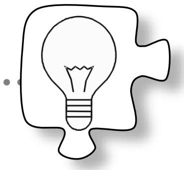
CHAPTER 1 Problem Solving

1.1.1 What stories can a graph tell?



Interpreting Graphs

You will focus on several challenges during this unit that will require you to use different problem-solving strategies. While all of the problems are solvable with your current math skills, some will be revisited later in the course so that you can apply new algebraic tools to solve them. Each problem also introduces you to an important concept that you will study in this course.

1-1. GETTING TO KNOW YOU, Part One

How can a graph tell a story? Today you will find your team members and then will work together to write a story for a graph.

Your task: Your teacher will give you one part of a graph. Find the students in the class who have the other pieces of the same graph. When you find all of the students whose graph parts belong with yours, sit down together as a team.

As a team, come up with a story that could be represented by your team's graph. Think carefully about each part of the graph. Once your team agrees on a story, make sure every member of the team can describe each part of the story and explain its connection to the corresponding part of the graph.

To help you work together today, each member of the team has a specific job, assigned by your first name (or by your last name if any team members have the same first name).

Team Roles

Resource Manager – If your name comes first alphabetically:

- Make sure that the team has tape.
- Ask the teacher when the **entire** team has a question. *"No one has an idea? Should I ask the teacher?"*
- Make sure your team cleans up by delegating tasks. You could say, *"I will put away the ________ while you _________ ."*

Problem continues on next page. →

1-1. *Problem continued from previous page.*

Facilitator – If your name comes second alphabetically:

- Start the team's discussion of the graph by asking, *"What could this graph be about?… What are some ideas?"*
- Help the team agree on a story: *"Do we agree on all of the parts of our story?"*

Recorder/Reporter – If your name comes third alphabetically:

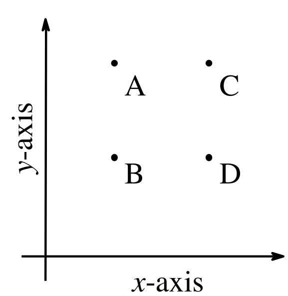
- Tape the graph pieces together on a piece of paper to form the graph.
- Take notes for the team. The notes should include phrases like, *"For part one…"* and explanations like, *"Because part one is not so steep…"*

Task Manager – If your name comes fourth alphabetically:

- Remind the team to stay on task and not to talk to students in other teams. You can suggest, *"Let's move on to another part of the graph."*
- Listen for reasons and challenge your teammates to justify their thinking. "*But why do you think that?"*

1-2. GETTING TO KNOW YOU, Part Two

Suppose the graph at right represents something about the four students in your team. But what is the graph about? Decide what information the *x*- and *y*-axes could represent so that each point represents a different member of your team. Justify your statements.

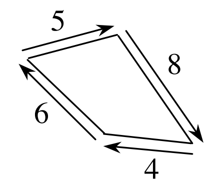


METHODS AND MEANINGS

MATH NOTES

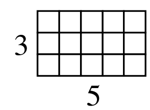
The Perimeter and Area of a Figure

The **perimeter** of a figure is the distance around the exterior (outside) on a flat surface. It is the total length of the boundary that encloses the interior (inside) region. See the example at right.



Perimeter = $5+8+4+6=$ 23

The **area** indicates the number of square units needed to fill up a region on a flat surface. For a rectangle, the area is computed by multiplying its length and width. The rectangle at right has a length of 5 units and a width of 3 units, so the area of the rectangle is 15 square units.



Area = $5 \cdot 3 = 15$ square units

Review & Preview

1-3. MATHOGRAPHY

Write a letter about yourself that will help your teacher get to know you as an individual, addressing each of the general topics below (in bold). Choose a few of the suggested questions to get you started.

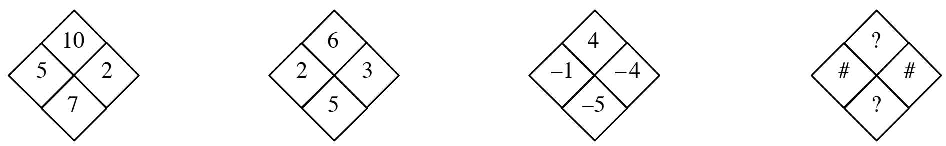
About You: By what name do you like to be called? What are your interests, talents, and hobbies? What are you proud of? With whom do you live? What languages do you speak? When is your birthday? What are you like as a member of a team? In what ways are you excited about working in a team? In what ways are you nervous about it?

You as a Math Student: Describe your memories as a math student from kindergarten until now. What experiences in math have you liked? Why? How do you feel about taking this math class? Have you ever worked in a team in a math class before? What kinds of math do you imagine yourself doing in this class?

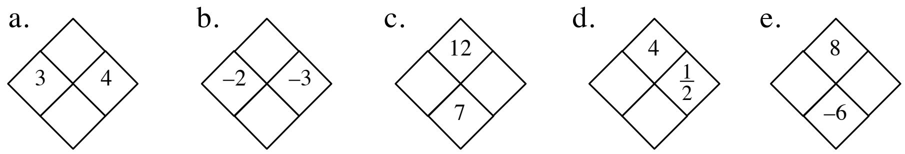
1-4. DIAMOND PROBLEMS

Finding and using a pattern is an important problem-solving skill you will use in algebra. The patterns in Diamond Problems will be used later in the course to solve other types of algebraic problems.

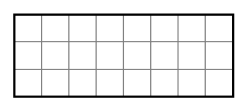
Look for a pattern in the first three diamonds below. For the fourth diamond, explain how you could find the missing numbers (?) if you know the two numbers (#).



Copy the Diamond Problems below onto your paper. Then use the pattern you discovered to complete each one.



1-5. The area of the rectangle at right is 24 square units. On graph paper, draw and label all possible rectangles with an area of 24 square units. Use only whole numbers for the dimensions (measurements).



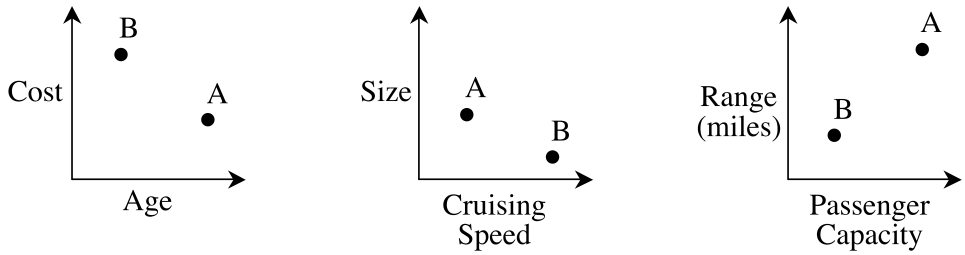
Area = 24 square units

a. Find the perimeter of each of these rectangles. You may want to refer to the Math Notes box in this lesson for more information on the perimeter of a figure.

b. Of these rectangles, which has the largest perimeter? Which has the smallest perimeter? Describe these shapes. Remember to use complete sentences.

1-6. CAR COMPARISON

The following three graphs describe two cars, A and B.



Decide whether each of the following statements is true or false. Explain your reasoning.

a. The newer car is more expensive.

b. The slower car is larger.

c. The larger car is newer.

d. The cheaper car carries more passengers.

1.1.2 How can I name a point?

Using the *xy*-Coordinate Plane

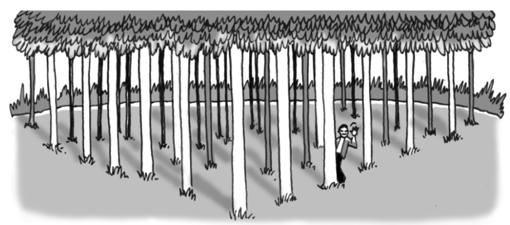
Today you will use a **coordinate system** to refer to the locations of specific points in the form (x, y). By the end of this lesson, be sure you and your teammates know the answers to the following target questions:

How can you plot a point using its (x, y) coordinates?

How can you name a point on the graph?

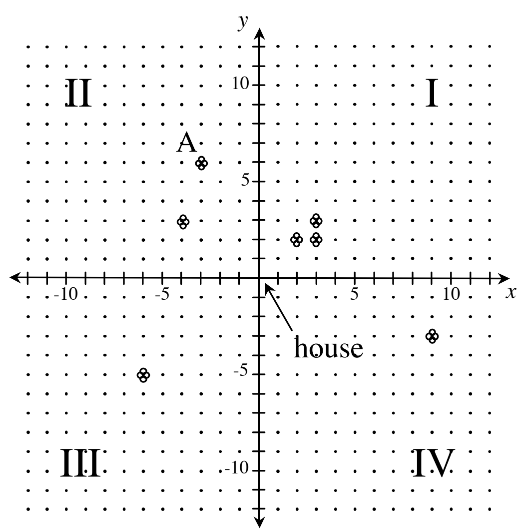
How can you describe a pattern formed by points?

1-7. THE EUCALYPTUS GROVE



Some communities in Mozambique plant eucalyptus tree farms because their tall, straight trunks make great poles for building homes.

While touring his farm, Etube (pronounced "eh-**too**-bay") noticed that some of the trees have a deadly disease. He created a coordinate system, shown in the diagram at right, to keep track of where the infected trees are.



The farm's roads are shown as the *x*- and *y*-axes in the diagram, and Etube's house is located where the two roads intersect. Each section of the farm (known as a **quadrant**) has 12 rows of 12 trees. The trees marked with a ⊗ show signs of disease – the tops are turning brown!

a. The tree marked A, located at the point $(–3, 6)$, is diseased. In (x, y) form, list the locations of all of the other diseased trees shown on the diagram.

Problem continues on next page. →

1-7. *Problem continued from previous page.*

b. On a piece of graph paper, neatly draw and label x- and y-axes to represent the roads intersecting at Etube's house. Place points or symbols on your graph to represent the diseased trees.

Etube just learned that the trees at (–8, 2) and (5, –7) are also diseased. Add these trees to your diagram.

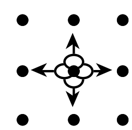
c. In (x, y) form, what is the location of Etube's house? This is also called the **origin** of a graph.

d. Etube is standing at the farmhouse looking out at Quadrant I and sees that the tree at $(3, 2)$ is diseased. However, he notices that he cannot see the tree at (6, 4) because it is blocked by the tree at (3, 2).

In (x, y) form, write down the locations of two other trees that he cannot see from his house because they are hidden behind the tree at $(3, 2)$. What do the locations of these trees have in common? When looking at the coordinates, what pattern(s) do you notice?

e. While standing at his house, can Etube see the diseased tree at (9, –3)? If so, explain how you know. If not, name any trees that block its view. How can you be sure that these trees hide the tree at (9, –3)? Be sure to justify your team's conclusion.

f. The tree disease is passed each day when the leaves of a diseased tree touch the leaves of a healthy tree that grows next to it, as shown on the diagram at right. (Note that the disease cannot pass between trees on opposite sides of the road because their leaves do not touch.) Etube knows that the tree at (–8, 2) is diseased. In (x, y) form, write the locations of four trees that will be infected by that tree on the first day.



g. In Quadrant I, three trees are diseased. Write the locations (x, y) of the trees that will be infected by these three trees by the end of the first day.

h. Etube noticed that there is one diseased tree in Quadrant III. The disease is spreading rapidly, and he is worried because the tree medicine will not arrive for four more days. How many trees in Quadrant III will still be healthy after the fourth day? How do you know? Use your diagram, keep track of the diseased trees, and justify your response.

1-8. Reflect on how you used the coordinates (the x- and y-values) to find and refer to points on the graph during today's lesson. Revisit the target questions, reprinted below, and share your conclusions in a class discussion.

How can you plot a point using its (x, y) coordinates?

How can you name a point on the graph?

How can you describe a pattern formed by points?

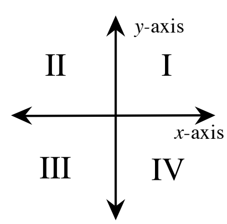
METHODS AND MEANINGS

MATH NOTES

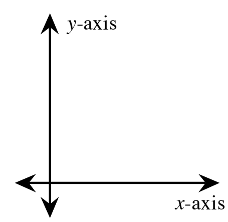
Axes, Quadrants, and Coordinates

The x- and y-axes help define points on a graph (called a "Cartesian Plane"). The ***x*-axis** is horizontal, while the ***y*-axis** is vertical. The x- and y-axes divide the graphing area into four sections called **quadrants**. Written as an **ordered pair**, a point is named by its **coordinates** (x, y), with the x-coordinate written first. The point $(0, 0)$ is called the **origin**.

4-quadrant graph:

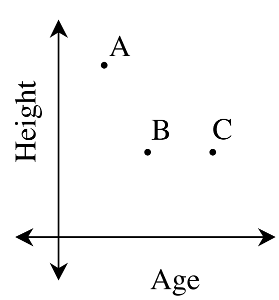


1st-quadrant graph:



Review & Preview

1-9. In the graph at right, points A, B, and C represent three different students.



a. Which student is oldest? Explain how you decided.

b. What can you say about student B compared to students A and C? Tell as much as you can and justify your statements.

1-10. Compute each of the following sums and differences.

a. $-7+(-2)$　　b. $3+(-4)$　　c. $-2-5$

d. $-1+5$　　e. $4-(-2)$　　f. $-7-(-8)$

1-11. Using whole numbers only, draw every possible rectangle with an area of 18 square units on graph paper. Write A = 18 un^2 inside each figure. Label the dimensions (length and width) of each rectangle.

1-12. Latisha is determined to do well in school this year. Her goal is to maintain at least an 85% average in all of her courses.

a. Latisha started with two scores: 72% and 89%. Confirm that the average of these two scores is 80.5%. Show your work.

b. Latisha's third score is 90%. Use her scores from part (a) to figure out her average now. Be sure to show your work.

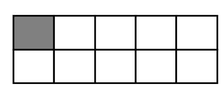
1-13. In this course you will need to be able to work with numbers, words, and geometric representations. Use these representations to answer the following problems.

a. Draw and shade a figure that represents 100%. Label your figure "100%." Then describe the figure in words.

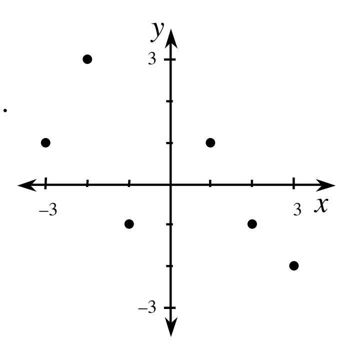
b. Similarly, draw and shade figures that represent 50%, 25%, and 150%. Label each figure and describe it in words.

c. Draw and shade a figure that represents "one-third." How can this figure be represented with a number?

d. Describe what the diagram at right represents using words and numbers.



1-14. Use the graph at right to answer the following questions about quadrants and coordinates of points.



a. What are the coordinates of the two points in Quadrant II (where the x-value is negative and the y-value is positive)?

b. What are the coordinates of the two points in Quadrant IV (where the x-value is positive and the y-value is negative)?

1.1.3 How can I use data to solve a problem?

Collecting, Organizing, and Analyzing Data

Computing batting averages, performing scientific experiments, and polling people during elections are just a few examples of how data can provide useful information when it is collected and analyzed. In this lesson you will be collecting and organizing data to determine the potential danger of riding a roller coaster.

1-15. NEWTON'S REVENGE

Have you heard about Newton's Revenge, the new roller coaster? It is so big, fast, and scary that people are already starting to talk. Some people are worried about the tunnel that thrills riders with its very low ceiling.

The closest the ceiling of the tunnel ever comes to the seat of the roller-coaster car is 200 cm. Although no accidents have been reported yet, rumors have been spreading that very tall riders have broken their arms as they went through the tunnel with their arms raised over their heads. Unfortunately, due to these rumors, many tall people have stopped riding the coaster.

Your task: Consider how you could determine whether the tunnel is actually safe for any rider, no matter how tall. Discuss the questions below with your team. Be ready to share your responses with the rest of the class.

Discussion Points

What is this problem about? What is it asking you to do?

What information can help you answer this question?

How can you get the information you need?

1-16. One way to determine if the roller coaster is safe is to collect and analyze data.

a. Collect data from each member of your team.

Each member of the team needs to be measured twice. First, have one team member stand and have another team member measure his or her height. Second, have the same student sit in a chair or desk, raise his or her arms so that they are stretched as far as possible above his or her head, and measure the distance from the seat of the chair to his or her fingertips. All measurements should be in centimeters.

Student Name	**Height (cm)**	**Reach (cm)**

Each person should record the team's data in a table like the one above.

b. Send one person up to record your team's data on the class table. Then add the rest of the class data to your own table.

c. Each person should put his or her initials on a sticky dot, then graph his or her own *height vs. reach* point on the class graph.

1-17. Use the class graph to answer the questions below.

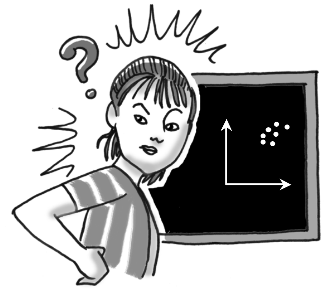
a. Are there any dots that you think show *human error*? That is, are there any dots that appear to be graphed incorrectly or that someone may have measured incorrectly? Explain why or why not.

b. Is a person's reach related to his or her height? That is, what seems to be true about the reach of taller people? Explain.

c. Since a person's reach depends on his or her height, we call the reach the **dependent** quantity and the height the **independent** quantity. Examine the class graph of the data from problem 1-16. On which axis was the independent data represented? On which axis was the dependent data represented?

d. Is there a trend in the data? How can you generalize the trend?

1-18. Everyone is complaining about how the teacher made the class graph!



a. Jorge is confused about how the teacher decided to set up the graph. *"Why is it a 1st-quadrant graph instead of a 4-quadrant graph?"* Answer Jorge's question. In general, how should you decide what kind of graph to use?

b. Lauren is annoyed with the *x*-axis. "*Why didn't the teacher just use the numbers from the table*?" she whined. "*Why count by twenties*?" What do you think?

c. Hosai thinks that the graph is TOO BIG. "*The dots are all mashed together! Why did the teacher begin both the x- and y-axes at zero? Anyone that short would never be allowed on the roller coaster. Why not just start closer to the smallest numbers on the table?*" she asked. What do you think?

d. Sunita says the graph is TOO SMALL! "*If we're supposed to be using this data to check if the coaster is safe for really tall people, the graph has to have room to graph tall people's dots too*." Do you agree? If so, how much room do you think is needed?

1-19. Using all of your ideas from problem 1-18, make your own graph that will help you determine whether the ride is safe for very tall people. For example, the basketball player Yao Ming is 7 feet 6 inches (about 228.6 cm) tall. Is the roller coaster safe for him? Explain.

1-20. Is the roller coaster safe for all riders? Prepare a poster that shows and justifies your team's answer to this question. Every team poster should include:

- A large, clear graph.
- A complete, clear, and convincing explanation of why your team thinks the ride is or is not safe for all riders.

METHODS AND MEANINGS

MATH NOTES

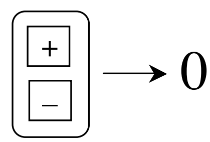
Adding and Subtracting Integers

An **integer** is any positive or negative whole number or zero. Look at the examples of integers and non-integers below:

$-1001 \quad 56 \quad 0 \quad -2$ — examples of integers

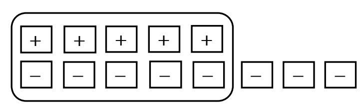
$\frac{1}{2} \quad 2.1 \quad \pi \quad 8.3$ — examples of non-integers

The diagram at right shows that $-1+1=0$. One way to think of this concept is to think of an elevator. If you start one floor below ground
(–1) and travel up one floor (+1), you end up on the ground floor (which can be represented with zero).

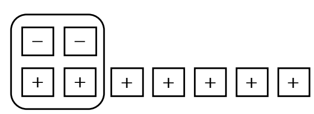


One useful strategy that works when adding and subtracting integers is to draw a diagram and eliminate zeros. Study the examples below:

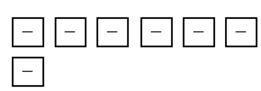
Example 1: $5-8=5+(-8)=-3$



Example 2: $-2+7=5$



Example 3: $-6-1=-6+(-1)=-7$



Review & Preview

1-21. Kerin discovered that a human's height is related to their reach. Kerin is curious if the same thing is true for foot size.

a. It was not practical for Kerin to measure her classmates' feet, so Kerin collected the following shoe-size data from some of her classmates. Make a graph with appropriately scaled axes.

shoe size	height (cm)
6	153
8	160
7.5	155
8.5	161
8	168
8	166
8.5	164
6.5	156
10	170
9.5	167
7.5	158
7.5	156
8	161

b. Is there a relationship between shoe size and height?

1-22. Do you remember how to make a box plot?

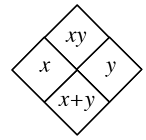
a. What is the median shoe size in problem 1-21? The minimum shoe size? The maximum?

b. What are the quartiles (the median of the upper half, and the median of the lower half)?

c. Plot these five numbers above a number line and create a box plot.

d. Where does your own shoe size fall in the distribution of Kerin's classmates?

1-23. Copy these Diamond Problems and use the pattern you discovered earlier, shown at right, to complete each of them. Some of these may be challenging!



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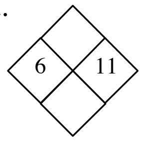

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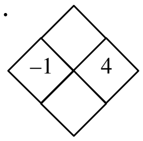

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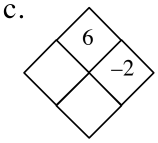

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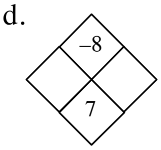

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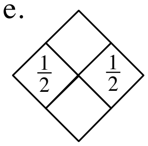

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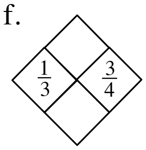

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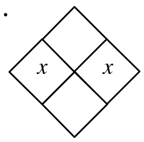

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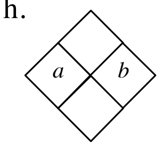


1-24. Compute *without* a calculator.

a. $-15+7$ b. $8-(-21)$ c. $-12-(-4)$

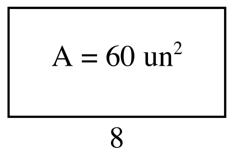
d. $-9+(-13)$ e. $-50-30$ f. $3-(-9)$

g. $-75-(-75)$ h. $(-3)+6$ i. $9+(-14)$

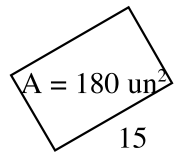
j. $28-(-2)$ k. $-3+(-2)+5$ l. $3+2+5$

1-25. The area of each rectangle below is shown in the middle of the rectangle. For each figure, find the missing length or width.

a.



b.



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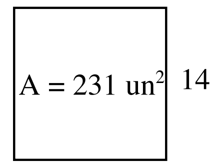


1-26. In this course you will need to be able to work with numbers, words, and geometric representations. Use these representations to answer the following questions.

a. Write another fraction that is equivalent to $\frac{4}{5}$. Draw diagrams to show that they are equal.

b. Find the equivalent decimal for both fractions. Was rounding your answer necessary?

c. Find the equivalent percent for both fractions.

1-27. Compute *without* a calculator.

a. $427-(-3)$

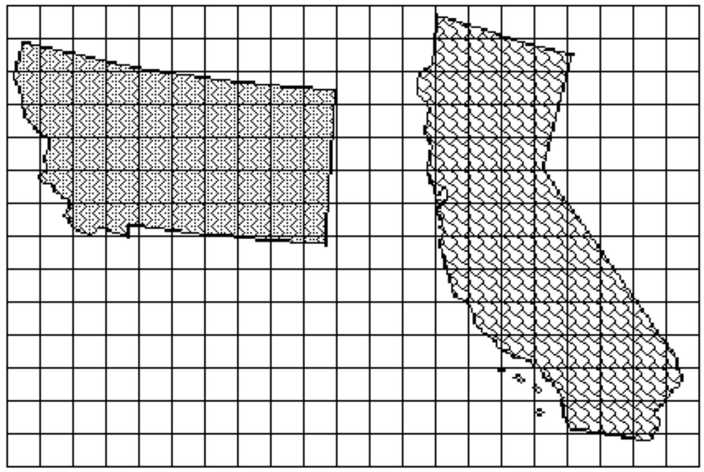
b. $-50+(-150)$

1-28. On graph paper, draw all of the possible rectangles with an area of 16 square units. Use only whole-number lengths (no decimals). What are the dimensions of the rectangle with the smallest perimeter?

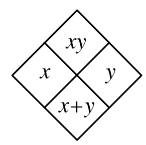
1-29. The area of a rectangle is 450 square inches. If the length of the rectangle is 24 inches, what is the width?

1-30. Latisha earned an 85% today. Her previous scores were 72%, 89%, and 90%. Calculate her new average.

1-31. Estimate the areas of Montana and California using the grid below. Which state has the greatest area? Compare the area of Montana to the area of California. Explain how you estimated the area of each state.

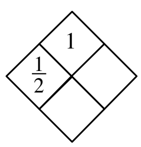


1-32. The diamond at right represents the pattern you found in problem 1-4.

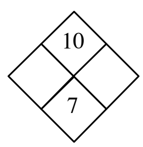


a. Complete these Diamond Problems.

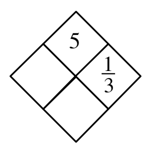
i.



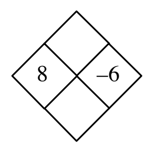
ii.



iii.



iv.



b. Create two new Diamond Problems of your own.

1.1.4 How can I generalize a pattern?

Finding and Generalizing Patterns

Often, mathematics is described as "the study of patterns." Today you will preview future work with patterns by studying two tile patterns and using them to make predictions. As you work on these patterns, consider the following questions:

How do I see the pattern?

How is it changing?

Is there another way to find a solution?

1-33. GROWING, GROWING, GROWING

Copy the tile pattern shown below onto graph paper.

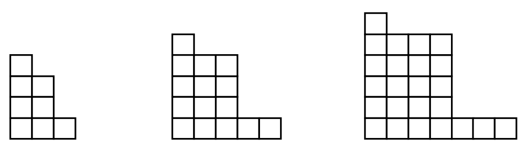


Figure 2 Figure 3 Figure 4

a. Draw the 1st, 5th, and 6th figures on your paper.

b. How is the pattern changing?

c. What would the 100th figure look like? How many tiles would it have? How can you justify your prediction?

1-34. Examine this new tile pattern. Copy it onto your paper.

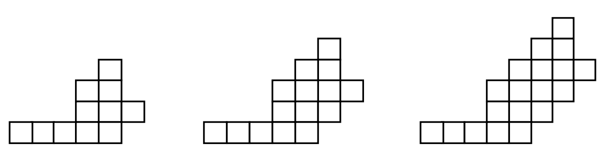


Figure 2 Figure 3 Figure 4

a. Draw the 1st, 5th, and 6th figures on your paper.

b. Michael knows that one of the figures in this tile pattern has 79 tiles. What is its figure number? There are *many* ways to figure this out – be sure to listen to each person's ideas about how to find a solution. Be prepared to explain how you answered this question.

1-35. For either the pattern in problem 1-33 or the pattern in problem 1-34, prepare a team transparency or poster with your description of the pattern and your prediction. Every team transparency or poster should include:

- Clear drawings of figures from your pattern.
- An explanation of the pattern you found.
- Your prediction. (Make sure your reasoning is clear!)

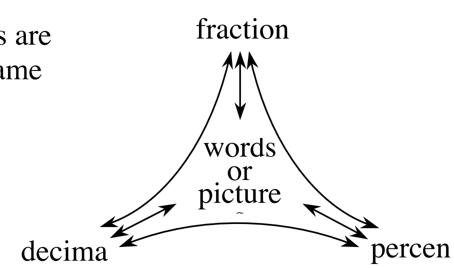
METHODS AND MEANINGS

MATH NOTES

Fractions, Decimals, and Percents

Fractions, decimals, and percents are different ways to represent the same number.

Below are some ways to convert a number from one of these representations to another.



Percent to decimal:

Since "percent" means "out of 100," divide the percent by 100.

$$29.6\% = 29.6 \div 100 = 0.296$$

Decimal to percent:

Reverse the process: Multiply the decimal by 100.

$$0.68 = (0.68)(100) = 68\%$$

Fraction to percent:

Find an equivalent fraction that has 100 in the denominator. The numerator is the percent.

$$\frac{3}{5} = \frac{60}{100} = 60\%$$

Percent to fraction:

Since "percent" means "out of 100," place the percent in a fraction over 100. Simplify as needed.

$$48\% = 0.48 = \frac{48}{100} = \frac{12}{25}$$

Fraction to decimal:

Since a fraction implies division, divide the numerator by the denominator.

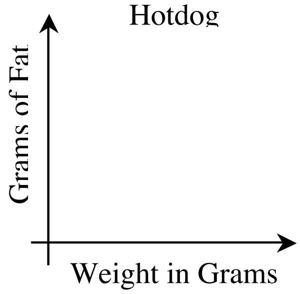
$$\frac{7}{8} = 7 \div 8 = 0.875$$

Decimal to fraction:

Write and reduce the fraction that has the same meaning of the decimal. For example, since 0.4 is "four-tenths":

$$0.4 = \frac{4}{10} = \frac{2}{5}$$

1-36. Copy the axes below onto your paper. Place and label a point on the graph for each of the products listed below.



a. Dog-Eat-Dog has a supreme hotdog that weighs 80 grams and has 40 grams of fat.

b. Hot Doggies has a diet hotdog that weighs 50 grams and has only 9 grams of fat.

c. Dog-alicious has a cheap hotdog that weighs 40 grams and has 30 grams of fat.

1-37. Copy and complete each sequence below. Using words, not numbers, describe how the patterns work. (For example, write, "Double the previous number.")

a. 1, 3, 6, 10, ___, ___

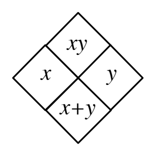
b. 1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, ___, ___

c. 1, 3, 9, 27, ___, ___

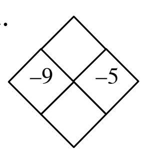
d. 8, 7, 5, 2, ___, ___

e. 49, 47, 52, 50, 55, ___, ___

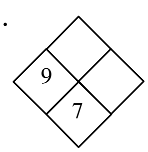
1-38. Recall the Diamond Problem pattern that you found in problem 1-4, which is represented in the diamond at right. Copy and complete the Diamond Problems below using the same pattern.



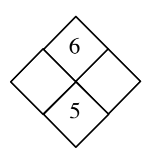
a.



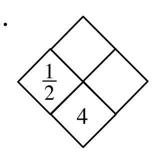
b.



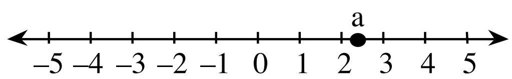
c.



d.



1-39. Copy the number line below onto your paper. Locate the following numbers by placing the lowercase letters a through e on the number line corresponding to the values given below. Part (a) is done for you.

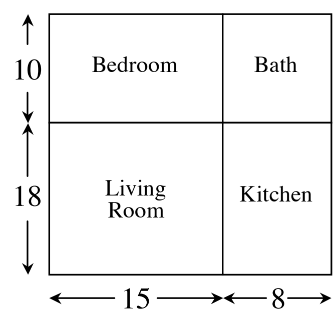


a. $2\frac{1}{3}$ b. –2.7 c. $\frac{1}{2}$ d. –0.2

e. $33\frac{1}{3}\%$ of 12

1-40. Draw and shade a diagram to represent $\frac{2}{3}$. Label your diagram with the fraction. Would 0.66 or 0.67 be a more appropriate decimal equivalent? Explain why.

1-41. Susan's apartment is shown at right. Assuming that all rooms are rectangular, find the quantities described below. All measurements are in feet.



a. Find the area of her living room.

b. Find the area of her entire apartment.

c. How much larger than her bedroom is her living room?

1.1.5 Can I graph myself?

The Algebra Walk

1-42. Algebra Walk*

The Algebra Walk is an exercise in "human graphing" where people represent points on a graph. Your teacher will give the class instructions on how to form human graphs. Then you will work in study teams to complete the problems below.

For each of the following rules, copy and complete the table. Then neatly graph each point. Use the resource page provided by your teacher.

The *x*-values in the table are sometimes referred to as **input** values, since they are the values used with the rule for x. The *y*-values are the **output** values, since they are the result of what happens to the input (*x*) value.

IN (*x*)	–6	–5	–4	–3	–2	–1	0	1	2	3	4	5	6
OUT (*y*)													

a. $y = 2x + 1$ b. $y = -2x$ c. $y = x + 4$

d. $y = -x + 4$ e. $y = x^2$

1-43. Describe what you did and what you observed in today's classwork.

a. Compare the graphs in 1-42. How are they similar? How are they different?

b. Express each symbolic rule in parts (a) through (e) in words.

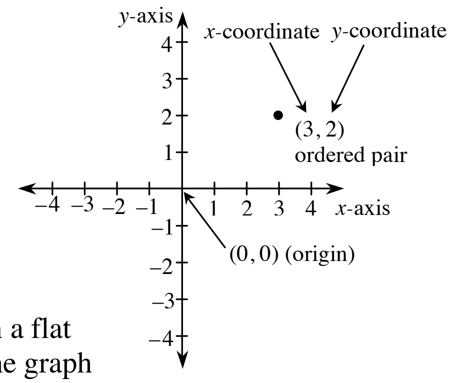
c. Did you notice any patterns? Why was it easy to spot someone who was out of place?

* Adapted from the MCTP Professional Development package, written by Australian mathematics teachers

MATH NOTES

METHODS AND MEANINGS

Graphing Points on an xy-Coordinate Grid



Coordinate axes on a flat surface are formed by drawing vertical and horizontal number lines. The **origin** is the point where the two number lines cross, which is 0 on each axis.

Numerical data can be graphed on a flat surface using **points**. Points on the graph are identified by two numbers in an **ordered pair** written as (x, y). The first number is the ***x*-coordinate** of the point and the second number is the ***y*-coordinate**.

To locate the point $(3, 2)$ on an xy-graph, go three units from the origin to the right to mark 3 on the horizontal axis and then, from that point, go 2 units up. To locate the point $(-2, -4)$, go 2 units from the origin to the left to the mark -2 on the horizontal axes and then 4 units down.

Review & Preview

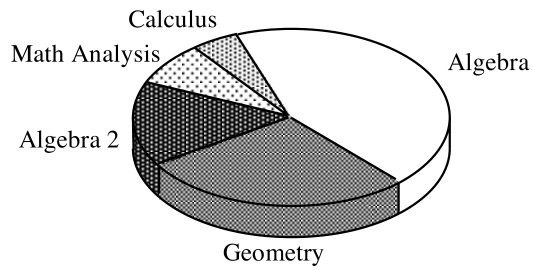
1-44. Use your graphs from problem 1-42 to answer the questions below.

a. How can the graph for the rule $y = 2x + 1$ be used to predict the result for an input (x-value) of 7? How can the graph be used to predict the output (y-value) associated with an input of $3\frac{1}{2}$?

b. If you wanted an output of 7 for the rule $y = -x + 4$, what would you need as an input?

c. For each of the rules in parts (a) through (e) of problem 1-42, where does the graph cross the y-axis? Describe any patterns you notice.

1-45. Enrollment in math courses at Kennedy High School in Bloomington, Minnesota, is shown in the pie chart at right. If there are 1000 students enrolled in math courses, approximately how many students are enrolled in Algebra? In Geometry? In Calculus?



1-46. Use substitution to find y.

a. $y=2+4.3x$, when $x=-6$

b. $y=x-2$, when $x=3.5$

c. $y=(x-3)^2$, when $x=9$

d. $y-5x=-4$, when $x=-2$

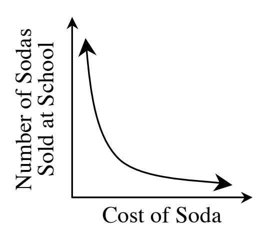
1-47. Latisha's friend Brandee forgot to make up a test and had these scores: 80%, 92%, 91%, 75%, 89%, 84%, 0%, and 85%.

a. Calculate Brandee's average. Does this average score really represent her abilities? Why or why not?

b. Brandee persuaded her teacher, Ms. Juarez, to allow her to make up the missed test. Brandee received a 78%. Calculate her new average.

c. What difference did the 0% score make? Does this new average represent Brandee's ability more accurately?

1-48. Explain what the graph at right represents. What information does it convey?



1-49. Find each sum or difference without a calculator.

a. $\frac{7}{10}+\frac{2}{3}$

b. $0.9-0.04$

c. $3\frac{1}{4}+2\frac{11}{12}$

d. $14\frac{1}{3}-9\frac{1}{5}$

1.1.6 How can I figure it out?

Finding Unknowns

Have you ever read a problem and been convinced that you did not have enough information to solve it? Sometimes the relationships just seem too complicated and you may even think it is a trick problem with no logical answer. However, if you persist and remember all the tools and strategies you have worked with and try to represent the situation in multiple ways, you may surprise yourself. In this lesson you will use what you have learned to solve some problems that may at first seem impossible. While you work, keep the following questions in mind:

How can we represent it?

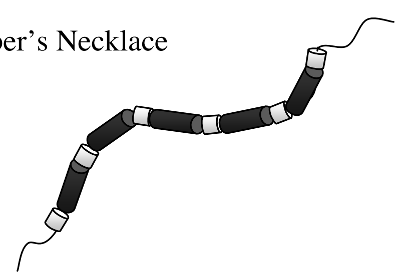
What is the best strategy or model for this problem?

Is this like any other problem we have seen?

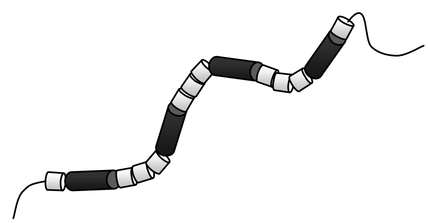
1-50. NIFTY NECKLACES

Amber and Melissa were making bead necklaces with one-centimeter wooden beads and longer green glass beads when they stopped to admire each other's work. Amber's necklace had only 11 total beads. She had designed a pattern that alternated 5 green beads with six wooden beads as shown below. Melissa's necklace used 4 green beads and 11 wooden beads in the pattern shown below.

Amber's Necklace



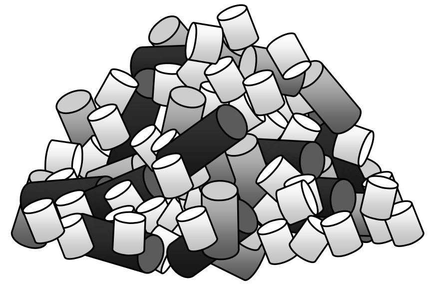
Melissa's Necklace



When they compared their progress, they were surprised to find that the necklaces were exactly the same length!

With your team, figure out the length of each green bead and the total length of each necklace. Be prepared to share your strategies with the class.

1-51. The necklaces are so popular that Amber and Melissa have decided to go into the jewelry business. They have located a supply house that will sell them beads in any color and any length. Help Amber and Melissa fill the orders below by figuring out the necessary bead lengths.



a. Cassie wants a necklace that is 58 centimeters long that has 12 of the 1 cm wooden beads arranged with some red beads. Red beads are available in lengths of 3 cm or 4 cm. Find at least two different ways that Amber and Melissa could fill Cassie's order.

b. Justin wants to order a necklace with the same pattern as Melissa's (one green alternating with three wooden beads, with one wooden bead on each end), but he wants it to be 61 centimeters long. Can his order be filled? If so, sketch a diagram and find out how many beads of each are needed. If not, explain how he could adjust his order.

c. **Additional Challenge:** Leonora wants two necklaces that use the 1 cm wood beads and some other bead of any color or any length. She has created the following designs: the longer necklace will use 24 of the 1 cm wooden beads and just one other bead in the center. The shorter one will use 4 of the other beads, each pair separated by just one of the 1 cm wooden beads. She wants one necklace to be exactly 5 cm shorter than the other. What length of bead should be used for this order?

1-52. THINKING ABOUT THINKING

a. With others, read and discuss the descriptions of making sense and multiple ways of seeing or doing below.

Making sense: To make sense of a problem means to understand how to solve it and why the answer works. Some ways you can make sense of a problem include breaking it into smaller steps, talking about it with others, and making a diagram or finding another way to visualize the problem. You will know that an answer makes sense when you understand it so well that you can explain it to someone else and answer questions about it. When you are able to answer *why* and *how* something works, you have made sense of it.

Multiple ways of seeing or doing: using multiple ways to *see* a problem means using different ways to interpret or make sense of the situation. For example, everyone in your class might look at the same dot or tile pattern but have different ways to see how the pattern grows. (Some students might see rows and columns, whereas some might see squares.) Using multiple ways to *do* a problem means using different strategies or ways to solve a problem. For example, can you think of more than one way to find the product $3\frac{1}{2} \cdot 2\frac{1}{5}$? When you worked with your team to look for multiple ways of seeing or doing problems in this course, you were building important thinking skills that will be useful throughout your life.

b. What questions did you ask yourself and your team that helped you make sense of problem 1-50?

c. What were the multiple ways your team saw problems 1-50 and 1-51? Describe the different ways your team represented the information and the various strategies your team used to solve the problems.

MATH NOTES

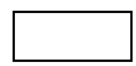
METHODS AND MEANINGS

Solving Problems with the 5-D Process

The **5-D Process** is an organized method to solve problems. The D's stand for Describe, Define, Do, Decide, and Declare. An example of this work is shown below.

Problem: The base of a rectangle is 13 centimeters longer than the height. If the perimeter is 58 centimeters, find the base and the height of the rectangle.

Describe/Draw: The shape is a rectangle and we are looking at the perimeter.



	Define		Do	Decide
	Height (trial)	Base (height + 13)	Perimeter 2(base) + 2(height)	58?
Trial 1:	10	10 + 13 = 23		66 is too high

Use a trial value.

Use the relationships stated in the problem to determine the values of the other quantities (such as base and perimeter).

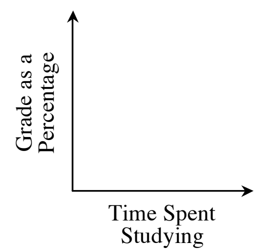
Decide if the answer is correct. Revise and make another trial until you find the correct answer.

Trial 2:	7	7 + 13 = 20	2(20) + 2(7) = 54	too low
Trial 3:	8	8 + 13 = 21	2(21) + 2(8) = 58	correct

Declare: The base is 21 centimeters and the height is 8 centimeters.

Review & Preview

1-53. Copy the axes at right and put a dot for each student described below.



a. Student A, who studies hard but gets only average grades.

b. Student B, who studies little but gets good grades.

1-54. Try these problems without a calculator first. Then use a calculator to check your answers.

a.	$-16+7$	b.	$10-(-24)$	c.	$(3)(-9)$	d.	$-9+(-11)$
e.	$-49-36$	f.	$-56\div(-7)$	g.	$15\div(-3)$	h.	$-7\div 7$
i.	$(-6)\cdot 9$	j.	$(-5)(-5)$	k.	$(-6)\cdot(43)$	l.	$27-(-3)-4$

1-55. Solve the problem below using the 5-D Process. State your solution in a sentence.

Todd is 10 years older than Jamal. The sum of their ages is 64. How old are Todd and Jamal?

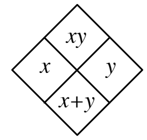
1-56. Copy the pattern at right and continue the pattern for successive powers of 3.

$3^1 = 3$
$3^2 = 9$
$3^3 =$ ____
$3^4 =$ ____
⋮
$3^9 =$ ____

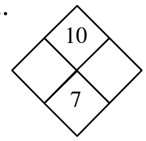
a. In a sentence or two, describe a pattern formed by the units digits (the "ones") of the numbers in the pattern.

b. $3^1 = 3$. List the next three powers of 3 for which the ones place is a 3.

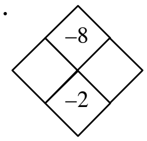
1-57. Copy and complete each of the Diamond Problems below. The pattern used in the Diamond Problems is shown at right.



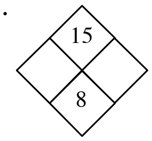
a.



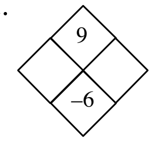
b.



c.



d.



1-58. Without a calculator, find the following products.

a. $\frac{11}{4}$ of $\frac{3}{7}$

b. $\frac{5}{12} \cdot 2$

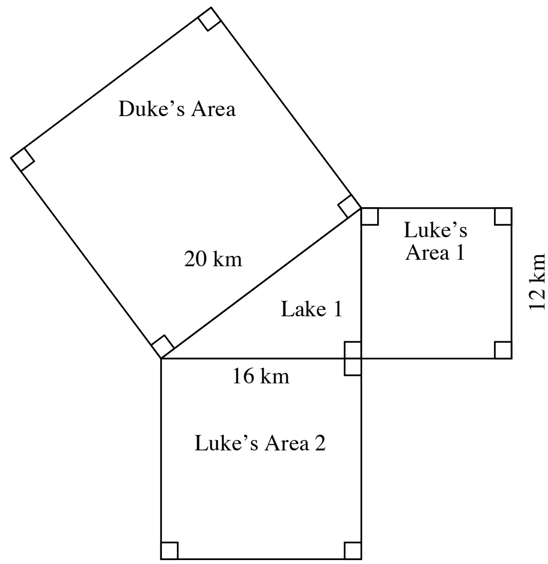
c. 4.16(0.2)

d. $4\frac{2}{5} \cdot 1\frac{1}{3}$

1.1.7 Are the areas the same?

Triangle Patterns

If you are given three lengths to make a triangle, how can you tell what kind of triangle will be created? Today you will investigate the different types of triangles that are formed when side lengths are specified.



1-59. Mr. Wrangler gave each of his sons, Luke and Duke, square-shaped property around triangular lakes. He knew Luke wanted more shoreline, so he gave Luke two smaller pieces on the shorter sides of the lakes. Duke wanted less shoreline and lots of wide open space. Therefore, his father gave him the big square of land on the long side. Luke was sure he had more land because he had two pieces of land on each lake. Duke's piece on the lake was largest, so he was sure he had more.

Using the diagram at right, help Luke and Duke settle their disagreement.

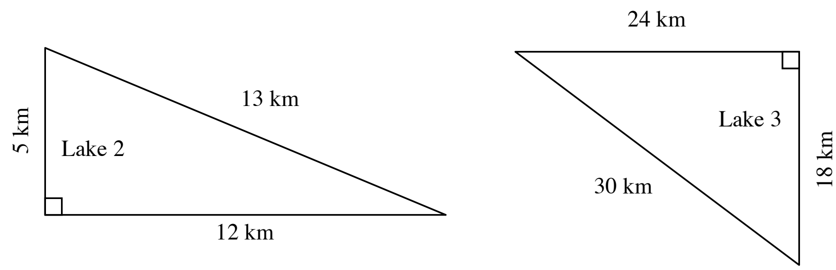
a. What shape is the lake?

b. Copy the table below. You will also need this table for the next problem. Find the area of each square around Lake 1. Record the data in the table.

c. Compare the sum of the area of Luke's land with the area of Duke's land. Was it split fairly?

Lake	Luke's Areas			Duke's Square Area
	Square 1	Square 2	Total Area	
1				
2				
3				

1-60. Luke and Duke received property around two other lakes on the Wrangler property. The lakes are pictured in the diagram below. Their property is shaped like the property around Lake 1.



a. Draw Lakes 2 and 3 and sketch the surrounding square plots of land. Remember that Luke has two pieces of land on the shorter sides of each lake. Duke has one piece of land on the longest side of each lake. Label each plot of land with the name of the owner. What is the shape of each lake?

b. Find the area of each square around Lakes 2 and 3. Record the data in the table from the previous problem.

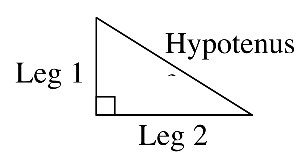
c. Compare the sum of the areas each brother received. Was the land split fairly?

METHODS AND MEANINGS

MATH NOTES

Right Triangle Vocabulary

A **right triangle** is a triangle in which the two shorter sides form a right (90°) angle. The shorter sides are called **legs**. The third and longest side, called the **hypotenuse**, is opposite the right angle.



1-61. Use the data from the table in problem 1-59 to make a conjecture about the side lengths of right triangles.

1-62. Now, you will test your conjecture from problem 1-61. Copy the table below. Cut off the bottom six rows of your graph paper to create a graph paper ruler. Then complete the following steps for each set of given leg lengths.

	Length of Leg 1	Length of Leg 2	Length of Hypotenuse	Test your conjecture	Was your conjecture correct?
a.					
b.					
c.					

- On your graph paper, carefully draw a right triangle with the leg lengths given below.
- Measure the length of the hypotenuse of the triangle using your graph paper ruler.
- Test your conjecture.
- Check your answers with your team. Do you need to revise your conjecture?

a. Leg 1 = 6, Leg 2 = 8

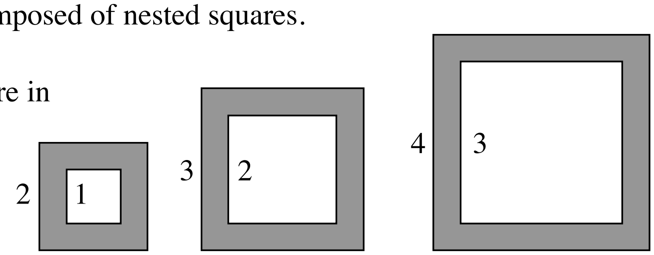
b. Leg 1 = 8, Leg 2 = 15

c. Leg 1 = 7, Leg 2 = 24

Review & Preview

1-63. The pattern below is composed of nested squares.

a. Draw the next figure in the pattern.



b. Find the area of the shaded region for the figure you drew in part (a).

1-64. Examine the tile pattern at right.

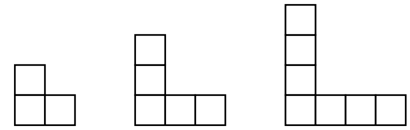


Figure 1 Figure 2 Figure 3

a. On your paper, sketch Figures 4 and 5.

b. How does the pattern grow? Explain how you know.

c. How many tiles will there be in Figure 100? Explain how you know.

1-65. Simplify each expression below without using a calculator.

a. $8+(-6)+4$

b. $-15+3+6$

c. $-8+12-2$

d. $6(-8)$

e. $5(-9)$

f. $-61-(-13)$

g. $4(-7)$

h. $120 \div (-10)$

1-66. Consider this data: 22, 15, 30, 51, 27, 33, 19.

a. Arrange the data into a stem-and-leaf plot.

b. Find the mean and median.

c. If the value 51 was replaced with 33, which measures of central tendency would change and which would not? Explain.

1-67. Solve the problem below using the 5-D Process. State your solution in a sentence.

Jabari is thinking of three numbers. The greatest number is twice as big as the least number. The middle number is three more than the least number. The sum of the three numbers is 75. Find the numbers.

1-68. Simplify each of the following expressions.

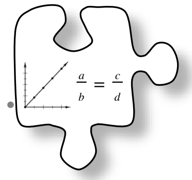
a. $\frac{11}{12}+\frac{4}{9}$

b. $4\frac{3}{5}-1\frac{13}{15}$

c. $\frac{9}{10}\cdot 2\frac{1}{3}$

d. $12 \div \frac{7}{8}$

1.2.1 How do they compare?



Proportional Relationships with Graphs and Tables

You may recall studying about proportional relationships in a previous course. Today you will investigate proportional relationships in graphs and tables.

1-69. Make a table and graph that represent each of the situations below.

Parvin often cleans her teacher's transparencies. She can clean 17 transparencies in 10 minutes. How many transparencies can she clean in different amounts of time?

Yasmin's puppy, Maggie, weighed 14 ounces at birth. She doubled her birth weight in 10 days. Assuming her growth is constant, how much will she weigh at various times in the first year?

Angel saw an Internet pop-up advertisement for an investment that doubles your money every year. If Angel invests the $20 her grandmother gave her for her birthday, how much money will she have in various years?

Which of these situations describe a proportional relationship? How do you know if a relationship is proportional from the table? From the graph?

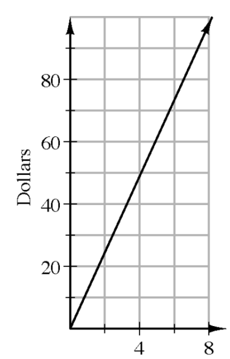
1-70. Doug regularly mows his neighbor's lawn. Last month, Doug's neighbor paid Doug $55 for 6 hours of mowing.

Doug	
Time (hr)	Earnings ($)
6	55

a. Is the situation described most likely a proportional relationship? How do you know?

b. Make a table that shows how much Doug earns for various numbers of hours of mowing.

c. Johnny brags that he is getting paid more to mow lawns. Johnny gets paid according to the graph at right. Who is getting paid more? How do you know?



d. At what unit rate do Johnny and Doug each get paid? How do you know?

e. If it is not already there, how could we show the unit rate in Doug's table? How could we show the unit rate on Johnny's graph?

1-71. Ferroza's pet ferret eats so much that Ferroza has to buy ferret food in bulk. Five pounds cost $17.50 and 30 pounds cost $105.00.

a. Make a graph of the cost of ferret food for various size bags.

b. Calculate the value of y at the point $(1, y)$ on Ferroza's graph. Why would Ferroza want to know what the value of y is?

1-72. Toby wrote the equation $t = \frac{7}{10}m$ to represent the relationship between the number of tubes of toothpaste (t) he uses in any number of months (m).

a. How much toothpaste does Toby use in 5 years?

b. Toby's sister kept track of her toothpaste use in the following table.

Who uses more toothpaste, Toby or his sister?

c. If you have not already done so, find the unit rate (in tubes/month) for both Toby and his sister. Do the unit rates confirm your answer to part (b)?

Toby's Sister	
Time (months)	Tubes (#)
14	9
28	18

1-73. The larger bag of ferret food is on sale at the SuperPetMart for $89. Ferroza made the following table. Explain to Ferroza why the cost of food at SuperPetMart is not a proportional relationship.

Ferret Food	
Weight (pounds)	Cost ($)
0	0
5	17.50
30	89

1-74. LEARNING LOG

In this course, you will often be asked to reflect on your learning in a Learning Log. Writing about your understanding will help you pull together ideas, develop new ways to describe mathematical ideas, and recognize gaps in your understanding. Your teacher will tell you where your Learning Log entries should go.

For your first entry, explain what a proportional relationship is in your own words. How do you recognize one from a table? How do you recognize one from a graph? How can you find the unit rate in a table and in a graph? Be sure to include examples to support your statements.

Title this entry "Proportional Relationships" and include today's date.

METHODS AND MEANINGS

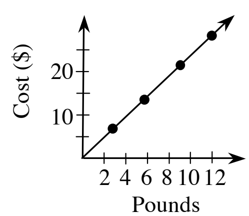
MATH NOTES

Directly Proportional Relationships

A **directly proportional** relationship can be seen in a table: if one quantity is multiplied by an amount, the corresponding quantity is multiplied by the same amount. On a graph, a directly proportional relationship is linear and goes through the origin.

Example: Three pounds of chicken costs $7.00. Other table values are shown and the values are plotted on the graph below.

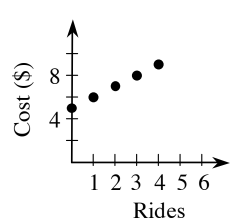
Pounds (x)	0	3	6	9	12
Cost (y)	0	7	14	21	28



The relationship between pounds and cost is directly proportional.

Example: The county fair costs $5.00 to enter and $1.00 per ride.

Rides (x)	0	1	2	3	4
Cost (y)	5	6	7	8	9



The relationship between rides and cost is **not** proportional because, for example, someone who goes on four rides ($9) does not pay twice as much as someone who went on two rides ($7). There is no multiplier for the relationship. The graph does not go through the origin.

1-75. Decide if each of the following is a proportional relationship. Explain why or why not.

a. Karim is ordering video games. Each game is $39.99 and there is a $4.85 shipping charge per order. How much will it cost him to order any number of video games?

b. A given rectangle has an area of 20 square feet. What is the length for various widths?

c. Oleg ran 8.8 miles in 1 hour 20 minutes. Assuming he continues at a constant rate, how long will it take him to run any number of miles?

1-76. Without a calculator, find the following quotients.

a. $\frac{3}{7} \div \frac{2}{3}$

b. $1.2 \div 0.04$

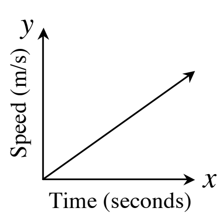
c. $8\frac{2}{3} \div 4\frac{1}{2}$

1-77. Jerome is keeping track of how many books he and his friends have read during the first 100 days of school. Make a box plot of how many books each person has read to help Jerome present the data to his teacher. The numbers of books are: 12, 17, 10, 24, 18, 31, 17, 21, 20, 14, 30, 9, 25.

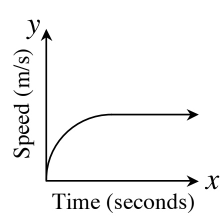
1-78. The area of a rectangle is 24,396 square centimeters. If the width is 38 centimeters, what is the length? How do you know?

1-79. Look at each graph below and write a story or description about what each graph shows.

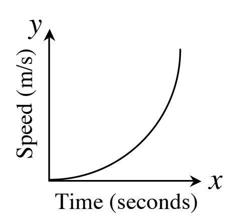
a.



b.



c.



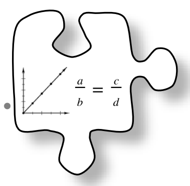
1-80. Riley was monitoring the growth of his favorite tomato plant and collected the data shown in the table at right.

a. Graph Riley's data.

b. What can you tell Riley about his plant based on the data?

Time (days)	Height (cm)
10	3
14	4.3
18	7
21	8.9
23	11.4

1.2.2 How can I solve the proportion?



Strategies for Solving Proportional Relationships

1-81. Kenny can make seven origami (folded-paper) cranes in ten minutes. He read a story about a girl who made 1505 cranes, and was curious how long it would take him to make that many without stopping.

a. Explain how you completed Kenny's table. How many minutes would it take Kenny? How many hours?

Origami Cranes	
Cranes (#)	Time (minutes)
0	0
7	10
1001	?

b. Instead of solving this problem using a table or a graph, Kenny represented 7 cranes in ten minutes as the ratio $\frac{10 \text{ minutes}}{7 \text{ cranes}}$. Then he found an equivalent ratio as follows:

$$\frac{10 \text{ minutes}}{7 \text{ cranes}} = \frac{?\ \text{minutes}}{1505 \text{ cranes}}$$

Use two different strategies to find the missing value in the equivalent ratio.

1-82. MULTIPLE STRATEGIES

Kenny's class found multiple ways to solve $\frac{10}{7} = \frac{x}{1505}$. Three of the strategies are below. Some of these strategies might be the same as what you came up with in problem 1-81. However, others may be new. Work to understand each strategy so that you can use it to solve a new problem.

a. Giant One

Multiplying a ratio by 1 does not change the value of the ratio. Can you find a value to use as a numerator and denominator in a Giant One, then find the value of x?

$$\frac{10}{7} \cdot \frac{\ }{\ } = \frac{x}{1505}$$

b. Undo Division

In this ratio, x is divided by 1505. You can undo the division by multiplying each side of the proportion by 1505 like this.

$$\left(\frac{1505}{1}\right)\frac{10}{7} = \frac{x}{1505}\left(\frac{1505}{1}\right)$$

Work with your team to explain how this idea works. Are the two ratios still equal? Why are both sides multiplied by 1505? Simplify each side of the equation.

c. Fraction Buster

If multiplying both sides by 1505 gets rid of the denominator of the x, then can we use the same strategy to get rid of the 7 in the other denominator? Discuss this question and decide if undoing both denominators is a reasonable strategy. Does this help solve the equation?

$$\frac{10}{7} = \frac{x}{1505}$$

$$\frac{7 \cdot 1505}{1}\left(\frac{10}{7}\right) = \left(\frac{x}{1505}\right)\frac{7 \cdot 1505}{1}$$

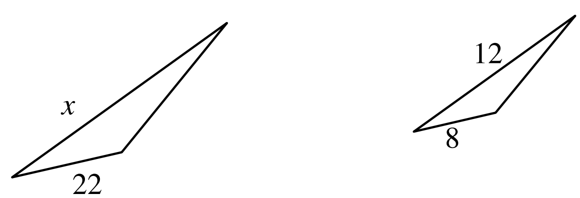
$$(1505)(10) = (x)(7)$$

1-83. Use the strategies from problem 1-82 to solve the problems below.

a. When he was little, Miguel could not sleep without his Captain Terrific action figure–it looked so life-like because it was a perfect scale model. The actor who plays Captain Terrific on television is 216 cm tall. Miguel's doll is 10 cm tall. If the doll's neck is 0.93 cm long, how long is the actor's neck? Use the undoing division method to solve this proportion: $\frac{216}{10} = \frac{x}{0.93}$.

b. The Northwood School Math Club is having a tamale sale! The school has 1600 students, but the club members are not sure how many tamales to make. One day during lunch, the club asked random students if they would buy a tamale. They found that 15 out of 80 students surveyed said they would definitely buy a tamale. How many tamales should the Math Club expect to sell? Use the Fraction Busters Method to solve a proportion.

c. On the school copy machine, Mr. Douglas reduced a triangle so that it would fit better in student portfolios. The shortest side of the original triangle was 22 cm; other measurements are shown in the diagram. How long was the longest side of the original triangle? Solve the proportion $\frac{22}{8} = \frac{x}{12}$ using the Giant One method.



1-84. Elsie is starting a recycling club at her school and hopes to use the money earned from recycling cans to buy recycling bins for the school.

Elsie first needs to figure out how much the cans that can be collected at her school weigh, so she starts by weighing the cans in her recycling bin at home. She finds that 50 cans weigh 0.8 kg. The next day, Elsie counts cans at school and finds that her fellow students throw away 1240 cans each day.

Solve the proportion below using the Fraction Busters Method to find how much all of the school's cans weigh.

$$\frac{50}{0.8} = \frac{1240}{x}$$

1-85. Cross-Multiplying

Juana remembered a strategy for solving equations that she learned her teacher showed her last year: "*We just multiply diagonally*." Juana's method is at right.

$$\frac{10}{4} = \frac{x}{7}$$
$$(7)(10) = (x)(4)$$

Explain to Juana why her method is just a shortcut to the Fraction Busters Method.

METHODS AND MEANINGS

MATH NOTES

Solving Proportions

If a relationship is known to be directly proportional, ratios from the situation are known to be equal. An equation stating that two ratios are equal is called a **proportion**. Some examples of proportions are:

$\frac{5}{7} = \frac{50}{70}$ $\frac{6\text{ mi}}{2\text{ hr}} = \frac{9\text{ mi}}{3\text{ hr}}$

Setting up a proportion is one strategy for solving for an unknown part of one ratio. For example, if the ratios $\frac{9}{2}$ and $\frac{x}{16}$ are equal, setting up the proportion $\frac{x}{16} = \frac{9}{2}$ allows you to solve for x.

Giant One: One way to solve this proportion is by using a Giant One to find the equivalent ratio. In this case, since 16 is 2 times 8, we create the Giant One to the right.

$$\frac{x}{16} = \frac{9}{2} \cdot \frac{8}{8}$$
$$\frac{x}{16} = \frac{9 \cdot 8}{2 \cdot 8}$$
$$\frac{x}{16} = \frac{72}{16}$$

which shows that $x = 72$.

Undo Division. Another way to solve the proportion is to think of the ratio $\frac{x}{16}$ as, " x divided by 16." To solve for x, use the inverse operation of division, which is multiplication. Multiplying both sides of the proportional equation by 16 "undoes" the division.

$$\frac{x}{16} = \frac{9}{2}$$
$$\left(\frac{16}{1}\right)\frac{x}{16} = \frac{9}{2}\left(\frac{16}{1}\right)$$
$$x = \frac{144}{2}$$
$$x = 72$$

Cross Multiplication. This method of solving the proportion is a shortcut for using a fraction buster (multiplying each side of the equation by the denominators).

Fraction Buster

$$\frac{x}{16} = \frac{9}{2}$$
$$2 \cdot 16 \cdot \frac{x}{16} = \frac{9}{2} \cdot 2 \cdot 16$$
$$2 \cdot x = 9 \cdot 16$$
$$2x = 144$$
$$x = 72$$

Cross Multiplication

$$\frac{x}{16} = \frac{9}{2}$$
$$\frac{x}{16} \times \frac{9}{2}$$
$$2 \cdot x = 9 \cdot 16$$
$$2x = 144$$
$$x = 72$$

Review & Preview

1-86. Solve each of the following proportions.

a. $\frac{x}{24} = \frac{30}{36}$

b. $\frac{5}{7} = \frac{x}{3}$

c. If Joan read 75 pages in 4 hours how long will it take her to read 250 pages?

1-87. For each situation, determine if it is proportional or not.

a. Carlos wants to buy some new video games. Each game he buys costs him $36. Is the relationship between the number of games Carlos buys and the total price proportional?

b. Single tickets cost $56 while five tickets cost $250. Is the relationship between the number of tickets bought and the total price proportional?

c. Vu is four years older than his sister. Is the relationship between Vu and his sister's age proportional?

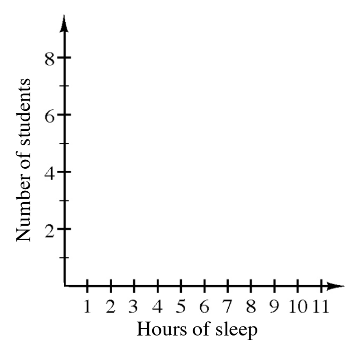
d. Carl just bought a music player and plans to load 50 songs each week. Is the relationship between the number of weeks after Carl bought the music player and the number of songs on his player proportional?

e. Anna has a new video game. It takes her five hours of playing the game to master level one. After so much time, Anna better understands the game and it only takes her three hours of playing the game to master level two. Is the number of hours played and the game level proportional?

1-88. Kelly asked some of her classmates how many hours of sleep they get on school nights. Here are the results:

$$6, 8, 7\tfrac{1}{2}, 9, 8, 8, 8, 9, 9, 10, 6, 8\tfrac{1}{2}, 9, 7, 8$$

Copy the set of axes at right and create a histogram for the data.



1-89. While organizing his bookshelf, Michael noticed that he had eight more science fiction novels than spy novels. If he owns 26 science fiction and spy novels, how many of each type of novel does he own? Explain how you found your solution.

1-90. Throughout this book, key problems have been selected as "checkpoints." Each checkpoint problem is marked with an icon like the one at left. These checkpoint problems are provided so that you can check to be sure you are building skills at the expected level. When you have trouble with checkpoint problems, refer to the review materials and practice problems that are available in the "Checkpoint Materials" section at the back of your book.

This problem is a checkpoint for computations with positive fractions. It will be referred to as Checkpoint 1.

Compute each of the following problems with fractions. Simplify if possible.

a. $\frac{2}{3}+\frac{4}{5}$

b. $1-\frac{3}{8}$

c. $4\frac{1}{3}+2\frac{3}{4}$

d. $5\frac{1}{2}-3\frac{7}{8}$

e. $5\frac{1}{3}\cdot\frac{3}{4}$

f. $\frac{7}{8}\div 1\frac{1}{2}$

Check your answers by referring to the Checkpoint 1 materials located at the back of your book.

If you needed help solving these problems correctly, then you need more practice with computations with positive fractions. Review the Checkpoint 1 materials and try the practice problems. Also, consider getting help outside of class time. From this point on, you will be expected to solve problems like this one quickly and easily.

Chapter 1 Closure What have I learned?

Reflection and Synthesis

The activities below offer you a chance to reflect on what you have learned during this chapter. As you work, look for concepts that you feel very comfortable with, ideas that you would like to learn more about, and topics you need more help with. Look for connections between ideas as well as connections with material you learned previously.

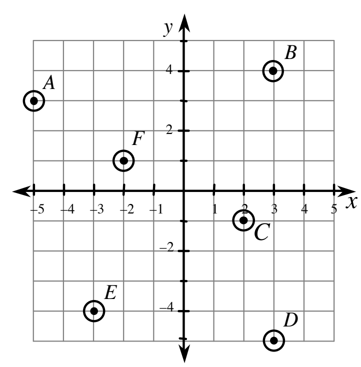
① SUMMARIZING MY UNDERSTANDING

This section gives you an opportunity to show what you know about certain math topics or ideas. Your teacher will assign you an activity to review the concepts you have studied in this chapter.

② WHAT HAVE I LEARNED?

Working the problems in this section will help you to evaluate which types of problems you feel comfortable with and which ones you need more help with. This section will appear at the end of every chapter to help you check your understanding.

Solve each problem as completely as you can. The table at the end of this closure section has answers to these problems. It also tells you where you can find additional help and practice on problems like them.



CL 1-91. In (x, y) form, write the coordinates of each point (A through F) circled on the graph at right.

CL 1-92. On graph paper, draw and label x- and y-axes. Find and label the following points:

$G(3, 2)$ $H(1, 4)$ $I(–2, –1)$

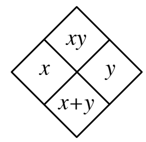
$J(4, –2)$ $K(–5, 1)$

CL 1-93. Solve the following problem using the 5-D Process. Show your work in an organized way.

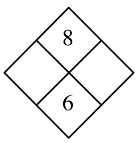
Alex hangs each pair of pants and each shirt on a separate hanger. He has 51 hangers in his closet all holding clothes. Every time he buys 1 pair of pants he also buys 2 shirts. How many shirts does Alex own?

CL 1-94. On graph paper, draw at least six different-sized rectangles that have an area of 64 square units. Then find the perimeter of each rectangle.

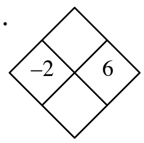
CL 1-95. Copy and complete each of the Diamond Problems below. The pattern used in the Diamond Problems is shown at right.



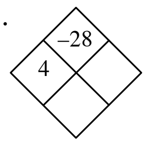
a.



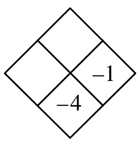
b.



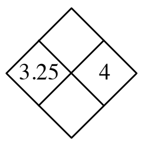
c.



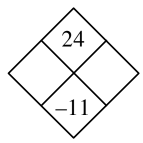
d.



e.



f.



CL 1-96. Copy the pattern below onto graph paper. Draw the 1st and 5th figures on your paper.

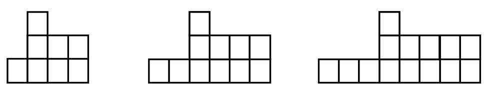


Figure 2 Figure 3 Figure 4

a. How many tiles are in each figure?

b. Describe how the pattern is changing.

c. How many tiles would the 6th figure have? the 10th figure?

CL 1-97. Molly bought 4.25 pounds of fish for $10.20.

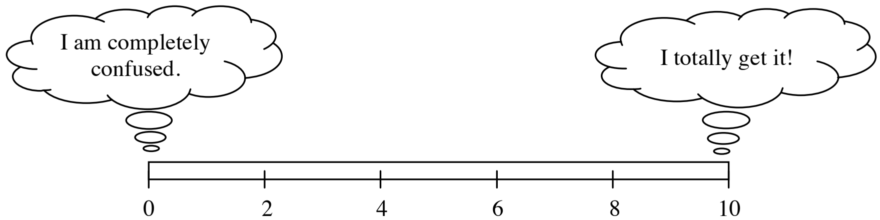
a. What is the unit rate (cost per pound)?

b. What should six ponds of fish cost at the same rate?

c. Write and equation relating cost (c) with pounds (p).

CL 1-98. For each of the problems above, do the following:

- Draw a bar or number line that represents 0 to 10.



- Color or shade in a portion of the bar that represents your level of understanding and comfort with completing that problem on your own.

If any of your bars are less than a 5, choose *one* of those problems and complete one of the following tasks:

- Write two questions that you would like to ask about that problem.
- Brainstorm two things that you DO know about that type of problem.

If all of your bars are a 5 or above, choose *one* of those problems and do one of these tasks:

- Write two questions you might ask or hints you might give to a student who was stuck on the problem.
- Make a new problem that is similar and more challenging than that problem and solve it.

③ WHAT TOOLS CAN I USE?

You have several tools and references available to help support your learning – your teacher, your study team, your math book, and your Toolkit, to name only a few. At the end of each chapter you will have an opportunity to review your Toolkit for completeness as well as to revise or update it to better reflect your current understanding of big ideas.

The main elements of your Toolkit should be your Learning Logs, Math Notes, and the vocabulary used in this chapter. Math words that are new to this chapter appear in bold in the text. Refer to the lists provided below and follow your teacher's instructions to revise your Toolkit, which will help make it a useful reference for you as you complete this chapter and prepare to begin the next one.

Learning Log Entries

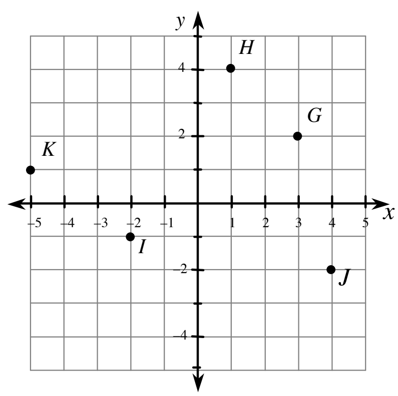
- Lesson 1.2.1 – Proportional Relationships

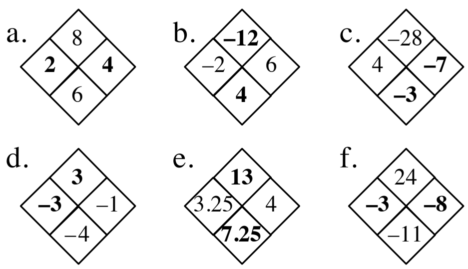
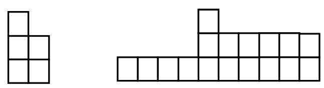
Math Notes

- Lesson 1.1.1 – The Perimeter and Area of a Figure
- Lesson 1.1.2 – Axes, Quadrants, and Coordinates
- Lesson 1.1.3 – Adding and Subtracting Integers
- Lesson 1.1.4 – Fractions, Decimals, and Percents
- Lesson 1.1.5 – Graphing Points on an *xy*-Coordinate Grid
- Lesson 1.1.6 – Solving Problems with the 5-D Process
- Lesson 1.1.7 – Right Triangle Vocabulary
- Lesson 1.2.1 – Directly Proportional Relationships
- Lesson 1.2.2 – Solving Proportions

Answers and Support for Closure Problems
What Have I Learned?

Note: MN = Math Note, LL = Learning Log

Problem	Solution	Need Help?	More Practice
CL 1-91.	a. (–5, 3) b. (3, 4) c. (2, –1) d. (3, –5) e. (–3, –4) f. (–2, 1)	Lessons 1.1.2, 1.1.5 MN: 1.1.2, 1.1.5	Problems 1-7, 1-14, 1-36, and 1-53
CL 1-92.		Lesson 1.1.2 MN: 1.1.2, 1.1.5	Problems 1-7, 1-14, 1-36, and 1-53
CL 1-93.	Alex owns 34 shirts.	Lesson 1.1.6 MN: 1.1.6	Problems 1-55, 1-67 and 1-89
CL 1-94.	Multiple answers are possible. Rectangles with integer sides have dimensions 1 by 64, 2 by 32, 4 by 16, and 8 by 8. However, to get more than four rectangles with different dimensions, you need to also use non-integer lengths, such as $\frac{1}{2}$ by 128 or $\frac{1}{3}$ by 192.	Lesson 1.1.1 MN: 1.1.1	Problems 1-5, 1-11, 1-25, 1-28, 1-29, and 1-78

Problem	Solution	Need Help?	More Practice
CL 1-95.		Problem 1-4	Problems 1-23, 1-32, 1-38, and 1-57
CL 1-96.	 Figure 1 Figure 5 a. 5, 8, 11, 14, 17 b. Each figure has three more tiles than the one before it. c. The 6th figure would have 20 tiles. The 10th figure would have 32 tiles.	Lesson 1.1.4	Problems 1-33, 1-34, and 1-64
CL 1-97.	a. \$2.40 b. \$14.40 c. $c = 2.40p$	Lessons 1.2.1, 1.2.2 MN: 1.2.1, 1.2.2 LL: 1.2.1	Problems 1-70, 1-71, 1-72, and 1-86