\angle Y$, subtract the sum, 90°, from 180°.

$$180^\circ - 90^\circ = 90^\circ$$

Angle Y has a measure of 90°.

A right angle has a measure of 90°. Therefore, angle Y is a right angle.

Question 28 (page 84)

D Correct. The sum of the measures of the three angles of a triangle always equals 180°. In choice D, $40^\circ + 50^\circ + 90^\circ = 180^\circ$.

Question 29 (page 85)

B Correct. A quadrilateral has 360 degrees. Subtracting the other three angle measures will give you the measure of $\angle R$. $360 - 73 - 105 - 52 = 130$. The measure of $\angle R$ is 130°.

Question 30 (page 85)

C Correct. Since $\angle P$ is congruent to $\angle R$ and $m\angle P = 35°$, then $m\angle R = 35°$. The sum of the measures of $\angle P$ and $\angle R$ is $35° + 35° = 70°$.

The sum of the measures of all the angles of a triangle always equals 180°. To find the measure of $\angle Q$, subtract 70° from 180°.

$$180° - 70° = 110°$$

The measure of $\angle Q$ is 110°.

Question 31 (page 85)

C Correct. The length of the radius of a circle is $\frac{1}{2}$ the length of the diameter of the circle. To calculate the length of the radius of a circle, multiply the length of its diameter by $\frac{1}{2}$. The length of radius of a circle with a diameter of 48 can be found by calculating the value of the expression $48 \div 2$.

Question 32 (page 85)

C Correct. The formula for the circumference of a circle is $C = \pi d$. If the radius is 3 feet, the diameter is 2 times 3, or 6, feet. Roy can find the circumference by using the expression $\pi \cdot 6$, which can also be written as 6π.

Question 33 (page 86)

C Correct. Each line on the grid represents 1 unit. Point T is 3 units to the right of the origin. Its x-coordinate is 3. Point T is 2 units above the origin. Its y-coordinate is 2. The coordinates of point T are (3, 2).

Question 34 (page 86)

B Correct. One vertex of the rectangle has the coordinates $(2\frac{1}{2}, 5)$.

Find how far the point $(6\frac{1}{2}, 5)$ is from the point $(2\frac{1}{2}, 5)$. Since $2\frac{1}{2} + 4 = 6\frac{1}{2}$, the point is 4 units to the right of $(2\frac{1}{2}, 5)$.

Find how far the point $(6\frac{1}{2}, 8)$ is from the point $(6\frac{1}{2}, 5)$. Since $8 - 5 = 3$, the point is 3 units above $(6\frac{1}{2}, 5)$.

Find how far the point $(2\frac{1}{2}, 8)$ is from the point $(6\frac{1}{2}, 8)$. Since $6\frac{1}{2} - 2\frac{1}{2} = 4$, the point is 4 units to the left of $(6\frac{1}{2}, 8)$.

Find how far the point $(2\frac{1}{2}, 5)$ is from the point $(2\frac{1}{2}, 8)$. Since $8 - 5 = 3$, the point is 3 units below $(2\frac{1}{2}, 8)$.

These coordinates form a rectangle that has one pair of sides of 4 units long and the other pair of sides of 3 units long.

Objective 4

Question 35 (page 100)

B Correct. Since the problem asks for an approximate answer, round the numbers before calculating. Round 62 to 60.

Subtract to find the distance in inches between the top of the player's head and the basketball hoop.

$$120 - 60 = 60$$

The top of the player's head is approximately 60 inches below the hoop.

There are 12 inches in 1 foot. Divide by 12 to convert inches to feet.

$$60 \div 12 = 5$$

The top of the player's head is about 5 feet below the hoop.

Question 36 (page 100)

A Correct. The amount of time between 10:00 A.M. and 3:00 P.M. is 5 hours.

To find the increase in temperature, multiply the number of hours by the rate the temperature is increasing.

$$5 \cdot 4 = 20$$

The temperature will increase 20°F.

Add the increase in temperature to the 10:00 A.M. temperature to find the 3:00 P.M. temperature.

$$51°F + 20°F = 71°F$$

The temperature at 3:00 P.M. will be 71°F.

Question 37 (page 100)

C Correct. The perimeter of a polygon is the sum of the lengths of all its sides.

Find the sum of the given lengths.

$$6 + 6 + 12 + 24 + 24 + 18 + 6 = 96$$

Subtract this sum from the perimeter to find x.

$$108 - 96 = 12$$

The missing length is 12 units, or $x = 12$ units.

Question 38 (page 101)

C Correct. Find the perimeter of the drawing in inches.

Measure the length and the width of the drawing in inches.

Length: 2 inches

Width: 1 inch

The formula for the perimeter of a rectangle is $P = 2(l + w)$. Substitute the variables.

$$P = 2(2 + 1)$$
$$P = 2(3)$$
$$P = 6$$

Use the scale for the drawing to find the actual perimeter in feet.

The scale states that 1 inch on the drawing equals 10 feet.

Multiply the perimeter of the drawing by 10 to find the actual garden's perimeter.

$$6 \cdot 10 = 60$$

The perimeter of the garden is 60 feet.

Question 39 (page 101)

C Correct. First add to find the total number of minutes.

$$53 + 27 + 36 = 116$$

Michael spent 116 minutes doing chores.

Next change 116 minutes to hours and minutes. There are 60 minutes in 1 hour. Divide the number of minutes by 60 to find the number of hours.

$$116 \div 60 = 1 \text{ R}56$$

The whole-number part of the answer shows the number of hours, and the remainder shows the number of minutes.

$$116 \text{ minutes} \div 60 \text{ minutes per hour} = 1 \text{ hour } 56 \text{ minutes}$$

Michael spent 1 hour 56 minutes doing chores.

Question 40 (page 102)

B Correct. One ray of $\angle R$ is lined up with 50° on the outer scale. The other ray crosses the protractor at 150° on the outer scale.

$$150° - 50° = 100°$$

The measure of $\angle R$ is 100°.

Question 41 (page 102)

D Correct. Use the protractor to find the measure of $\angle M$. One ray of $\angle M$ is lined up with 0° on the inner scale. The other ray crosses the protractor at 50° on the inner scale. The measure of $\angle M$ is 50°. Since $m\angle M$ is equal to $m\angle N$, the measure of $\angle N$ is 50°. Therefore, the measure of $\angle P$ is 180° – 100°, or 80°.

Question 42 (page 103)

C Correct. First change 5 gallons to quarts. There are 4 quarts in 1 gallon. Multiply by 4 to find the number of quarts in 5 gallons.

$$5 \cdot 4 = 20$$

There are 20 quarts in 5 gallons.

Next change 20 quarts to pints. There are 2 pints in 1 quart. Multiply by 2 to find the number of pints in 20 quarts.

$$20 \cdot 2 = 40$$

There are 40 pints in 20 quarts.

Then change 40 pints to cups. There are 2 cups in 1 pint. Multiply by 2 to find the number of cups in 40 pints.

$$40 \cdot 2 = 80$$

There are 80 cups in 40 pints.

Five gallons is equivalent to 80 cups.

Question 43 (page 103)

C Correct. First add to find the total number of yards he carried the ball.

$$34 + 28 + 41 = 103$$

Miguel carried the ball a total of 103 yards.

Next change 103 yards to feet. There are 3 feet in 1 yard. Multiply by 3 to find the number of feet.

$$103 \cdot 3 = 309$$

Miguel carried the ball a total of 309 feet.

Question 44 (page 103)

B Correct. Measure the length and the width of the rectangle in inches.

Length: 3 inches

Width: 2 inches

The formula for the area of a rectangle is $A = lw$.

$$A = (3)(2)$$
$$A = 6$$

The area of the rectangle is 6 square inches.

Objective 5

Question 45 (page 122)

A Incorrect. This choice displays a sample space that combines cereal with cereal and milk with milk.

B Correct. This tree diagram shows that rice cereal can be served with skim milk or whole milk, that corn cereal can be served with skim milk or whole milk, and that wheat cereal can be served with skim milk or whole milk. There are six different outcomes.

C Incorrect. This choice displays a sample space that includes two types of milk and three types of cereal, but it is not organized correctly.

D Incorrect. This choice displays a sample space that includes two types of milk and three types of cereal, but it is not organized correctly.

Question 46 (page 123)

B Correct. This list shows that large shirts are available in either yellow or orange, that medium shirts are available in either yellow or orange, and that small shirts are available in either yellow or orange. There are six possible outcomes.

Question 47 (page 123)

D Correct. A favorable event for this experiment is to select an even-numbered tile. The bag contains 5 even-numbered tiles: 2, 4, 6, 8, and 10. Therefore, there are 5 favorable outcomes. There are 11 tiles in all, which means that there are 11 possible outcomes. The probability of selecting an even-numbered tile is $\frac{5}{11}$.

Question 48 (page 123)

D Correct. If Marcus does not get a blue gumball, he will get either a pink or a white gumball. There are 3 pink gumballs and 1 white gumball. Therefore, there are 4 favorable outcomes. There are 10 possible outcomes because there are 10 gumballs in all. The probability that Marcus will not get a blue gumball is $\frac{4}{10}$, which simplifies to $\frac{2}{5}$.

Question 49 (page 124)

A Correct. This is the only line plot in which the numbers in the table match the number of Xs on the line plot. For example, there were 5 students who drink 2 bottles of water a day, so there should be 5 Xs over the 2 on the line plot.

Question 50 (page 125)

A Correct. Each picture of a sandwich represents 5 sandwiches. The pictograph shows that 20 sandwiches were made on Monday, 20 were made on Tuesday, 10 were made on Wednesday, 35 were made on Thursday, and 15 were made on Friday. These values match the values in the table.

B Incorrect. Each section of this circle graph is the same size, so this graph indicates that the same number of sandwiches were made each day. The table, however, shows that a different number of sandwiches were made on nearly all of those days.

C Incorrect. This bar graph shows that the cafeteria made 15 sandwiches on Thursday and 35 sandwiches on Friday. These values do not match the ones in the table. They have been switched.

D Incorrect. This line graph shows that the cafeteria made 35 sandwiches on Wednesday and 10 sandwiches on Thursday. These values do not match the ones in the table. They have been switched.

Question 51 (page 126)

B Correct. The median of a set of data is the middle value when the data are listed in order. The ages listed in order are as follows:

8, 8, 9, 9, 9, 10, 11, 11, 11, 12, 12, 12, 12

The middle value in this list is 11, so the median of the students' ages is 11.

Question 52 (page 126)

A Correct. The range is the difference between the highest and lowest temperatures. The lowest temperature listed in the table is 66°F. Because the range is 13°F, the highest temperature for the week must be 13°F higher than 66°F.

$$13°F + 66°F = 79°F$$

The high temperature on Sunday must have been 79°F.

Question 53 (page 127)

A Correct. According to the table, the order of preference of animals is dog, cat, gerbil, and fish. In order from largest to smallest, the sections of this graph are "Dog," "Cat," "Gerbil," and "Fish." This graph matches the values in the table.

B Incorrect. This graph shows that the numbers of people who prefer gerbils and who prefer cats are equal. The table, however, shows that more people prefer cats than prefer gerbils. This graph does not match the values in the table.

C Incorrect. This graph shows that the numbers of people who prefer different pets are equal. The table shows that different numbers of people prefer each type of pet. This graph does not match the values in the table.

D Incorrect. This graph shows that the numbers of people who prefer dogs and who prefer cats are equal. The table, however, shows that more people prefer dogs than prefer cats. The graph also shows that the numbers of people who prefer gerbils and who prefer fish are equal. The table, however, shows that more people prefer gerbils than prefer fish. This graph does not match the values in the table.

Question 54 (page 128)

A 2 is the most common value, which is called the mode, not the mean.

B Correct.

C 3 is the median, the middle number of the set of numbers of pieces of candy listed in numerical order: 2, 2, 3, 6, 7.

D 5 is the number of pieces of candy, 20, divided by the number of Rory's friends, 4.

Question 55 (page 129)

A Incorrect. The difference in sales between Monday and Tuesday was about 12 cases.

B Correct. The graph shows that 40 cases were sold on Wednesday and that 20 cases were sold on Friday. Subtract to find the difference in sales.

$$40 - 20 = 20$$

The sales decreased about 20 cases. This represents the greatest change in sales.

C Incorrect. The difference in sales between Wednesday and Thursday was about 8 cases.

D Incorrect. The difference in sales between Thursday and Friday was about 12 cases.

Objective 6

Question 56 (page 142)

D Correct. Janet's jogging time was 1 minute less than Martha's each day. If you know the number of minutes Martha jogged each day, you can add to find her total time and then subtract 10 minutes (1 minute for each of the 10 days) to find Janet's total jogging time.

Question 57 (page 142)

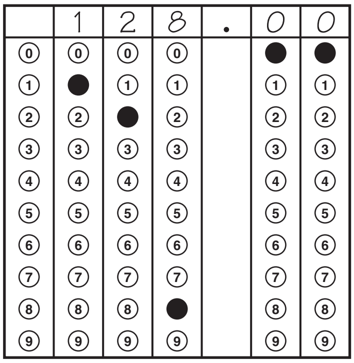
B Correct. If the car made a trip of 45 miles and another trip of 180 miles, it would travel a total of 225 miles. The problem says that the car uses gasoline at the rate of 25 miles to a gallon of gasoline. Divide 225 miles by 25 miles per gallon to find the number of gallons used. The car would use 9 gallons of gasoline.

Question 58 (page 142)

A Correct. The fence will go around the edge of the backyard. This is the perimeter of the backyard. To find the perimeter of the backyard in feet, add the lengths of the four sides of the backyard. The total cost of the fence is equal to the perimeter of the backyard in feet multiplied by the cost per foot of the fencing. Knowing the area to be enclosed by the fence will not help in determining the cost of the fencing.

Question 59 (page 142)

The correct answer is 128.00. Divide the total hotel cost by 4 to find the amount Henry spends on the room: $200 \div 4 = 50$. Multiply the daily cost of food by 5 to find the total cost of his food: $11 \cdot 5 = 55$. Add to find the total cost for the trip: $50 + 55 + 23 = 128.00$.



Question 60 (page 143)

C Correct. In order to determine the number of bags of fertilizer Arlen needs to purchase, first find the area of each garden plot. Then add the areas of the three plots to find the total area. Finally divide the total area by 25 to find the number of bags to purchase. The correct order for the steps is O, M, N.

Question 61 (page 143)

B Correct. Bill's change should be equal to \$20 minus the cost of the groceries. The 3 cans of soup cost $3 \cdot 1$. Two loaves of bread cost $2 \cdot 2$. The roast costs \$8. To find the change, c, subtract.

$$c = 20 - (3 \cdot 1) - (2 \cdot 2) - 8$$

Question 62 (page 143)

A Correct. The formula for the area of a triangle is $A = \frac{1}{2}bh$. Substitute the numbers in the problem for the base (b) and for the height (h).

$$A = \frac{1}{2}(18 \cdot 24)$$

Question 63 (page 144)

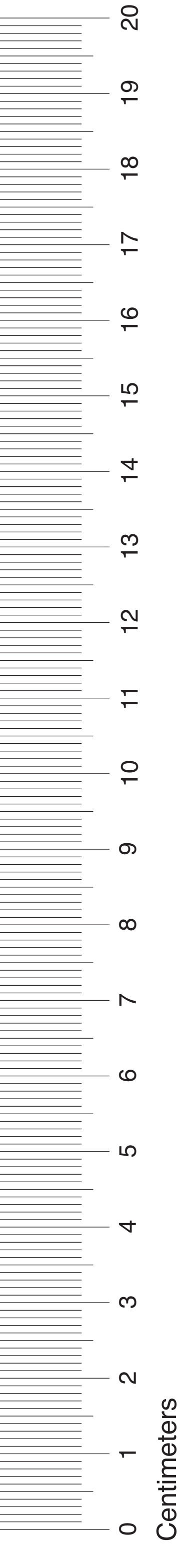
B Correct. Like the figures above it, the figure in answer choice B has a perimeter of 24. None of the other figures has a perimeter of 24.

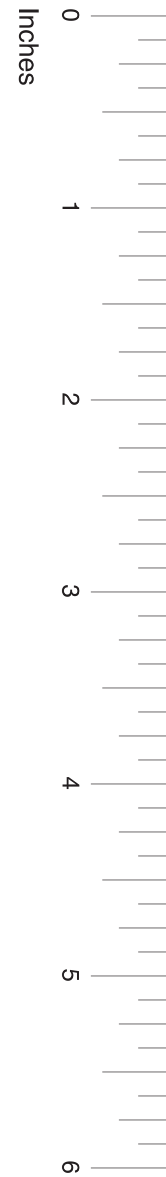
Question 64 (page 144)

C Correct. Of the answer choices, only 416 is a multiple of 8. The number 416 divides evenly by 8, meaning there is no remainder: $416 \div 8 = 52$. Only a number of pages that is a multiple of 8 would be possible for this book.

TAKS
Texas Assessment of Knowledge and Skills

Grade 6
Mathematics Chart





LENGTH

Metric	Customary
1 kilometer = 1000 meters	1 mile = 1760 yards
1 meter = 100 centimeters	1 mile = 5280 feet
1 centimeter = 10 millimeters	1 yard = 3 feet
	1 foot = 12 inches

CAPACITY AND VOLUME

Metric	Customary
1 liter = 1000 milliliters	1 gallon = 4 quarts
	1 gallon = 128 fluid ounces
	1 quart = 2 pints
	1 pint = 2 cups
	1 cup = 8 fluid ounces

MASS AND WEIGHT

Metric	Customary
1 kilogram = 1000 grams	1 ton = 2000 pounds
1 gram = 1000 milligrams	1 pound = 16 ounces

TIME

1 year = 365 days

1 year = 12 months

1 year = 52 weeks

1 week = 7 days

1 day = 24 hours

1 hour = 60 minutes

1 minute = 60 seconds

Continued on the next side

Grade 6 Mathematics Chart

Perimeter	square	$P = 4s$
	rectangle	$P = 2l + 2w$ or $P = 2(l + w)$
Circumference	circle	$C = 2\pi r$ or $C = \pi d$
Area	square	$A = s^2$
	rectangle	$A = lw$ or $A = bh$
	triangle	$A = \frac{1}{2}bh$ or $A = \frac{bh}{2}$
	trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$ or $A = \frac{(b_1 + b_2)h}{2}$
	circle	$A = \pi r^2$
Volume	cube	$V = s^3$
	rectangular prism	$V = lwh$
Pi	π	$\pi \approx 3.14$ or $\pi \approx \frac{22}{7}$