

BIG IDEAS MATH.[®]

RED

The *Resources by Chapter* book contains blackline masters of support material.

Resources by Chapter

- Family and Community Involvement
- Start Thinking! and Warm Up
- Extra Practice (A and B)
- Enrichment and Extension
- Puzzle Time
- School-to-Work
- Graphic Organizers / Study Help
- Financial Literacy
- Technology Connection
- Life Connections
- Stories in History
- Cumulative Practice
- Unit Project with Rubric

Here is a list of resources available in the book.



The front matter contains a table of contents with page references.

Contents

	About the Resources by Chapter.....	iv
Chapter 1	Operations with Integers	vi
Chapter 2	Rational Numbers and Equations.....	45
	Unit 1 Project	90
Chapter 3	Proportions and Variation	94
Chapter 4	Percents	153
Chapter 5	Similarity and Transformations	184
	Unit 2 Project	236
Chapter 6	Surface Areas of Solids.....	240
Chapter 7	Volumes of Solids	285
	Unit 3 Project	330
Chapter 8	Data Analysis and Samples.....	334
Chapter 9	Probability.....	365
	Unit 4 Project	396
Appendix B	Exploring Equations and Functions	400
	Answers.....	A1

Unit Projects are incorporated as a comprehensive assessment tool.

About the Resources by Chapter

Family and Community Involvement (English, Spanish, and Haitian Creole)

The Family and Community Involvement letters provide a way to quickly communicate to family members how they can help their student with the material of the chapter. They make the mathematics less intimidating and provide suggestions for helping students see mathematical concepts in common activities.

Start Thinking! and Warm Up

Each Start Thinking! and Warm Up includes two options for getting the class started. The Start Thinking! questions provide students with an opportunity to discuss thought-provoking questions and analyze real-world situations. The Warm Up questions review prerequisite skills needed for the lesson.

Extra Practice

The Extra Practice exercises provide additional practice on the key concepts taught in the lesson. There are two levels of practice provided for each lesson: A (basic) and B (average).

Enrichment and Extension

Each Enrichment and Extension extends the lesson and provides a challenging application of the key concepts.

Puzzle Time

Each Puzzle Time provides additional practice in a fun format in which students use their mathematical knowledge to solve a riddle. This format allows students to self-check their work.

School-to-Work

The School-to-Work projects show students how the concepts of the chapter are applied in various careers.

Graphic Organizers / Study Help

The ready-to-use Graphic Organizers assist students with organizing key ideas and concepts of the chapter

About the Resources by Chapter (continued)

Financial Literacy

The Financial Literacy projects help students develop an awareness of good financial practices. Students will consider risks and trade offs as they practice decision making.

Technology Connection

Each Technology Connection provides opportunities for students to explore mathematical concepts using tools such as scientific and graphing calculators, spreadsheets, geometry software, and the Internet.

Life Connections

The Life Connections connect the mathematics of the chapter to real-life situations.

Stories in History

The Stories in History allow students to learn about the development of mathematical ideas in an entertaining and engaging way.

Cumulative Practice

The Cumulative Practice exercises help students maintain skills through ongoing review.

Unit Project with Rubric

The Unit Projects summarize the key concepts of the unit. They require students to investigate a concept, gather and analyze data, and summarize the results. Scoring rubrics are provided.

The front matter also contains a description of each resource. The resources outlined in green are available in every lesson. The resources outlined in red are available in every chapter. The resources outlined in blue are available at the chapter level depending on the number of lessons in the chapter.

Financial Literacy is available in chapters with 5+ lessons. *Technology Connection* is available in chapters with 6+ lessons. *Life Connections* is available in chapters with 7+ lessons. *Stories in History* is available in chapters with 8 lessons.

The first page of every chapter shows the contents of the chapter with page references.

Each section has 4 resources within its pages.

Chapter 3

Family and Community Involvement (English).....	95
Family and Community Involvement (Spanish).....	96
Family and Community Involvement (Haitian Creole).....	97
Section 3.1.....	98
Section 3.2.....	104
Section 3.3.....	110
Section 3.4.....	116
Section 3.5.....	122
Section 3.6.....	128
Section 3.7.....	134
Section 3.8.....	140
School-to-Work.....	146
Graphic Organizers / Study Help.....	147
Financial Literacy.....	148
Technology Connection.....	149
Life Connections.....	150
Stories in History.....	151
Cumulative Practice.....	152

Not all chapters have the same number of resources, but the progression of resources is consistent from chapter to chapter.

Name _____ Date _____

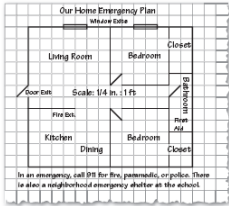
Chapter 3 Proportions and Variation

Dear Family,

An emergency evacuation plan is required in most commercial buildings. A good plan shows the locations of exits in the building as well as the locations of fire extinguishers and other emergency equipment. The plan is usually shown on a scale drawing of the building's floor plan.

Creating an emergency evacuation plan for your home is a good idea as well. You and your student can work together to make a scale drawing of your home.

Choose a scale that will make measurements relatively easy and allow the plan to fit on a single piece of paper. A common scale is $\frac{1}{4}$ " for every foot. This scale will allow a building as large as 34 x 44 feet to fit on a letter-sized piece of paper. If your home won't fit within those dimensions, you can choose larger paper or a smaller scale—such as $\frac{1}{8}$ " for every foot.



Mark the exits, fire extinguishers, and any alarms in red. If you have emergency medical equipment available, such as a first aid kit, mark those in blue.

Ask your student to help you with the following.

- Make measurements of each room in the home. Include measurements of doors and windows that will work as exits.
- Convert your measurements to the scale you have chosen.
- Draw the plan on $\frac{1}{4}$ " graph paper. The sides of each square have a length of $\frac{1}{4}$ " which makes it easier to use for $\frac{1}{4}$ " and $\frac{1}{8}$ " scales.

It's a good idea to include other information on the plan as well, such as the numbers for fire, paramedic, and police services (provided by 911 in many towns). Work with your student to decide what information should be included.

Being prepared will give you great peace of mind!

English

Nombre _____ Fecha _____


Capítulo 3 Proporciones y Variación

Estimada Familia:

En la mayoría de edificios comerciales se requiere un plano de evacuación de emergencia. Un buen plano muestra las ubicaciones de las salidas del edificio, así como las ubicaciones de los extintores de incendios y otros equipos de emergencia. El plano generalmente se muestra en un dibujo a escala del plano del piso del edificio.

Crear un plano de evacuación de emergencia para su hogar también puede ser una buena idea. Usted y su estudiante pueden trabajar juntos para hacer un dibujo a escala de su hogar.

Elijan una escala en la que puedan hacerse medidas de manera relativamente fácil y permita que el plano quepa en una sola hoja de papel. Una escala común es $\frac{1}{4}$ " por cada pie. Esta escala permite que un edificio tan grande como de 34 x 44 pies quepa dentro de una hoja de papel tamaño carta. Si su hogar no cupiera dentro de esas dimensiones, puede elegir un papel más grande o una escala más pequeña—como por ejemplo $\frac{1}{8}$ " por cada pie.



Marque las salidas, extintores y alarmas en rojo. Si tiene disponible equipo médico de emergencia, como por ejemplo un equipo de primeros auxilios, márquelo en azul.

Pida a su estudiante que lo ayude con lo siguiente:

- Hagan medidas de cada habitación de la casa. Incluyan medidas de las puertas y ventanas, ya que funcionarían como salidas.
- Conviertan sus medidas en la escala elegida.
- Dibujen el plano en un papel para gráficos de $\frac{1}{4}$ ". Los lados de cada cuadrado miden $\frac{1}{4}$ " de largo, lo que los hace más fácil de usar con las escalas de $\frac{1}{4}$ " y $\frac{1}{8}$ ".

Es una buena idea incluir también otra información en el plano, como los teléfonos de los servicios de bomberos, paramédicos y policías (proporcionados por 911 en muchas ciudades). Trabaje con su estudiante para decidir qué información debe incluirse.

¡Estar preparado le dará una gran tranquilidad!

Spanish

Non _____ Dat _____

Chapit 3 Pwopòsyon ak Varyasyon

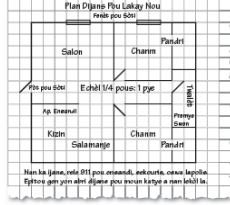
Chè Fammi:

Yon plan pou evokye dijans obligatwa nan pifò bilding komèsyal. Yon bon plan montre ki kote pòt sòti bilding nan yo ak ki kote aparèy pou etenn ensandi ak lòt ekipman dijans yo ye. Abityèlman plan an sou yon desen alechèl plan nivo bilding nan.

Kreye yon plan pou evokye dijans pou lakay ou se yon bon ide tou. Ou menm akèk elèv ou a kapab travay ansanm pou fè yon desen alechèl lakay nou.

Chwazi yon echèl k'ap rann mezi yo ase fasil epi k'ap pèmèt plan an kenbe sou yon sèl fèy papye.

Yon echèl komen se $\frac{1}{4}$ " pou chak pye. Echèl sa a ap pèmèt yon bilding dimansyon 34 x 44 pye kenbe sou yon fèy papye dimansyon lèt. Si lakay ou pap kenbe nan dimansyon sa yo, ou kapab chwazi yon pi gran papye oswa yon echèl pi piti—tankou $\frac{1}{8}$ " pou chak pye.



Markè sòti yo, aparèy pou etenn ensandi yo, ak tout alam yo an wouj. Si ou gen ekipman medikal dijans ki disponib, tankou twous premye swen, make sa yo an ble.

Mande elèv ou a ede ou ak bagay sila yo.

- Pran mezi chak pyès nan kay la. Enklè mezi pòt ak fenèt k'ap kapab sèvi kòm sòti.
- Konvèti mezi nou yo nan echèl nou chwazi a.
- Desen plan an sou yon papye kadriye $\frac{1}{4}$ ". Bò chak kare gen yon longè $\frac{1}{4}$ " sa ki fè sa pi fasil sèvi avèk echèl $\frac{1}{4}$ " ak $\frac{1}{8}$ ".

Se yon bon ide pou enklè lòt enfòmasyon sou plan an tou, tankou nimewo sèvis porpye, sekouris, ak polis (se 911 nan anpil vil). Travay avèk elèv ou a pou deside ki enfòmasyon ki ta dwe enklè.

Lè ou pane sa ap ba ou bon kè poze!

Haitian Creole

The *Family and Community Involvement* letters provide a way to quickly communicate to family members how they can help their student with the material of the chapter. They make the mathematics less intimidating and provide suggestions for helping students see mathematical concepts in common activities. This resource is provided in three languages: English, Spanish, and Haitian Creole.

Activity 3.1 Start Thinking!
For use before Activity 3.1

You are planning a trip to Atlanta, Georgia. Discuss with a partner the factors you need to consider to determine if it would be better to fly or to drive. Determine which method of transportation you would use and explain why.

Activity 3.1 Warm Up
For use before Activity 3.1

Convert the measurement.

- 30 min = ? h
- 4 h = ? min
- 15 sec = ? min
- 60 h = ? days
- 3 days = ? h
- 1 wk = ? h

for the Activity

Lesson 3.1 Start Thinking!
For use before Lesson 3.1

You and your sister go to a store. You buy 3 erasers for \$1.00. Your sister buys 4 erasers for \$1.25. Explain who gets the better deal.

Lesson 3.1 Warm Up
For use before Lesson 3.1

Find the product. List the units.

- $6 \text{ h} \times \frac{\$7}{\text{h}}$
- $2 \text{ gal} \times \frac{\$24}{\text{gal}}$
- $8 \text{ h} \times \frac{25 \text{ mi}}{\text{h}}$
- $9 \text{ mo} \times \frac{\$650}{\text{mo}}$
- $12 \text{ lb} \times \frac{\$2.50}{\text{lb}}$
- $6 \text{ yr} \times \frac{35 \text{ in.}}{\text{yr}}$

for the Lesson

The font is larger because this resource is designed to be an overhead transparency.

Each *Start Thinking!* and *Warm Up* includes two options for getting the class started. The *Start Thinking!* questions provide students with an opportunity to discuss thought-provoking questions and analyze real-world situations. The *Warm Up* questions review prerequisite skills needed for the lesson.

Name _____ Date _____

3.1 Practice A

Find the product. List the units.

1. $12 \text{ h} \times \frac{\$5}{\text{h}}$ 2. $6 \text{ oz} \times \frac{\$0.59}{\text{oz}}$ 3. $9 \text{ h} \times \frac{70 \text{ mi}}{\text{h}}$

Write the ratio as a fraction in simplest form.

4. 12 to 15 5. 24 : 9 6. 14 tetras : 6 angelfish

Find the unit rate.

7. 360 miles in 6 hours 8. 18 bowlers on 6 lanes 9. \$28 for 7 people

Use the table to find the rate.

10.

Minutes	0	2	4	6
Laps	0	1	2	3

 11.

Servings	0	1	2	3
Grams of Protein	0	15	30	45

12. At 9 A.M. you have run 2 miles. At 9:24 A.M. you have run 5 miles. What is your running rate in minutes per mile?

13. Are the two statements equivalent? Explain your reasoning.

- The ratio of orange to blue is 3 to 4.
- The ratio of blue to orange is 12 to 9.

14. There are 234 students in 9 different classrooms. What is the ratio of students to classrooms?

15. Dishwasher detergent is sold in individual packs. It is sold in 20-, 60-, and 90-pack containers.

- Which container do you think has the lowest unit rate of dollars per pack? Why?
- The 20-pack container sells for \$5.49. What is the unit rate in dollars per pack? Round your answer to the nearest cent.
- The 60-pack container sells for \$10.97. What is the unit rate in dollars per pack? Round your answer to the nearest cent.
- The 90-pack container sells for \$18.95. What is the unit rate in dollars per pack? Round your answer to the nearest cent.
- Which container has the lowest unit rate? How does this compare with your answer in part (a)?

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for the basic student

Name _____ Date _____

3.1 Practice B

Write the ratio as a fraction in simplest form.

1. 35 to 63 2. 10.8 seconds : 36 feet

3. 198 women to 110 men 4. 1000 songs : 2 megabytes

5. 26.1 miles : 3.6 hours 6. 12 completions to 28 attempts

Find the unit rate.

7. \$5.40 for 24 cans 8. \$1.29 for 20 ounces 9. 50 meters in 27.5 seconds

10. There are 16 bacteria in a beaker. Four hours later there are 228 bacteria in the beaker. What is the rate of change per hour in the number of bacteria?

11. The table shows nutritional information for three energy bars.

Energy Bar	Calories	Protein	Fiber	Sugar
A	220	20 g	12 g	14 g
B	130	12 g	8 g	10 g
C	140	4 g	9 g	9 g

- Which has the most protein per calorie?
- Which has the least sugar per calorie?
- Which has the highest rate of sugar to fiber?
- Compare bar A with bar B. Which nutritional item do you think has the highest ratio: calories, protein, fiber, or sugar?
- Calculate the ratios in part (d). Which one has the highest ratio?

12. The graph shows the cost of buying scoops of gelato.

- What does the point (4, 6) represent?
- What is the unit cost?
- What is the cost of 12 scoops?
- Explain how the graph would change if the unit rate was \$1.75 per scoop.
- How would the coordinates of the point in part (a) change if the unit rate was \$1.75 per scoop?

Write a situation for the ratio.

13. $\frac{9}{5}$ 14. 2 : 3

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for the average student

The *Extra Practice* exercises provide additional practice on the key concepts taught in the lesson. There are two levels of practice provided for each lesson: A (basic) and B (average).

Each *Enrichment and Extension* extends the lesson and provides a challenging application of the key concepts.

Name _____ Date _____

3.1 Enrichment and Extension

Ratios, Rates, and On-the-Job Decisions

Sally Smith has been offered two employment opportunities. Help her decide which job is better by answering the following questions.

1. Job A will pay \$32,448 a year. How much money would Sally be making per hour? Assume pay is based on fifty-two 40-hour weeks.
2. Job B pays \$14.80 per hour. How much money would she make in a year? Assume the pay is based on fifty-two 40-hour weeks.
3. Which job pays better? Explain your reasoning.
4. Sally lives 18 miles from Job A. A work week is five days. How many miles would she have to drive each week just to get to and from work?
5. For Job A, Sally would have to put 7.5 gallons of gas in her tank every 3 days that she drives to and from work only. How many gallons of gas would she use in a five-day work week?
6. Based on your answers to Exercises 4 and 5, what is Sally's gas mileage? (*Hint:* Gas mileage is a unit rate that is calculated as miles per gallon.)
7. If gas costs \$4 per gallon, how much will gas cost Sally per day just to get to and from Job A per day? per week? per year?
8. The ratio of the length of Sally's drive to Job A to the length of Sally's drive to Job B is 2 : 3. How much money would she save on gas in a week with Job A as opposed to Job B?
9. Other than distance and cost of gas, what other factors should Sally consider when comparing commutes to work?
10. Macaroni and cheese is one of Sally's favorite lunch foods. In the cafeteria at Job A, $1\frac{1}{4}$ cups of macaroni and cheese contains 6.5 grams of fat. The macaroni and cheese at Job B contains 10 grams of fat per pint. Which one has a lower fat content? Explain your reasoning.
11. Both places sell macaroni and cheese by weight. Job A's cafeteria charges \$7.25 per pound and Job B's cafeteria charges \$0.58 per ounce. Which cafeteria has the cheaper macaroni and cheese? Explain your reasoning.
12. Based on the information on this page, would you recommend that Sally take Job A or Job B? Explain your reasoning.
13. Other than pay, transportation costs, and cafeteria selections, what other factors should Sally consider when choosing a job?

Enrichment and Extension is for students who have mastered the concepts. The questions require students to think in different ways than the exercises in the textbook and to use higher order thinking skills.

Each *Puzzle Time* provides additional practice in a fun format in which students use their mathematical knowledge to solve a riddle. This format allows students to self-check their work.

Name _____ Date _____

3.1 Puzzle Time

What Do You Get If You Cross A Duck With A Firework?

Write the letter of each answer in the box containing the exercise number.

Find the product.

1. $4 \text{ tbsp} \times \frac{20 \text{ cal}}{\text{tbsp}}$

P. 5 cal Q. 80 cal R. 5 tbsp

2. $3 \text{ lb} \times \frac{\$1.29}{\text{lb}}$

E. \$0.43 F. \$3.87 G. 3.87 lb

3. $4 \text{ gal} \times \frac{17.5 \text{ mi}}{\text{gal}}$

C. 70 mi D. 35 mi E. 70 gal

4. $40 \text{ h} \times \frac{\$8.50}{\text{h}}$

T. 340 h U. \$340 V. \$300

Write the ratio as a fraction.

5. 12 to 36

I. $\frac{1}{6}$ J. $\frac{1}{4}$ K. $\frac{1}{3}$

6. 15 : 75

E. $\frac{1}{5}$ F. $\frac{1}{4}$ G. $\frac{1}{3}$

7. 10 out of 25

E. $\frac{2}{5}$ F. $\frac{1}{5}$ G. $\frac{1}{25}$

8. 52 males to 28 females

P. $\frac{27}{14}$ Q. $\frac{7}{13}$ R. $\frac{13}{7}$

Find the unit rate.

9. 24 cups in 12 quarts

R. $\frac{2 \text{ qt}}{\text{c}}$ S. $\frac{2 \text{ c}}{\text{qt}}$ T. $\frac{4 \text{ c}}{\text{qt}}$

10. \$17.85 for 3 pounds

A. $\frac{\$5.95}{\text{lb}}$ B. $\frac{\$5.56}{\text{lb}}$ C. $\frac{\$3.65}{\text{lb}}$

11. 26.2 miles in 4 hours

A. $\frac{6.55 \text{ mi}}{\text{h}}$ B. $\frac{7.5 \text{ mi}}{\text{h}}$ C. $\frac{6.5 \text{ mi}}{\text{h}}$

12. \$12.60 for 3 boxes

G. $\frac{\$3.15}{\text{box}}$ H. $\frac{\$4.15}{\text{box}}$ I. $\frac{\$4.20}{\text{box}}$

10	2	12	8	6	-	1	4	11	3	5	7	9
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The *School-to-Work* projects show students how the concepts of the chapter are applied in various careers.

Name _____ Date _____

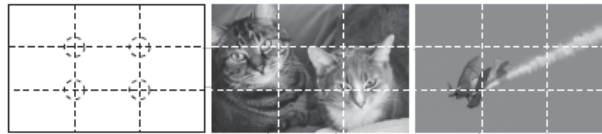
Chapter 3 School-to-Work

For use after Section 3.3

Photographer

Photographers think about proportions when they decide where they want to place the subjects in the camera's viewing window. The *Rule of Thirds* is a guideline that can make a photograph look pleasing.

You can divide an image in thirds both vertically and horizontally, as shown in the first image below. The subject(s) of the photo can then be placed near the intersections of those divisions, as shown in the second and third images.



1. Using a digital camera or a phone camera, take several pictures of the same subject(s)—a person, a pet, or an object of interest. Try placing the subject at the very center, and also try placing it near one of the “intersection” points. Which photo(s) do you think are the most pleasing to the eye? Why?

Most cameras create an image where the ratio of the width to the height is 2 : 3. Which popular print sizes, given below in inches, are in this same proportion?

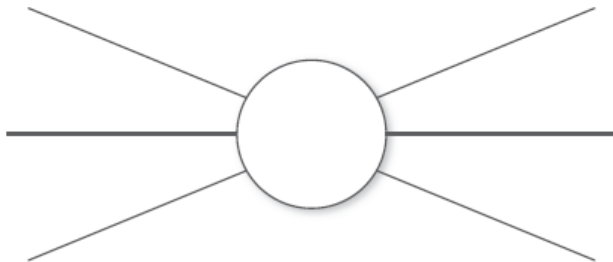
2. 4×6
3. 5×7
4. 6×8
5. 8×10
6. 8×12
7. 11×14
8. An 8-inch by 10-inch print of an image taken by most cameras will not include all of the image due to the different ratios involved. Draw a diagram that shows how much of the image will be lost.
9. If you know that a photograph will be printed as an 8-inch by 10-inch image, what should you keep in mind when taking the picture? Explain.

The ready-to-use *Graphic Organizers / Study Help* assist students with organizing key ideas and concepts of the chapter. This is the same feature that is in every chapter of the textbook.

Name _____ Date _____

Chapter 3 Study Help

You can use an **information wheel** to organize information about a concept.



On Your Own

Make an information wheel to help you study these topics.

1. ratio
2. rate
3. unit rate
4. proportion
5. cross products
6. solving proportions

After you complete this chapter, make information wheels for the following topics.

7. U.S. customary system
8. metric system
9. converting units
10. direct variation
11. inverse variation

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Big Ideas Math Red
Resources by Chapter **147**

The *Financial Literacy* projects help students develop an awareness of good financial practices. Students will consider risks and trade offs as they practice decision making.

Name _____ Date _____

Chapter 3 Financial Literacy

For use after Section 3.3

Unit Prices

Grocery stores display unit prices along with the price for each item. The unit price tells you how much the item costs per unit of weight or volume.

Unit prices are especially useful when you are looking at the same product packaged in different ways or in different sizes. For example, here are several different ways that you can buy bottled water.

Nature's Water	1 liter bottle	\$0.03/fl oz	\$0.99
Nature's Water	2.5 gallons	\$0.01/fl oz	\$3.99
Nature's Water 12 Pack	16.9-fl oz bottle	\$0.02/fl oz	\$4.19
Nature's Water 6 Pack	24-fl oz bottle	\$0.02/fl oz	\$3.39

1. In which package is the water the least expensive per ounce?
2. In which package is the water the most expensive per ounce?
3. Describe a situation where it might be better to buy a 2.5-gallon container and a situation where it might be better to buy a 12-pack of 16.9-fluid ounce bottles.
4. The last two packages list the unit price as \$0.02/fl oz but they are not exactly the same.
 - a. Find out how much water is in each package.
 - b. Find the unit price of each package to four decimal places.
 - c. Are the unit prices you found in part (b) equal? Is the store wrong to list both unit prices as \$0.02/fl oz? Explain.

The page begins with background information and an example. Exercises follow the example

This resource is only available in chapters with 5 or more lessons.

Each *Technology Connection* provides opportunities for students to explore mathematical concepts using tools such as scientific and graphing calculators, spreadsheets, geometry software, and/or the Internet.

This resource is only available in chapters with 6 or more lessons.

Name _____ Date _____

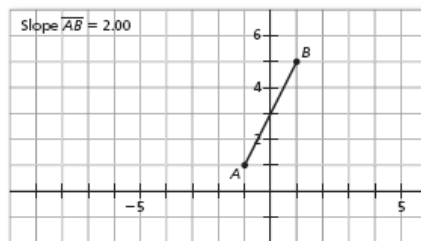
Chapter 3 Technology Connection

For use after Section 3.2

Exploring Slope

Geometry software, like the *Geometer's Sketchpad*, allows you to explore the slope of a line or line segment.

Open a **New Sketch**. Use the **Segment** tool on the left side of the screen to draw a short segment that slants upward.



Click on the middle of the segment you made. In the **Measure** menu, select **Slope**. A grid and the slope of the segment will appear on the grid. In the **Graph** menu, select **Snap Points**. This will make it so that the segment will always have integer coefficients.

Move the endpoints of the segment you made so that it has the given slope. Sketch the line segment on a piece of paper and label the slope.

- 1
 - $\frac{1}{2}$
 - $\frac{2}{3}$
 - $-\frac{4}{5}$
 - 0
 - 0.75
 - $1\bar{3}$
 - 2.5
9. Which line segments are the steepest? Which are the least steep? Describe their slopes.
10. What is the slope of a horizontal line segment?
11. What happens to the slope when you make the line segment vertical? Why?
12. Can you move the line segment without changing the slope? How?

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Big Ideas Math Red 149
Resources by Chapter

The *Life Connections* connect the mathematics of the chapter to real-life situations.

This resource is only available in chapters with 7 or more lessons.

Name _____ Date _____

Chapter 3 Life Connections

For use after Section 3.3

Sports Statistics

It's impossible to watch sports on TV without hearing statistics about a player's or team's performance. All those statistics help us to understand why teams choose certain strategies.

Football

1. A quarterback completes 26 passes out of 37 attempts in one game. Write his completion rate as a fraction and as a decimal.
2. At the same rate, about how many attempts will it take for the quarterback in Question 1 to complete 100 passes? About how many games will this be?
3. **Research** Find the name of last year's top rusher for the 16-game NFL season. Write two rates to represent the player's achievement. Which rate do you think sounds more impressive? Why?

Soccer

4. You allow 2.09 goals in ninety minutes of playing time. About how many minutes will you play before 10 goals are scored against you?
5. You make 107 saves during 2485 minutes of playing time. How many saves do you make during a 90-minute game?

Basketball

6. You make 11 baskets in 19 attempts during a game. About how many attempts will you need to make 30 baskets?
7. You average 2.8 three-point attempts per game. You make an average of 1.2 of the three-point shots per game. How many three-point shots do you usually make in 10 games? How many points is this?

The *Stories in History* allow students to learn about the development of mathematical ideas in an entertaining and engaging way.

Name _____ Date _____

Chapter 3 **Stories in History**
For use after Section 3.5

The Golden Ratio

The Parthenon was built in ancient Athens, Greece. The structure has many examples of the *Golden Ratio*, $\frac{L}{1} = \frac{1}{L-1}$.



You will find out in a future algebra class that one solution to this proportion is $L = 1.618$. In other words, the length of the Golden Rectangle is about 1.618 times its width. The ancient Greeks felt that this ratio gave a pleasing appearance to the building.

1. Substitute $L = 1.618$ in the proportion $\frac{L}{1} = \frac{1}{L-1}$ and simplify. Is the value of L a solution of the equation?
2. Use a ruler or tape measure to find the length and width, in centimeters, of several different rectangles, including those described below. Record your measurements in a table like the one shown below. Then find the ratio of length to width written as a decimal to complete the table.

Description	Length	Width	$\frac{\text{length}}{\text{width}}$ as a decimal
Computer screen			
TV screen			
Credit card			
Photograph			
Poster			
Other			

3. What patterns do you see? Are there any ratios near the Golden Ratio?

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Big Ideas Math Red **151**
Resources by Chapter

This resource is only available in chapters with 8 lessons.

The *Cumulative Practice* exercises help students maintain skills through ongoing review.

Name _____ Date _____

Chapter 3 Cumulative Practice

Find the unit rate.

- 10 cans for 5 dollars
- 960 pages in 3 books
- \$7.40 for 4 drinks
- 36 trees in 3 acres
- 28 kittens for 7 cats
- 492 meters in 4 seconds
- A switchboard operator receives 98 calls in 7 days. How many calls does the operator receive each day?

Tell whether the ratios form a proportion.

- $\frac{3}{8}, \frac{12}{48}$
- $\frac{5}{13}, \frac{15}{36}$
- $\frac{6}{9}, \frac{8}{12}$

- An amusement park sells 9 tickets for \$12 and 12 tickets for \$15. Is this fair? Explain.

Solve the proportion.

- $\frac{4}{7} = \frac{n}{49}$
- $\frac{y}{5} = \frac{15}{3}$
- $\frac{14}{p} = \frac{91}{104}$
- $\frac{1}{17} = \frac{6}{k}$
- $\frac{v}{9} = \frac{2}{18}$
- $\frac{35}{50} = \frac{x}{10}$

- A \$16 item is on sale for \$11. What is the sale price of a \$48 item?

Copy and complete the statement. Round to the nearest hundredth, if necessary.

- 15 lb = ? kg
- 30 in. = ? ft
- 4 mi = ? km
- 6 m/sec = ? ft/sec
- 20 qt/min = ? gal/min
- 35 g/h = ? mg/h

- Water pours out of a faucet at a rate of 120 inches per hour. What is the rate in centimeters per hour?

Tell whether x and y show *direct variation*, *inverse variation*, or *neither*. Explain your reasoning.

- $y = x + 5$
- $\frac{1}{5}y = \frac{1}{6}x$
- $7y = \frac{10}{x}$
- $y = 4x$
- $xy = 12$
- $y - 8 = x$

- What is the slope of the line that passes through the two points $(-1, -4)$ and $(3, 12)$?

Name _____ Date _____

Unit 2 Bouncing Balls
For use after Unit 2

Objective To find and compare the bounce heights for various types of balls.

Materials Graph paper, tape measure or meter sticks, tape, five or six types of balls (table tennis ball, softball, rubber ball, tennis ball, golf ball, soccer ball).

Investigation

1. Predict which balls will have the most bounce. List the balls in order from the most bounce to the least bounce.
2. Work in a group of three. Choose one ball for your group to use. Gather your materials and attach the tape measure or two meter sticks (one on top of the other) to the wall. Put the zero mark at the floor. Choose a drop height from which you will drop the ball.
3. Record the drop height. Hold the ball at the drop height and let it go. (Don't throw it down.) Have another member of the group watch the height the ball reaches after the first bounce. Record your results in a table like the one below. Repeat this procedure three more times from the same drop height and record your results.

Type of Ball:				
Drop Height H (cm)	Bounce height (cm)		Mean of bounce heights, M	Ratio $\frac{M}{H}$

4. Choose a different drop height and repeat Step 3.
5. Choose a third drop height and repeat Step 3.

Data Analysis

6. Complete the table. Find the mean M of the bounce heights in each row. Then find the ratio of the mean to the bounce height for each row.
7. What patterns do you notice in your table?
8. Write the ordered pairs (H, M) . Graph each ordered pair. Use your graph to make other predictions about your ball's bounce height.
9. Compare your graph to the graphs of other groups. What do you notice? How can the graphs of all the groups help you check your prediction in Step 1?

Summary Report Write a report describing the Investigation, your data, and the results of your data analysis. Include a comparison of your prediction in Step 1 and the actual results. Draw a scale diagram of your measuring tools and the ball to show the different drop heights you used during the Investigation.

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The *Unit Project* summarizes the key concepts of the unit. It requires students to investigate a concept, gather and analyze data, and summarize the results.

Name _____ Date _____

Unit 2 Student Grading Rubric
For use after Unit 2

Cover Page 10 points

- a. Name (4 points) _____
- b. Class (2 points) _____
- c. Project Name (2 points) _____
- d. Due Date (2 points) _____

Investigation 80 points

- a. Predict which balls will have the most bounce. (5 points) _____
- b. Write predictions from most bounce to least bounce. (10 points) _____
- c. Carefully set up the measuring tools. (5 points) _____
- d. Record four bounce heights for a ball dropped at each drop height. Total of 12 heights. (60 points) _____

Analysis 90 points

- a. Find the means and the ratios to complete the table. (30 points) _____
- b. Identify any patterns in the table. (10 points) _____
- c. Write the ordered pairs (H, M) . Graph each ordered pair. Make predictions from your graph. (30 points) _____
- d. Describe how your graph compares to the graphs of other groups. Explain how the graphs of the class can help you check your initial predictions about the bounce heights of the balls. (20 points) _____

Summary Report 30 points

- a. Write a report that presents the full project. Include your data, tables, and graphs to describe the investigation and display results. (20 points) _____
- b. Make a scale drawing to illustrate the investigation. Include your measuring tools, drop height, and bounce height for each of the drop heights you used. (10 points) _____

FINAL GRADE

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The *Student Grading Rubric* serves as a checklist for the student. It identifies the required components of the project and the components point value.

Unit 2 **Teacher's Project Notes**
For use after Unit 2

Materials Graph paper, tape measure or meter sticks, tape, five or six types of balls (table tennis ball, softball, rubber ball, tennis ball, golf ball, soccer ball, etc.).

Alternatives The number of balls students use can be expanded or shortened to change the length of the project.

It may be a good idea to model the experiment as a class before having students work on their own.

Common Errors Students may have difficulty finding accurate bounce height measurements. It may help to have two students kneeling near the bounce height so that they can more clearly see the bounce height.

Make sure that students find the bounce height from a given drop height three times so that they can find an average. Students sometimes just find one drop height.

Suggestions The science department may be a source for meter sticks. A yard stick with metric measurements can also be used or a tape measure.

Have all the groups plot their coordinate points on the same graph. Use different colors so that it is easier to see which points correspond to which groups.

Unit 2 **Grading Rubric**
For use after Unit 2

Cover Page 10 points

- a. Name (4 points)
- b. Class (2 points)
- c. Project Name (2 points)
- d. Due Date (2 points)

Scoring Rubric	
A	179-200
B	159-178
C	139-158
D	119-138
F	118 or below

Investigation 80 points

- a. Predict which balls will have the most bounce. (5 points)
- b. Write predictions from most bounce to least bounce. (10 points)
- c. Carefully set up the measuring tools. (5 points)
- d. Record four bounce heights for a ball dropped at each drop height. Total of 12 heights. (60 points)

Analysis 90 points

- a. Find the means and the ratios to complete the table. (30 points)
- b. Identify any patterns in the table. (10 points)
- c. Write the ordered pairs (H, M) . Graph each ordered pair. Make predictions from your graph. (30 points)
- d. Describe how your graph compares to the graphs of other groups. Explain how the graphs of the class can help you check your initial predictions about the bounce heights of the balls. (20 points)

Summary Report 30 points

- a. Write a report that presents the full project. Include your data, tables, and graphs to describe the investigation and display results. (20 points)
- b. Make a scale drawing to illustrate the investigation. Include your measuring tools, drop height, and bounce height for each of the drop heights you used. (10 points)

FINAL GRADE

The *Teacher's Project Notes* is a description of the project for the teacher. It includes a materials list, possible alternatives, and common errors for students to avoid. It also gives additional notes and suggestions of what to look for in the student project.

The *Grading Rubric* is the teacher's rubric for assessing the project.

At the end of the *Resources by Chapter* book, *Answers* are provided for all exercises and projects.

Answers

Chapter 1

1.1 Start Thinking!

For use before Activity 1.1

Sample answer: Both football and games have rules players must follow. In football, there is an order to the game. For example, one team must kick-off before the other team can begin their drive, they must score a touchdown before kicking the extra point. In math problems, there is the order of operations. Students must first multiply or divide before doing addition and subtraction.

1.1 Warm Up

For use before Activity 1.1

1. < 2. > 3. >
4. < 5. > 6. <

1.1 Start Thinking!

For use before Lesson 1.1

Sample answer: Going to school is like moving the positive direction on a number line. Returning home after school is like moving the negative direction on a number line. No, you never travel a negative direction.

1.1 Warm Up

For use before Lesson 1.1

1. 15 2. 23 3. 7 4. 35
5. 43 6. 0 7. 39 8. 212

1.1 Practice A

1. 7 2. 12 3. 13 4. 0
5. > 6. = 7. > 8. -5, 3
9. -1, |-1|, |4|, |5|, 8 10. 0, |2|, |3|, |5|, 6
11. 19 12. -8 13. -13
14. a. 2 b. 2 ft per sec c. positive d. 2 ft per sec
15. a. LATE b. TEAL
16. *Sample answer:* -5

1.1 Practice B

1. = 2. < 3. < 4. 15, -6
5. -|-34|, |0|, 14, |-25|, 28
6. -16, 10, |-16|, |25|, |-43|
7. 249 8. -183 9. -153
10. a. Phosphorus b. Oxygen

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11. a. up b. 13 ft/sec c. down d. 17 ft/sec
12. 0 13. -1
14. True; Both numbers have an absolute value of 3.
15. False; *Sample answer:* Let $x = -4$. Then $|x| = 4$ and 4 is not less than -4 .

1.1 Enrichment and Extension

1. always 2. never 3. sometimes
4. sometimes 5. never 6. always
7. sometimes 8. sometimes
9. all negative integers 10. all positive integers
11. none 12. all integers 13. none
14. all integers 15. all integers 16. none
17. all integers 18. none
19. all positive integers 20. all positive integers
21. all negative integers 22. all negative integers
23. all negative integers 24. all positive integers
25. none 26. all negative integers
27. all positive integers 28. all positive integers
29. none 30. all integers
31. all positive integers 32. all integers
33. all positive integers 34. all integers
35. all integers 36. all integers

Check students' picture, it should be a dog.

1.1 Puzzle Time

A TENNIS BALL

1.2 Start Thinking!

For use before Activity 1.2

Sample answer: In golf, the goal is to get below par. This would represent zero. Scores above a par on a hole would be positive integers and scores below par on a hole would be negative integers.

1.2 Warm Up

For use before Activity 1.2

1. 22 2. 42 3. 77
4. 150 5. 122 6. 221

Big Ideas Math Red **A1**
Answers