LESSONS
31–60

UNIT
2

Simply Good and Beautiful

MATH 7

COURSE BOOK 2

The Good and the Beautiful
CURRICULUM

COURSE BOOK 2

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LESSONS 31–60

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- Writing unit multipliers from any conversion factors

Set Notation

SUPPLIES: colored pencils

WARM-UP

Draw the correct comparison symbol.

a. $10 \bigcirc |14-24|$ b. $14 \bigcirc 7^2$ c. $\sqrt{121} \bigcirc -15$

LESSON

Use the app to watch the video lesson. Complete problems when instructed during the video in the Video Notes section. Optionally, read the Lesson Overview in place of the video or after the video if more instruction is needed.

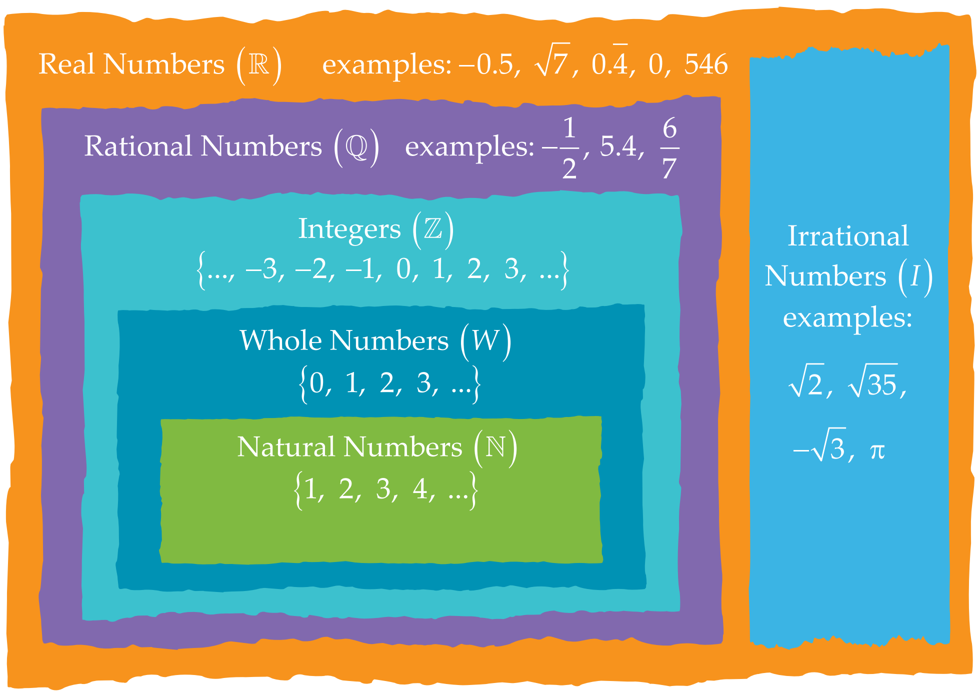
VIDEO NOTES

Rational numbers	a group or collection of objects
Real numbers	the set of all rational and irrational numbers
Integer	numbers that can be written as fractions where both the numerator and denominator are integers and the denominator is not zero
Natural numbers	numbers that cannot be written as fractions
Whole numbers	a number with no fractional or decimal part
Set	numbers representing a whole amount (not a fraction or decimal)
Irrational numbers	the numbers we say when we count

$\subseteq$	"is an element of" (or "is in")
$\in$	"intersect"
$\notin$	"is a subset of"
$\cap$	"the empty set"
$\cup$	"is not an element of" (or "is not in")
$\varnothing$	"the complement of Set A"
A'	"union"

LESSON OVERVIEW

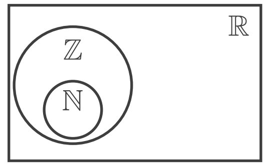
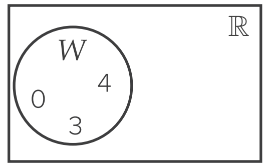
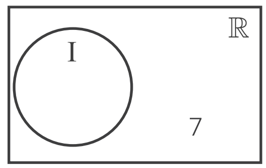
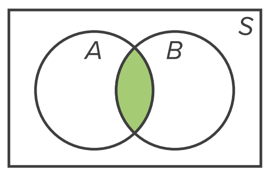
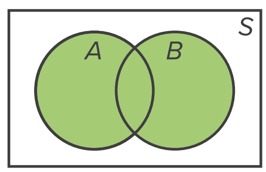
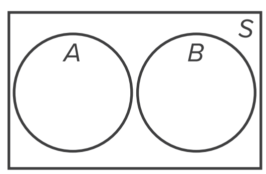
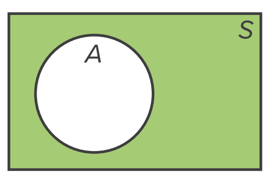
Organizing large groups of things can make them easier to understand. Numbers can be organized into sets. A ***set*** is a group or collection of objects. Number sets describe different characteristics of numbers. Below is a diagram showing the relationships between different number sets.



Real numbers are the set of all rational and irrational numbers. Any point on the number line is a real number.

Irrational numbers are numbers that cannot be written as fractions. All real numbers that are not rational numbers are irrational numbers. When written in decimal form, the decimal expansion of an irrational number is infinite (it does not end or repeat). Any irrational number must be rounded to be written as a decimal.

This chart shows symbols used for set notation. Objects in a set are referred to as ***elements***.

Symbol	Meaning	Examples in Words	Example in Symbols	Illustration
$\subseteq$	"is a subset of" A subset is a set that is entirely within another set.	The set of natural numbers is a subset of the set of integers.	$\mathbb{N} \subseteq \mathbb{Z}$	
$\in$	"is an element of" or "is in"	4 is an element of the set of whole numbers.	$4 \in W$	
$\notin$	"is not an element of" or "is not in"	7 is not in the set of irrational numbers.	$7 \notin I$	
$\cap$	"intersect" The intersection of sets contains all the numbers the sets have in common.	*A* intersect *B* or *A* and *B* or The intersection of *A* and *B*.	$A \cap B$	
$\cup$	"union" The union of sets contains everything included in both sets.	*A* union *B* or *A* or *B* or The union of *A* and *B*.	$A \cup B$	
$\varnothing$	"the empty set" The empty set is a set that contains no elements.	If two sets have no elements in common, the intersection of sets is the empty set.	$A \cap B = \varnothing$	
A'	"the complement of Set *A*" The complement of a set contains everything NOT included in the set.	The complement of *A* contains all elements of *S* that are not in *A*.	$S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ $A = \{1, 2, 3, 4\}$ $A' = \{5, 6, 7, 8, 9, 10\}$	

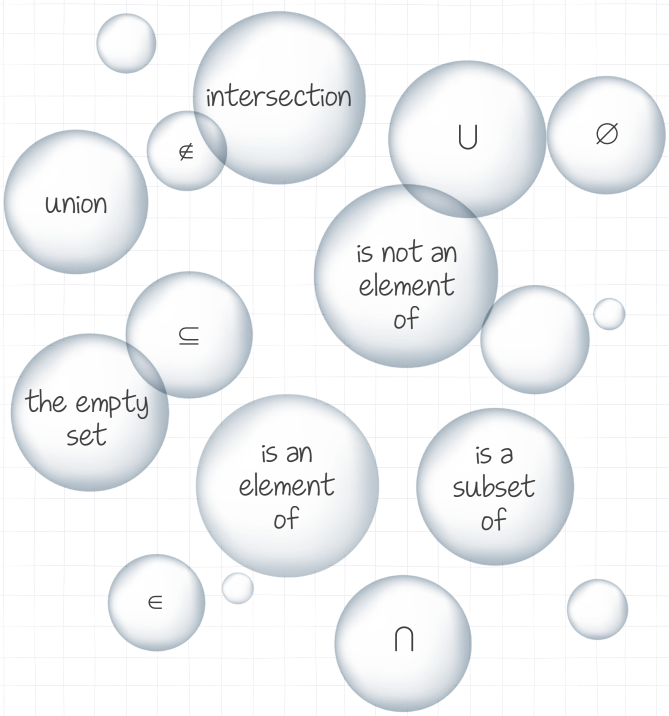
PRACTICE

1. Draw a line from each number to the *smallest* subset that contains it.

REMEMBER: Rational numbers have a repeating decimal pattern, or they terminate. Any decimal pattern that does NOT repeat or terminate is an irrational number.

3	Natural numbers
$\frac{1}{2}$	
0.0125	Whole numbers
$-2\frac{3}{17}$	
0.1011011101111...	Integers
–5	
0	Rational numbers
$0.\overline{142857}$	
3.1415926535897...	Irrational numbers

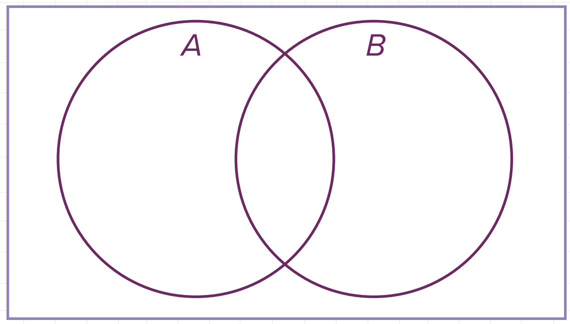
2. Color the bubbles with a symbol and its meaning the same color.



3. Shade the parts of each Venn diagram that correspond to each set. Then write the union or intersection on the line.

✦ Hint: Complements may be used with unions and intersections.

a. The set of things that are in *A* and also *B*



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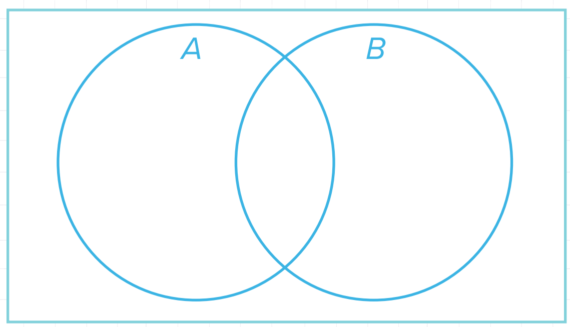
b. The set of things that are in *A* but not *B*



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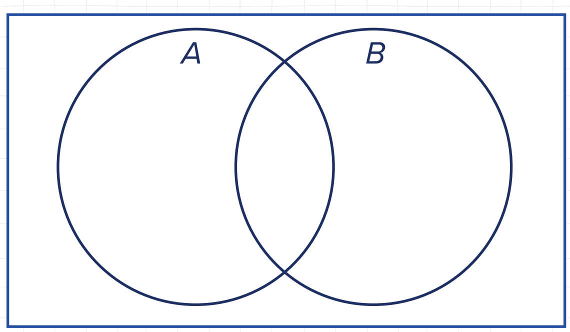
c. The set of things that are not in *A* and also not in *B*

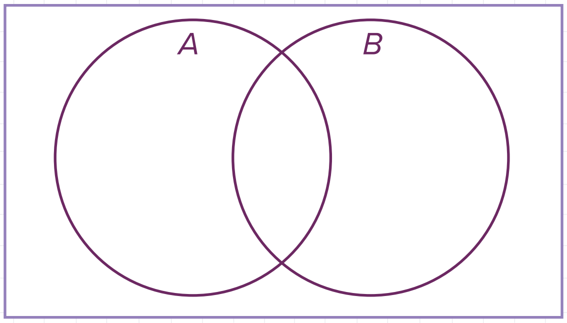


____

4. Complete the Venn diagram for the following sets.

$A = \{-6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6\}$

$B = \{\text{all prime numbers less than } 40\}$



Using set notation, determine the elements in the unions and intersections below. Remember to use curly braces around a set.

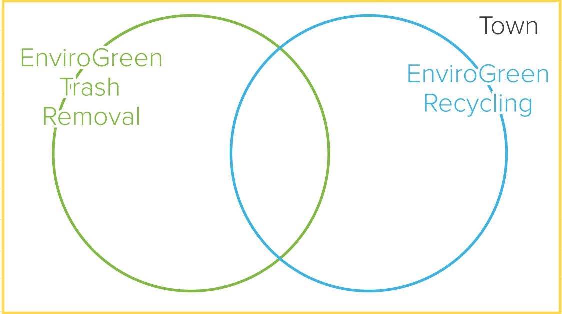
a. $A \cap B$ ____________________

b. $A \cup B$ ____________________

5. Complete the Venn diagram to model the situation below. Then answer the question.

In a town of 8,000 people, 5,400 use EnviroGreen for trash removal, 4,500 use EnviroGreen for recycling, and 3,900 use EnviroGreen for both.

✦ Hint: To find the number of people who use EnviroGreen for trash removal only, find 5400 – 3900. To find the number of people who use EnviroGreen for recycling only, subtract 4500 – 3900.



How many people do not use EnviroGreen's services? ____________

✦ Hint: Add the three numbers in the Venn diagram and subtract the sum from 8,000 people.

REVIEW

1. Solve for the variable of each equation. L27

a. $2.4d = 12$

b. $11.9 + f = -49.1$

____________ ____________

2. Write an equation to model each statement. L26

a. Fifteen less than one-eighth of n is equal to four more than the opposite of p.

____

b. The product of q and r is nine times s.

____

3. Evaluate each expression when $g = -3$ and $h = 27$. L24

a. $g - \sqrt[3]{h}$

b. $6g + h$

____________ ____________

4. Rewrite each number in scientific notation. L18

a. 0.0002009 ____________________

b. 6,530,000,000 ____________________

5. A garden store is having a 30%-off sale. Saving 30% is equivalent to paying 70% of the original price. Mentally find the sale price for each item by multiplying the original price by seven and then moving the decimal point one place to the left.

a. A shrub with an original price of $30

____

b. A gardening book with an original price of $12

____

c. A large basket of flowers with an original price of $50

____

6. Fill in each blank with a number that makes the statement true. L16

a. $(-25+31)+8=\_\_\_\_+(31+8)$

b. $23 \bullet \_\_\_\_ = 47 \bullet 23$

7. A number is divisible by 4 if the number formed by its last two digits is divisible by 4. Circle the numbers that are divisible by 4.

222	554
1,124	3,780
936	826

PRACTICE

Solve the equations. Color the picture according to the solution value. A hint is given for a suggested first step for each problem, but the problems can be solved in other ways.

Blue

1. $-3x + 4 = 20 - x$ ✦ Hint: Add x to both sides.

Solution: ________

Red

5. $3r - 1 = r + 3$ ✦ Hint: Subtract r from both sides.

Solution: ________

Green

2. $3 - 2a + 5 = -12 + 2a$ ✦ Hint: Add $2a$ to both sides.

Solution: ________

Blue

6. $4y + 5 = 7 + y - 5$ ✦ Hint: Combine 7 and –5 on the right side.

Solution: ________

Yellow

3. $7 - 2b = 1 + b + 5 - 2b$ ✦ Hint: Combine b and $-2b$ on the right side.

Solution: ________

Green

7. $2 - 3z = z + 2$ ✦ Hint: Add $3z$ to both sides.

Solution: ________

Orange

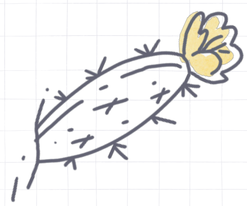
4. $12 + 14s = 72 - 6s$ ✦ Hint: Add $6s$ to both sides.

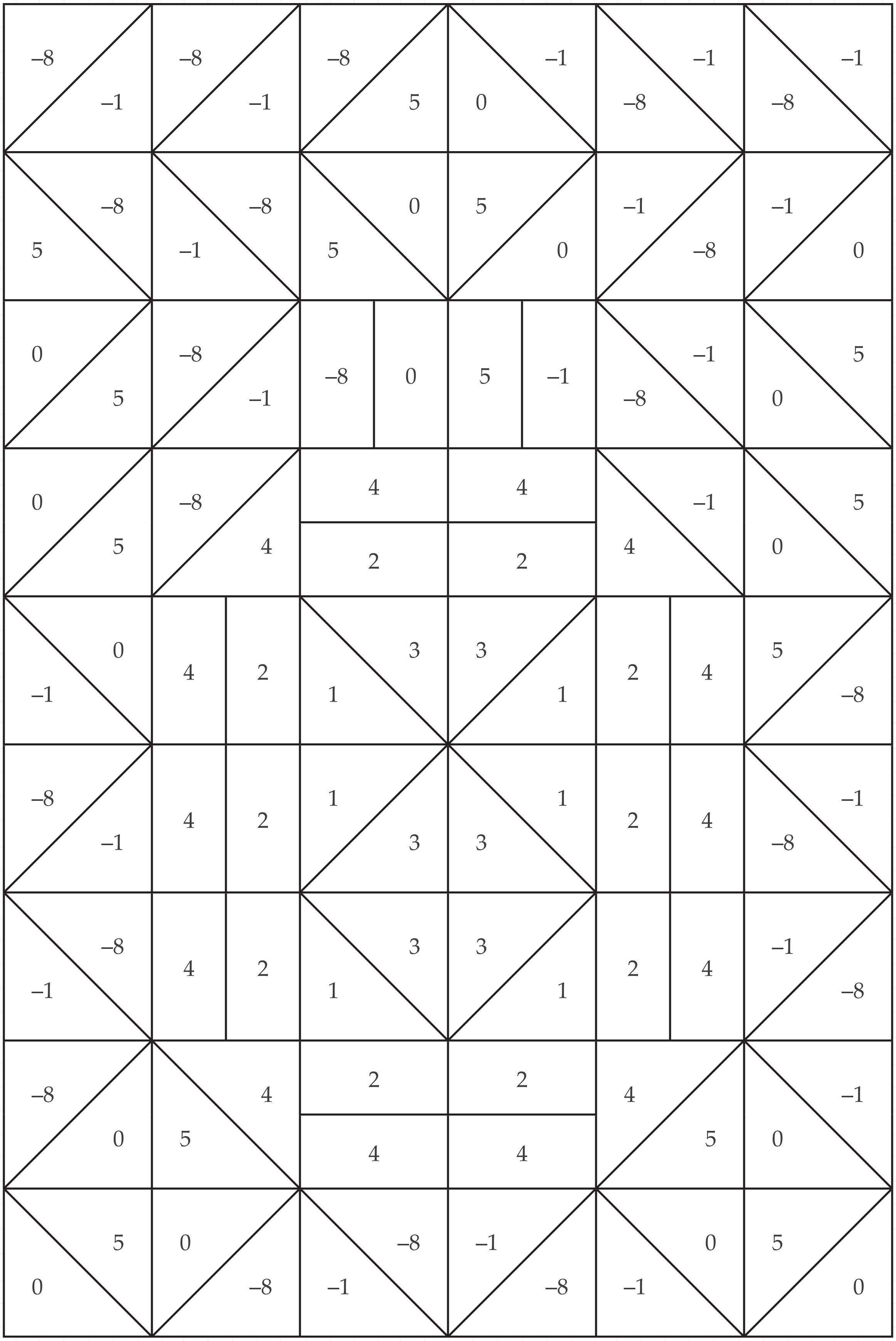
Solution: ________

Brown

8. $p - 3 = 5 - p$ ✦ Hint: Add p to both sides.

Solution: ________




–8 –8 –8 –1 –1 –1
–1 –1 5 0 –8 –8
–8 –8 0 5 –1 –1
5 –1 5 0 –8 0
0 –8 –1 5
–8 0 5 –1
5 –1 –8 0
4 4
0 –8 –1 5
5 4 4 0
2 2
0 3 3 5
4 2 2 4
–1 1 1 –8
–8 1 1 –1
4 2 2 4
–1 3 3 –8
–8 3 3 –1
4 2 2 4
–1 1 1 –8
2 2
–8 4 4 –1
0 5 5 0
4 4
5 0 –8 –1 0 5
0 –8 –1 –8 –1 0

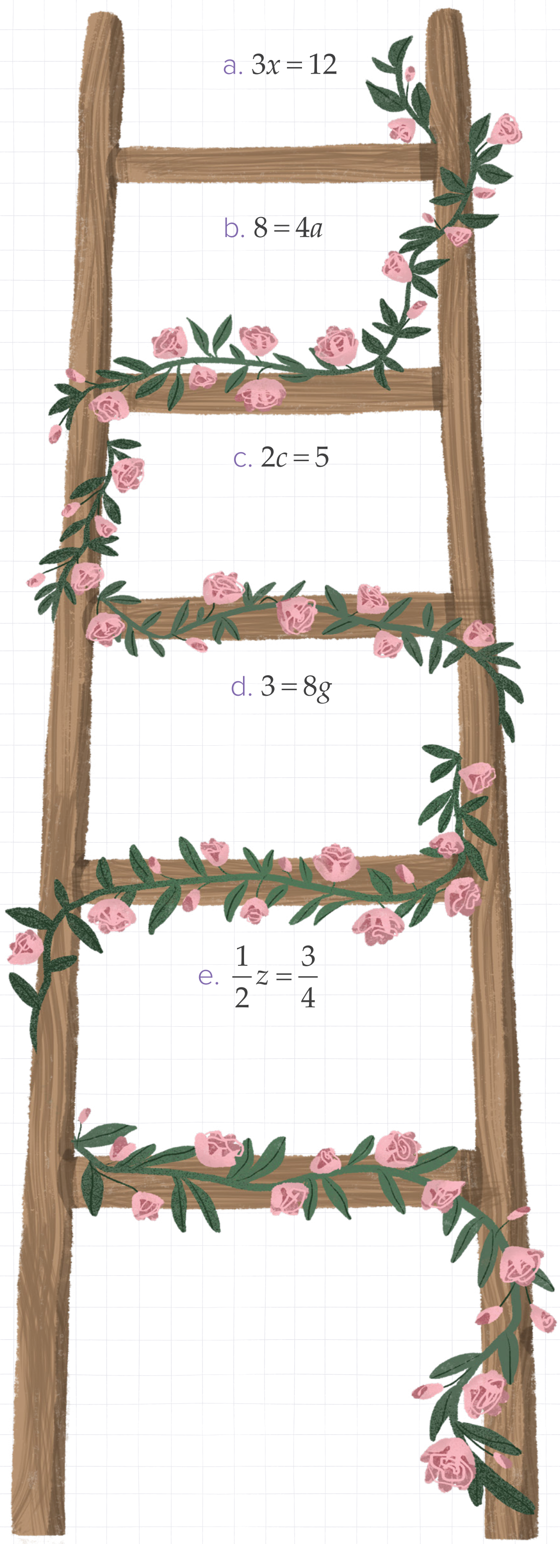
Solving Equations Review

There is no video for this lesson. The entire lesson is practice and applications for solving equations.

LADDER TO SUCCESS

Solve the problems on each ladder.

1.



a. $3x = 12$

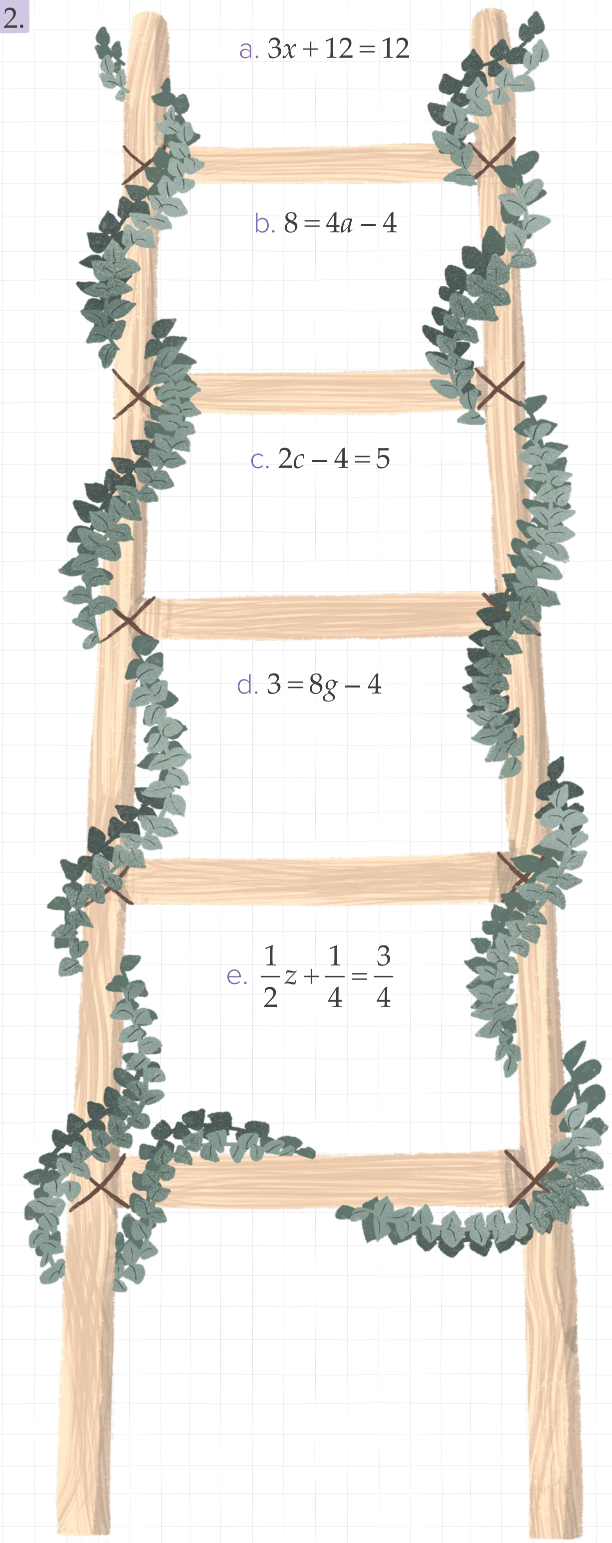
b. $8 = 4a$

c. $2c = 5$

d. $3 = 8g$

e. $\frac{1}{2}z = \frac{3}{4}$

2.



a. $3x + 12 = 12$

b. $8 = 4a - 4$

c. $2c - 4 = 5$

d. $3 = 8g - 4$

e. $\frac{1}{2}z + \frac{1}{4} = \frac{3}{4}$

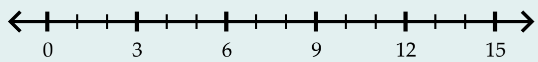
Solving and Graphing Multi-Step Inequalities

SUPPLIES: colored pencils and/or highlighters

WARM-UP

Solve and graph the inequality.

$$x - 10 > -3$$



LESSON

Use the app to watch the video lesson. Complete problems when instructed during the video in the Video Notes section. Optionally, read the Lesson Overview in place of the video or after the video if more instruction is needed.

VIDEO NOTES

When solving multi-step inequalities, perform inverse operations in the same order as when solving equations.

1. Add or subtract ____________ to isolate the term with the variable.
2. Divide (or multiply by the reciprocal of) ________________ to isolate the variable on one side.

Note: Like terms may need to be combined before completing these steps.

$$4 + 1.5r \leq 25$$

LESSON OVERVIEW

As when solving equations, multiple steps may be required to solve an inequality. When solving multi-step inequalities, perform inverse operations in the same order as when solving equations. Note that like terms may need to be combined before completing these steps.

1. Add or subtract constants to isolate the term with the variable.
2. Divide (or multiply by the reciprocal of) coefficients to isolate the variable on one side.

KEY INFORMATION

- Any operation done to one side of the inequality must also be done to the other side of the inequality.
- When multiplying or dividing by a negative, switch the direction of the inequality sign.

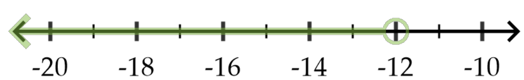
Example 1: $\frac{4}{3}x - 16 < -32$

$\frac{4}{3}x - 16 + 16 < -32 + 16$ Add 16 to both sides.

$\frac{4}{3}x < -16$

$\frac{3}{4} \bullet \frac{4}{3}x < -16 \bullet \frac{3}{4}$ Dividing by $\frac{4}{3}$ is the same as multiplying by the reciprocal. The reciprocal of $\frac{4}{3}$ is $\frac{3}{4}$.

$x < -12$ The graph of the inequality has an **open circle** at –12 because the inequality is less than, not less than *or equal to*, –12. x is any number less than –12.



Example 2: $-6p + 25 \geq 49$

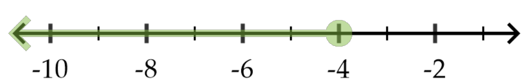
$-6p + 25 - 25 \geq 49 - 25$ Subtract 25 from both sides.

$-6p \geq 24$ Divide both sides by –6.

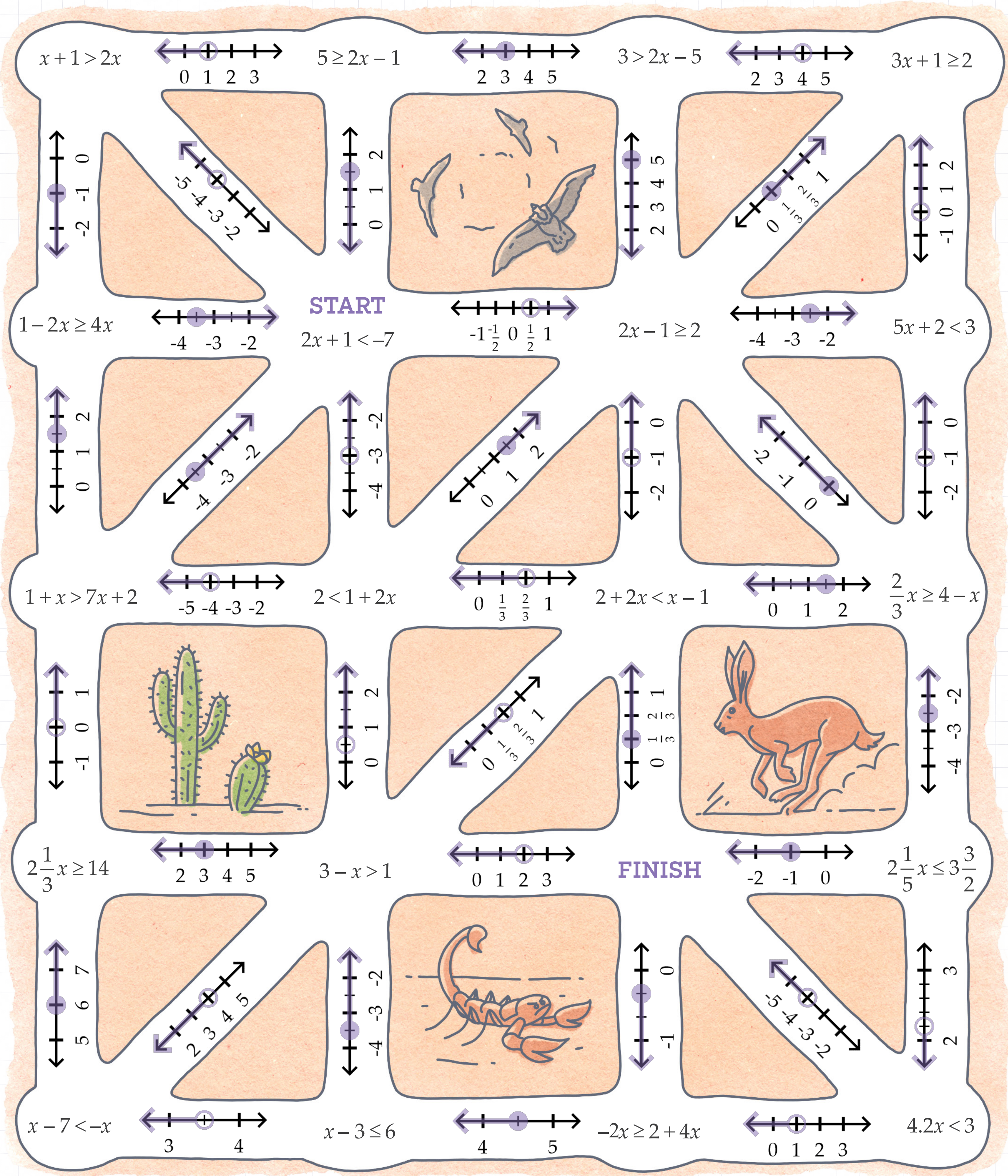
$\frac{-6p}{-6} \geq \frac{24}{-6}$

$p \leq -4$ The graph has a **closed circle** at –4 because p is less than *or equal to* –4. p can be any number less than –4, or p can equal –4.

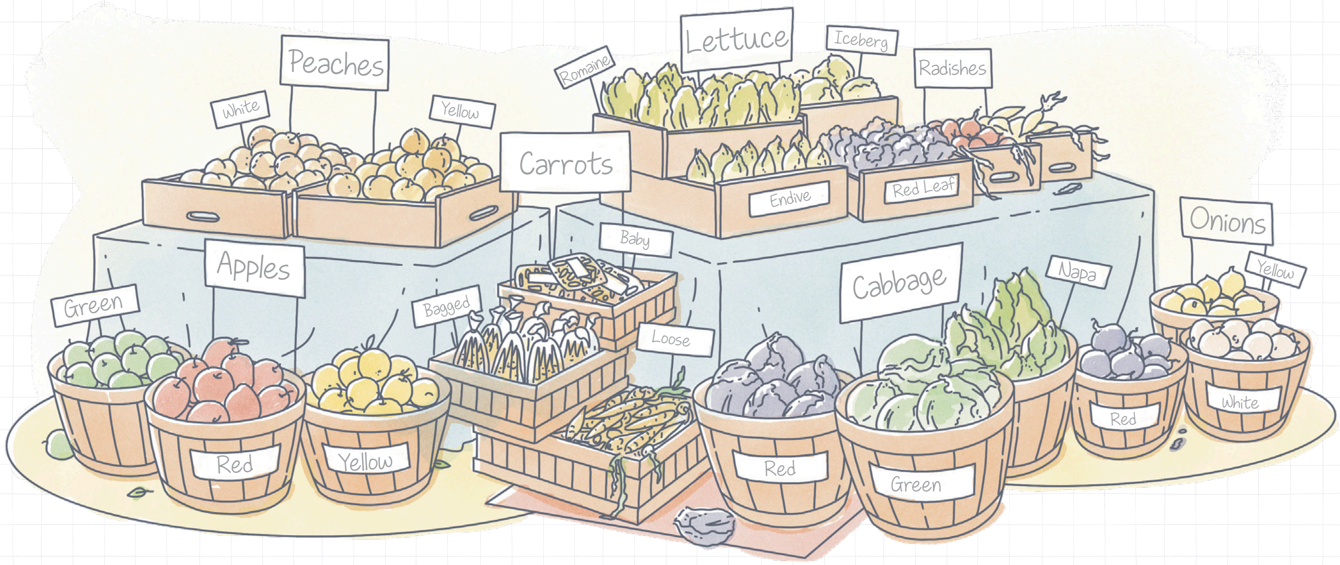
The inequality sign switches directions when dividing by a negative.



4. Begin at the START. Solve the inequality. Then find the number line that shows the solution and follow that path to the next inequality to solve. Continue following the number line solutions until you reach the FINISH.



PRACTICE



1. If $\frac{1}{4}$ of the peaches are white and there are 51 white peaches, how many peaches are there altogether?

✦ Hint: 51 is $\frac{1}{4}$ of what number?

______

2. There are 30 lb of baby carrots. If baby carrots make up $\frac{3}{8}$ of the total pounds of carrots, how many pounds of carrots are there?

✦ Hint: 30 is $\frac{3}{8}$ of what number?

______

3. $\frac{5}{6}$ of the cabbage heads are napa cabbage. There are 35 heads of napa cabbage. How many total cabbage heads are there?

✦ Hint: 35 is $\frac{5}{6}$ of what number?

______

4. In a basket of onions, $\frac{2}{7}$ of the onions are red onions. If there are 56 onions in the basket, how many are red onions?

✦ Hint: What is $\frac{2}{7}$ of 56?

______

5. $\frac{5}{12}$ of the 84 apples are yellow apples. How many yellow apples are there?

✦ Hint: What is $\frac{5}{12}$ of 84?

______

6. There are 28 heads of lettuce. $\frac{3}{4}$ of the heads are iceberg. How many heads of iceberg lettuce are there?

✦ Hint: What is $\frac{3}{4}$ of 28?

______

Salik's Squares

In Greenland the northern lights, or *aurora borealis*, are best viewed on clear winter nights. The colorful lights, which are caused by high-energy particles from the sun colliding with particles in the earth's upper atmosphere, appear to dance across the sky.

Suppose that you are visiting Greenland and are excitedly waiting to see the northern lights. A young Greenlander named Salik suggests that you pass the time by solving a puzzle he created.

Each row, column, and 3x3 square must contain the digits 1 through 9 exactly once. Fill in the missing numbers in the puzzle.

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

Hint: Start with a row, column, or 3x3 square that is mostly filled in. Go through each number (1 through 9) to see what is missing and where it could go. Be sure that writing a number will not cause that same number to appear in a row, column, or 3x3 square more than once.

PRACTICE

A calculator may be used for this entire practice section.

Finding the Percent Decrease

1. Color in the matching bubbles to show which new and original amounts correspond to which amount of decrease and percent decrease. An example is given.

Original: 10
New: 7.8

Amount of decrease: 3

Original: 5
New: 2

Amount of decrease: 2.2

Percent decrease: 60%

Percent decrease: 40%

Original: 2.5
New: 1.5

Amount of decrease: 1

Percent decrease: 22%

2. A computer costs $1,200 new but is only worth $570 two years later. Find the percent decrease in the value of the computer.

______

Finding the New Amount

3. Color in the matching bubbles to show which original amount and percent decrease correspond to which new amount. An example is given.

Original amount: 220
Percent decrease: 60%

New amount: 88

Original amount: 12
Percent decrease: 15%

New amount: 57

New amount: 10.2

Original amount: 60
Percent decrease: 5%

Original amount: 500
Percent decrease: 35%

New amount: 325

Proportions Within Similar Triangles

SUPPLIES: colored pencils

WARM-UP

Solve for x.

$$\frac{14}{17} = \frac{x}{68} \qquad x = \_\_\_\_\_\_$$

LESSON

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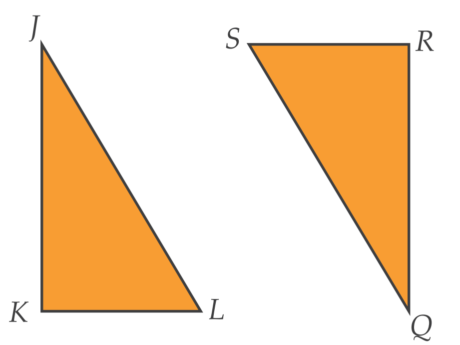
VIDEO NOTES



$\triangle JKL \cong \triangle QRS$

$\angle Q \cong \angle$____

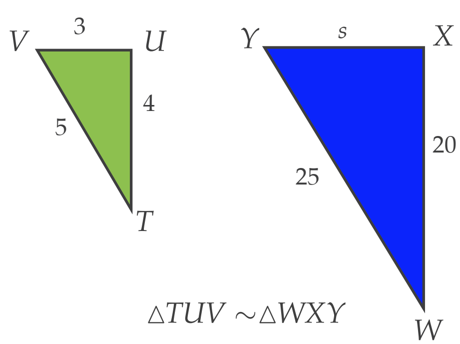
$\overline{LJ} \cong$ ____

$\angle K \cong \angle$____

$\overline{JK} \cong$ ____

$\angle S \cong \angle$____

$\overline{KL} \cong$ ____



$\triangle TUV \sim \triangle WXY$

$$\frac{WY}{\_\_\_} = \frac{XY}{\_\_\_}$$

$$\frac{\_\_\_}{\_\_\_} = \frac{\_\_\_}{\_\_\_}$$

____ • ____ = ____ • ____

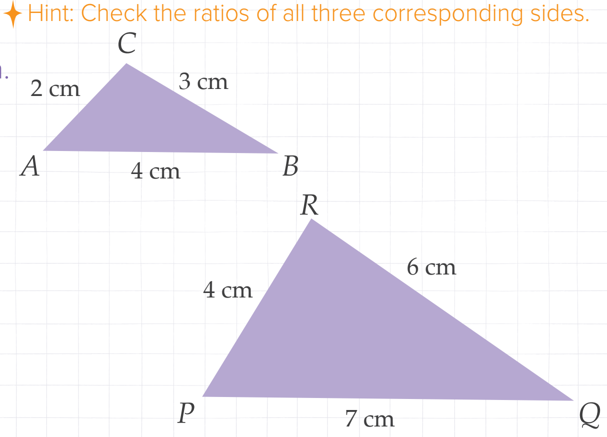
____ = ____

$s =$ ____

3. Use ratios to determine if the triangles are similar. Write *yes* or *no* on the line.

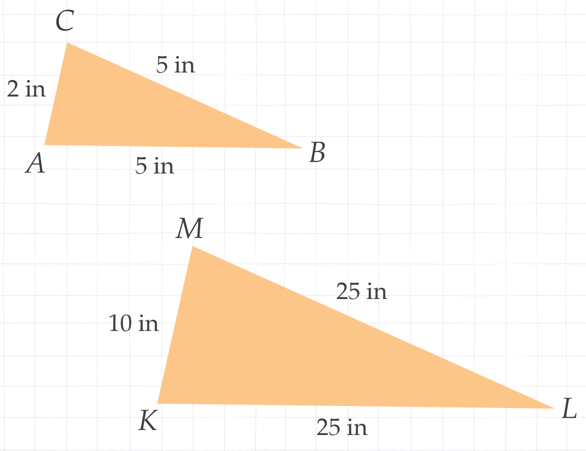
✦ Hint: Check the ratios of all three corresponding sides.

a.



____

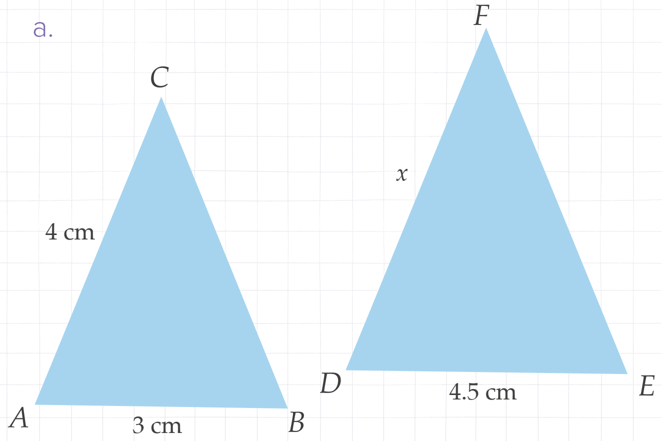
b.



____

4. Find the missing side lengths for the proportional triangles.

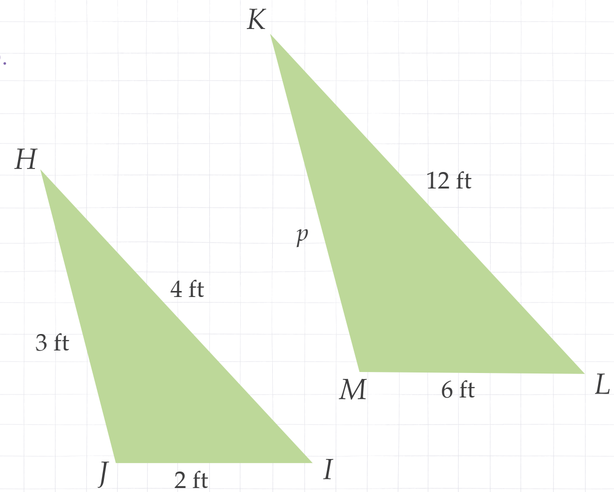
a.



$\triangle ABC \sim \triangle DEF$

$x =$ __________

b.



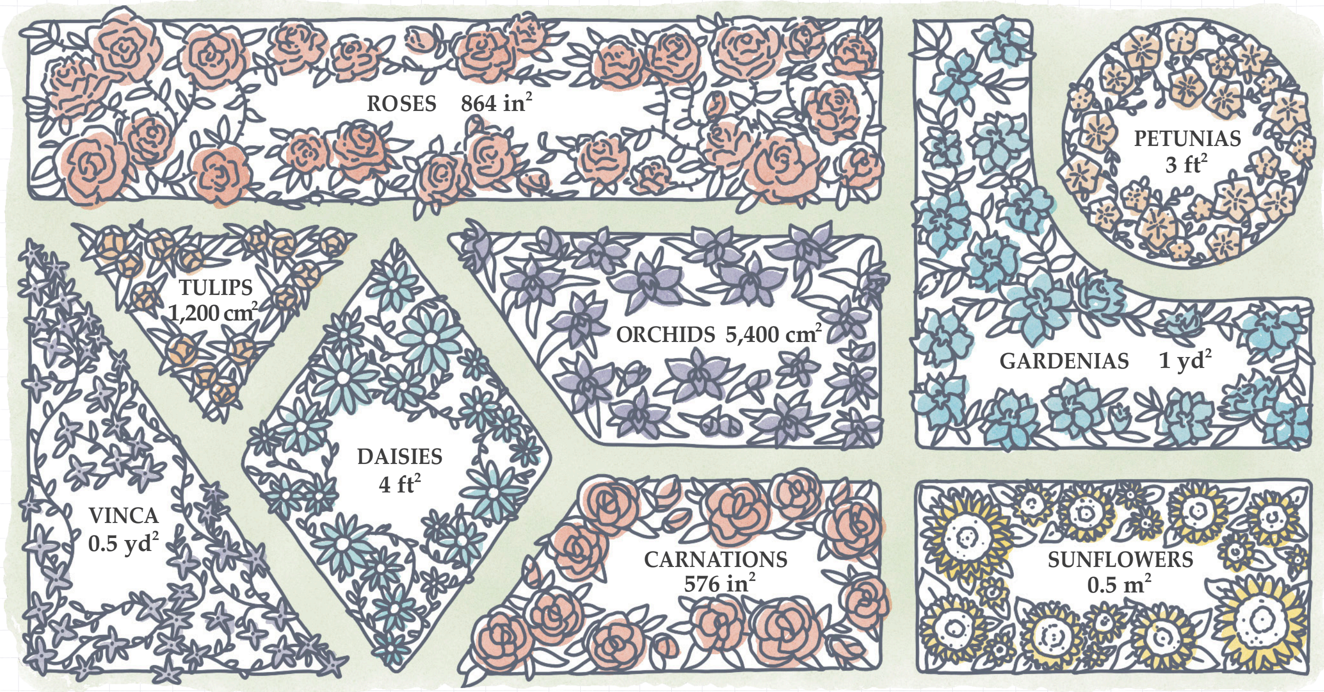
$\triangle HIJ \sim \triangle KLM$

$p =$ __________

PRACTICE

A calculator may be used for this entire practice section.

A family collaborated on a blueprint for a garden, but they all used different units! Use unit multipliers and convert between units to answer the questions below.



1. a. Convert the area of the rose bed into square feet.

____

b. How much more space do the roses have than the daisies?

____

2. a. Convert the area of the vinca bed into square feet.

____

b. Do the petunias or the vinca have more space? How much more space?

____

____

Mixed Review

This lesson is a mixed review. There is no video, practice, or review section.
You may use a calculator for this entire review activity.

SHARPEN YOUR SKILLS!

Suppose your neighborhood is having a potluck, and your family volunteered to bring a pan of enchiladas to the party. It is your responsibility to buy all the ingredients for the enchiladas and stay within budget.

Your budget is $35, including sales tax. Tax is 3% of the total cost.

Note: Some US states do not charge sales tax on groceries. For this review activity, suppose groceries are taxed at 3%.

The lists below show the ingredients you must purchase, as well as optional ingredients.

Required ingredients

- 12 tortillas
- 2 lb of meat
- $\frac{3}{4}$ lb of cheese
- 3 cans of beans
- 3 jars of sauce

Optional ingredients

- Additional tortillas (Up to 16 tortillas can fit in one pan.)
- 1–2 lb of extra meat
- $\frac{1}{4}$ lb of extra cheese
- Additional cans of beans
- Up to 3 cans of chiles
- 1 extra jar of sauce
- Onion
- Sour cream
- Olives

Instructions

- Use the illustration on the following page to choose your ingredients. The illustration page can be removed from the book if desired. Record your choice for each ingredient variety in the second table. Record any optional ingredients you choose to include in the rows labeled "extra ingredient."
- Write the given unit cost of one item in the Unit Cost column. Under Quantity, write how many/much of each item you plan to buy.
- Multiply the Unit Cost by the Quantity to get the Ingredient Cost.
  Unit Cost • Quantity = Ingredient Cost
- Add the Ingredient Costs to get the Subtotal.
- Find 3% of the Subtotal to get the Tax Amount. Multiply the Subtotal by 0.03.
  Subtotal • 0.03 = Tax Amount
- When finding the Tax Amount, round to the nearest hundredth. For example,
  13.59 • 0.03 = 0.4077. The tax rounded to the nearest hundredth is $0.41.
- Add the Subtotal and the Tax Amount to get the TOTAL. Make sure your TOTAL is less than your budget of $35. If your total is over budget, eliminate or change ingredients.


TODAY SPEC
MEAT
Chicken $2.37/lb
Beef $4.50/lb
Pork $4.25/lb
CHEESE
3-Cheese blend $5.78/1 lb
Sour cream $2.48/16 oz
MILK
Monterey Jack $6.12/1 lb block
Cheddar $5.00/1 lb block
NEW PRODUCT
3
TORTILLAS
2
Green sauce $2.19/10 oz jar
Refried beans $1.16/can
Black beans $0.60/can
Chiles $0.30/can
Precooked corn 15 for $2.40
Uncooked corn 25 for $4.10
Red sauce $1.78/10 oz jar
Olives $1.98/can
Pinto beans $0.78/can
SPECIAL PRICE
Precooked flour 12 for $2.75
Uncooked flour 18 for $4.00
1
SPECIAL PRICE
Onions $0.65 each
NEW TODAY
BUY 2, GET 1 FREE

Unit 2 Review

Complete this Unit Review to prepare for the Unit Assessment. There is no video, lesson, or practice. Because Unit Reviews include practice for an entire unit, they may take longer than regular lessons, and students may decide to take two days to finish.

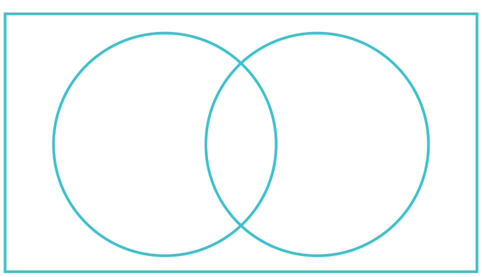
Chinese New Year is based on a lunisolar calendar and typically begins at the new moon, which falls between January 21 and February 20. After completing each problem, copy the word that is underlined onto the line with its problem number at the end of the review.

Venn Diagrams and Set Notation
Lesson 31

1. For a village gathering, everyone votes to have spring rolls with either pork or shrimp. There are 63 people who want shrimp, 45 people who want pork, and 34 people who want both shrimp and pork.

   a. Create a Venn diagram to model this situation.

   ✦ Hint: If 63 people want shrimp, this includes people who want both.

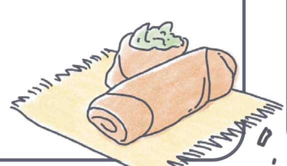


   b. Use the Venn diagram to determine how many villagers there are.

   __________ villagers

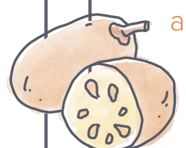
   c. If A is the set of people who want shrimp, and B is the set of people who want pork, use set notation to write the set of people who would like both pork and shrimp.

   ____



Square and Cube Roots
Lessons 32, 34

2. Lotus root is commonly eaten during the new year festival to symbolize abundance. Answer these questions about mathematical roots!



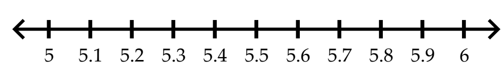
   a. Determine which two perfect squares are closest to 33. Circle the one that is closer to 33.

   ________ and ________

   b. Calculate $\sqrt{33}$ rounded to the nearest hundredth.

   $\sqrt{33} \approx$ ____

   c. Plot the approximate value of $\sqrt{33}$ on the number line.



3. Find the following roots.

   a. $\sqrt{81}$ ______

   b. $\sqrt[3]{64}$ ______

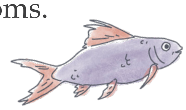
   c. $\sqrt[3]{-27}$ ______

Other Fun Facts About the Chinese New Year and Its Symbols

- The Chinese New Year celebration is also called the ____________ festival.
  1

- ____________ flowers grow in the mud.
  2
  They are day-blooming flowers. This means they curl their petals back into the mud at night.

- Besides fish and ____________ envelopes,
  14
  other ____________ symbols associated with
  4
  the Chinese New Year are three coins tied with a ribbon, bamboo plants, and fruit blossoms.

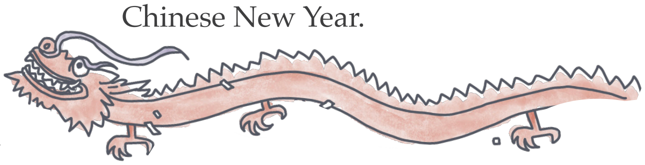


- A Chinese saying to wish someone well on an exam is to say, "A ____________ leaping
  5
  over the dragon gate!"

- Chinese families may set off ____________
  7
  when opening a door for the first time in a day. It symbolizes good fortune for the whole year.

- China is credited with the invention of ____________. A legend tells
  9
  of a Chinese scientist who invented ____________ by accident while
  9
  mixing charcoal, sulfur, and saltpeter. After being pressed into a bamboo tube, the mixture exploded!

- The Chinese word for ____________
  11
  sounds like "luck," and the Chinese word for ____________ sounds like
  12
  "wealth." Both of these fruits are given as gifts and used as decorations during the Chinese New Year.



- More Chinese children tend to be born during the years of the ____________
  16
  than during other years.

- Another popular tradition is to put a riddle inside a ____________ for others to
  17
  solve.

- The filling for ____________ usually
  20
  consists of ground nuts or sesame seeds, sugar, and lard.

Unit 2 Assessment

- This assessment covers concepts taught in Unit 2. Problems are designed to assess multiple skills. Read the instructions carefully and do not rush through the problems.
- You may use the Reference Chart at the back of the book for the assessment. Calculators should be used only when noted.
- Lesson numbers are given by each problem so you can review lessons for any answers that are incorrect.

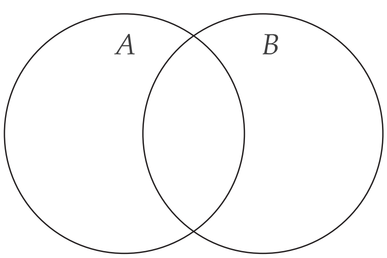
1. Match the number with the smallest set the number belongs in. L31

3	rational $(\mathbb{Q})$
0	whole numbers (W)
-11	irrational (I)
$\frac{1}{2}$	natural numbers $(\mathbb{N})$
$\sqrt{2}$	integers $(\mathbb{Z})$

2. Fill in the Venn diagram and find $A \cap B$. L31

$A:\{1,2,3,4,5,6,7,8,9,10\}$

$B:\{2,4,6,8,10,12,14,16,18,20\}$



____

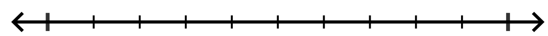
3. Write the two integers each square root falls between. L32

a. $\sqrt{56}$ ________ and ________

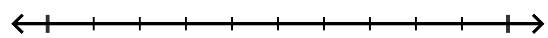
b. $\sqrt{11}$ ________ and ________

4. Calculate the value of each square root in Problem 3 (rounded to the nearest hundredth). Then plot the rounded value on a number line. L32

a. $\sqrt{56} \approx$ ________



b. $\sqrt{11} \approx$ ________



5. Solve the following equations. L33, L35

a. $5x - 10 = 45$ ________

b. $\frac{1}{2}z - \frac{5}{6} = \frac{1}{6}$ ________

c. $a + 5 = 6a$ ________

d. $7 - 4c = 8c + 17$ ________

Enrichment: Graph Theory

This is an enrichment lesson. Mastery is not expected at this level.
There is no video, practice, or review.

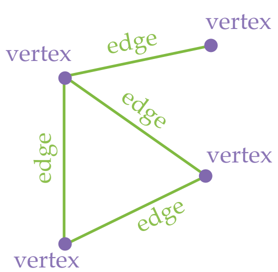
SUPPLIES: colored pencils

Modeling with Graph Theory

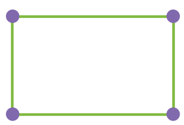
What do you think of when you hear the word "graph"? Maybe you think of a number line or coordinate plane? Maybe you think of a bar, line, or circle graph? In graph theory, we study graphs made out of *vertices* (singular: one *vertex*) and *edges*.

Each of the following is a graph. In graph theory, the *vertices* are points (or dots), and the *edges* are lines connecting those vertices.

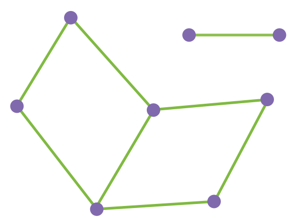
Example 1:



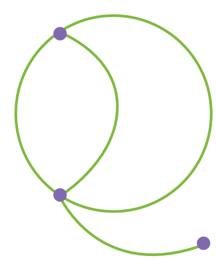
Example 2:



Example 3:

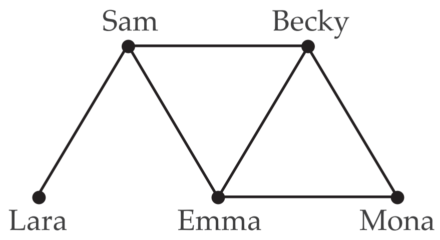


Example 4:



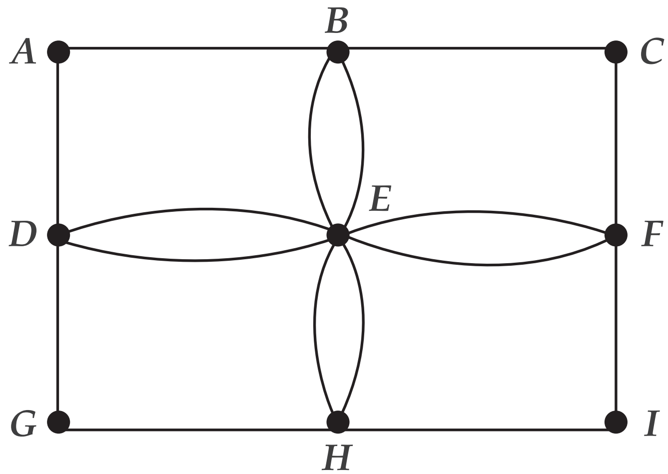
Graphs can be used to model many things, like relationships and transportation networks. In these models, the vertices usually represent some kind of object, and the edges represent relationships between those objects.

Example 5:



Becky, Emma, and Mona are in the same ballet class. Becky is also in band with Emma and Sam. Sam and Lara take French lessons together. On the left is a graph that represents this situation; edges show the relationship "have a class together."

Label the edges "1," "2," etc., to help the mail carrier find a mail delivery route that begins and ends at his truck (A) and lets him deliver mail to all the houses without having to walk any sidewalk more than once.



Graph Theory and Maps

Another application of graph theory is maps! Think of the maps that you have seen. Neighboring countries or states are usually colored with different colors to make the borders easy to see. A natural question when creating a map is how many colors are needed to color a map so that neighboring regions are always different colors. We consider regions to be neighbors if they actually share part of a border (not just meeting at corners).

Here are some examples of maps where neighboring regions are colored differently.

Example 8:

Example 9:

Example 10:

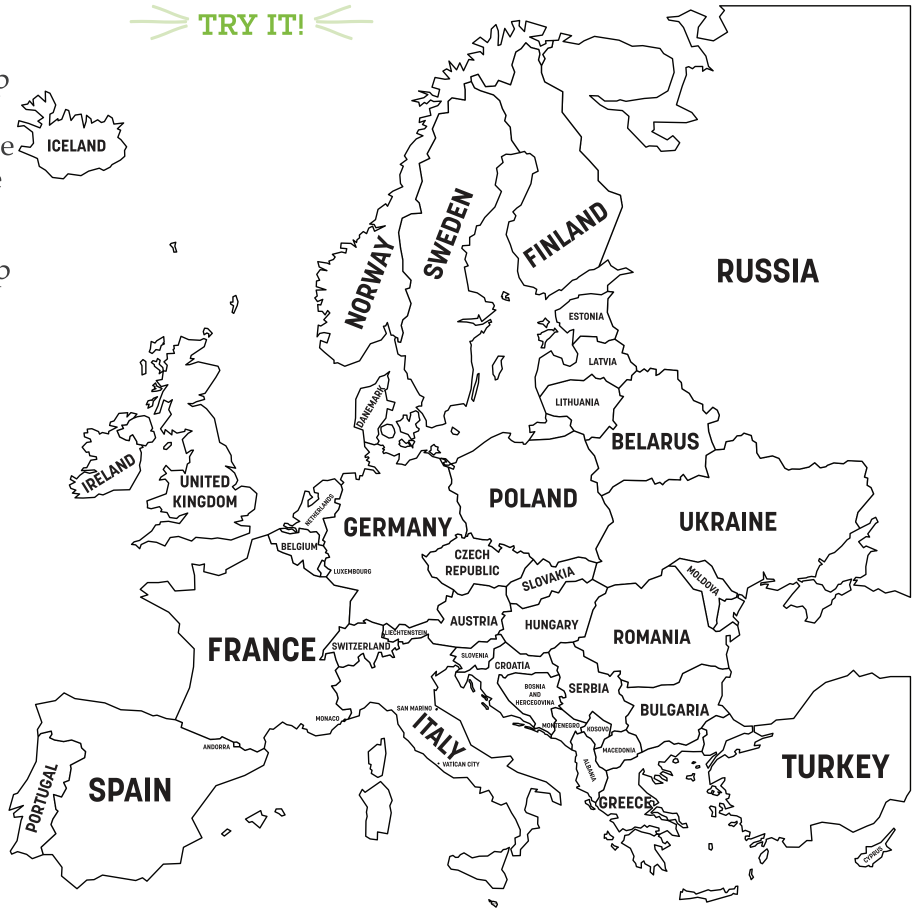
Notice that these examples use many different colors to color the maps.

Note: You may want to make a copy of this page before completing the next two activities so you can try it multiple times!

TRY IT!

4. Can you color the same map as in Example 10, but with FEWER colors, and still have all neighboring countries be different colors?

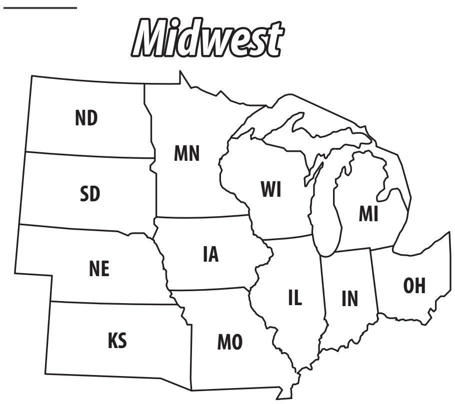
Remember, the game of map coloring is to use as FEW colors as possible while still having neighbors be different colors.



5. Try coloring the maps below with the FEWEST colors so that neighboring states are always different colors. Write how many colors you need in each case.

a. ______

b. ______



Note: For this graph, only color states that are labeled. Do not color the upper region of Michigan that is not labeled.