IMKH California

KINDERGARTEN

Student Edition

UNITS

3 | 4

Illustrative Mathematics LEARN MATH FOR LIFE | Kendall Hunt

Book 2
Certified by Illustrative Mathematics®

ISBN 9798385165469

K5_vII

20240207

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KINDERGARTEN

UNIT

3

Exploring Shapes All Around Us

Content Connections

In this unit you will learn to identify, describe, compare, and compose two-dimensional shapes. You will make connections by:

- **Reasoning with Data** while exploring the differences in shapes and use informal language to describe, compare and sort them.
- **Exploring Changing Quantities** while using counting skills to count and compare pattern blocks used to make larger shapes.

- **Taking Wholes Apart, Putting Parts Together** while using pattern blocks to make larger shapes.
- **Discovering Shape and Space** while describing shapes, identifying shapes and combining known shapes.

Addressing the Standards

As you work your way through **Unit 3 Exploring Shapes All Around Us,** you will use some mathematical practices that you may have started using in kindergarten and have continued strengthening over your school career. These practices describe types of thinking or behaviors that you might use to solve specific math problems.

Mathematical Practices	Where You Use these MPs
MP1 Make sense of problems and persevere in solving them.	Lesson 12
MP2 Reason abstractly and quantitatively.	Lesson 10
MP3 Construct viable arguments and critique the reasoning of others.	Lesson 1, 7, 12, and 13
MP4 Model with mathematics.	Lesson 2, 8, 9, 14, and 15
MP5 Use appropriate tools strategically.	Lesson 5
MP6 Attend to precision.	Lesson 4, 5, 6, 7, and 8

Mathematical Practices	Where You Use these MPs
MP7 Look for and make use of structure.	Lesson 1, 5, 6, and 11
MP8 Look for and express regularity in repeated reasoning.	Lesson 3 and 8

The California Common Core State Standards for Mathematics (CA CCSSM) describe the topics you will learn in this unit. Many of these topics build upon knowledge you already have and challenge you to expand upon that knowledge. The table below shows what standards are being addressed in this unit.

Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Shapes in the World	**K.G.1** Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as *above, below, beside, in front of, behind,* and *next to.*	Lesson 2, 4, 9, 13, 14, and 15
• Shapes in the World	**K.G.2** Correctly name shapes regardless of their orientations or overall size.	Lesson 2, 8, 9, 11, 14, and 15

Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Sort and Describe Data • Bigger or Equal? • Shapes in the World	**K.G.4** Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/"corners") and other attributes (e.g., having sides of equal length).	Lesson 1, 3, 4, 5, 6, 8, 9, and 15
• Shapes in the World • Making Shapes from Parts	**K.G.5** Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes.	Lesson 7, 8, 9, and 15
• Being Flexible within 10 • Shapes in the World • Making Shapes from Parts	**K.G.6** Compose simple shapes to form larger shapes. *For example, "Can you join these two triangles with full sides touching to make a rectangle?"*	Lesson 10, 12, 14, and 15
• How Many?	**K.CC.1** Count to 100 by ones and by tens.	Lesson 4 and 7

Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• How Many? • Place and Positions of Numbers	**K.CC.3** Write numbers from 0 to 20. Represent a number of objects with a written numeral 0–20 (with 0 representing a count of no objects).	Lesson 5, 11, and 12
• Sort and Describe Data • How Many? • Bigger or Equal?	**K.CC.4** Understand the relationship between numbers and quantities; connect counting to cardinality. a. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted. c. Understand that each successive number name refers to a quantity that is one larger.	Lesson 5, 11, and 13

Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Sort and Describe Data • How Many? • Bigger or Equal? • Place and Position of Numbers	**K.CC.5** Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.	Lesson 5, 10, 11, 12, and 15
• How Many? • Bigger or Equal? • Being Flexible within 10	**K.CC.6** Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.	Lesson 10, 12, and 15
• How Many?	**K.CC.7** Compare two numbers between 1 and 10 presented as written numerals.	Lesson 10

Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Sort and Describe Data • Bigger or Equal? • Model with numbers • Shapes in the World • Making Shapes from Parts	**K.MD.2** Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. *For example, directly compare the heights of two children and describe one child as taller/shorter.*	Lesson 6 and 7
• Sort and Describe Data • How Many? • Shapes in the World	**K.MD.3** Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.	Lesson 4

Unit 3, Lesson 1

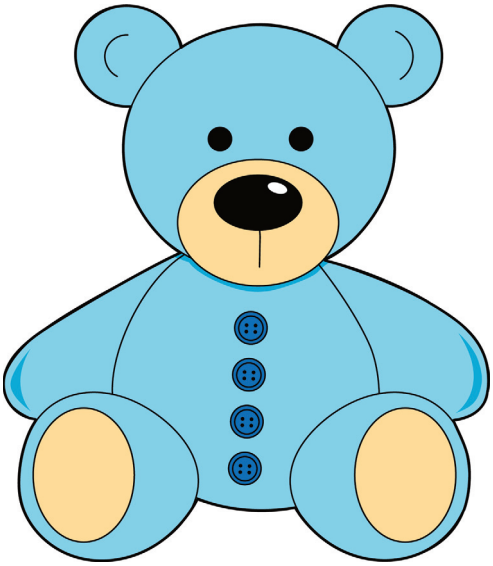
Addressing CA CCSSM K.G.4; building on K.MD.3; building towards K.G.1-2; practicing MP3 and MP7

What We Know about Shapes

Let's find and talk about shapes.

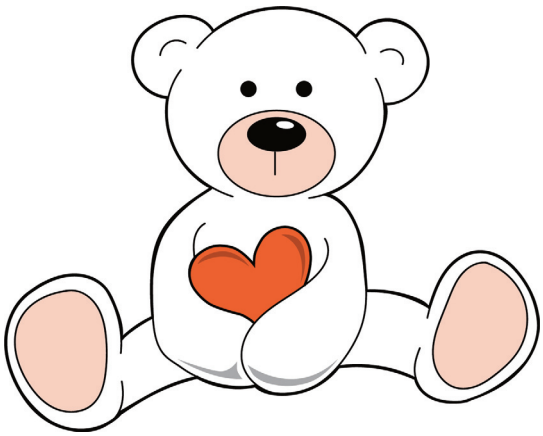
Warm-up

Which Three Go Together: Teddy Bears

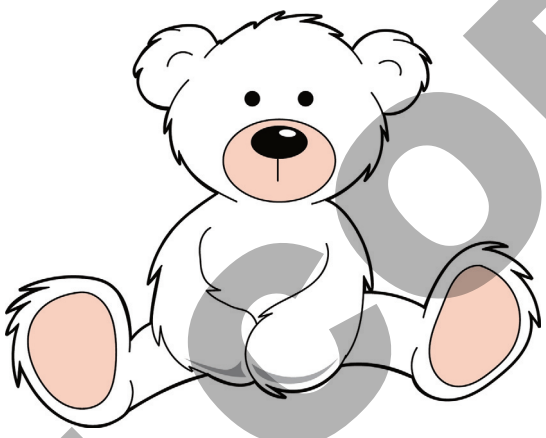


Which 2 go together?

A



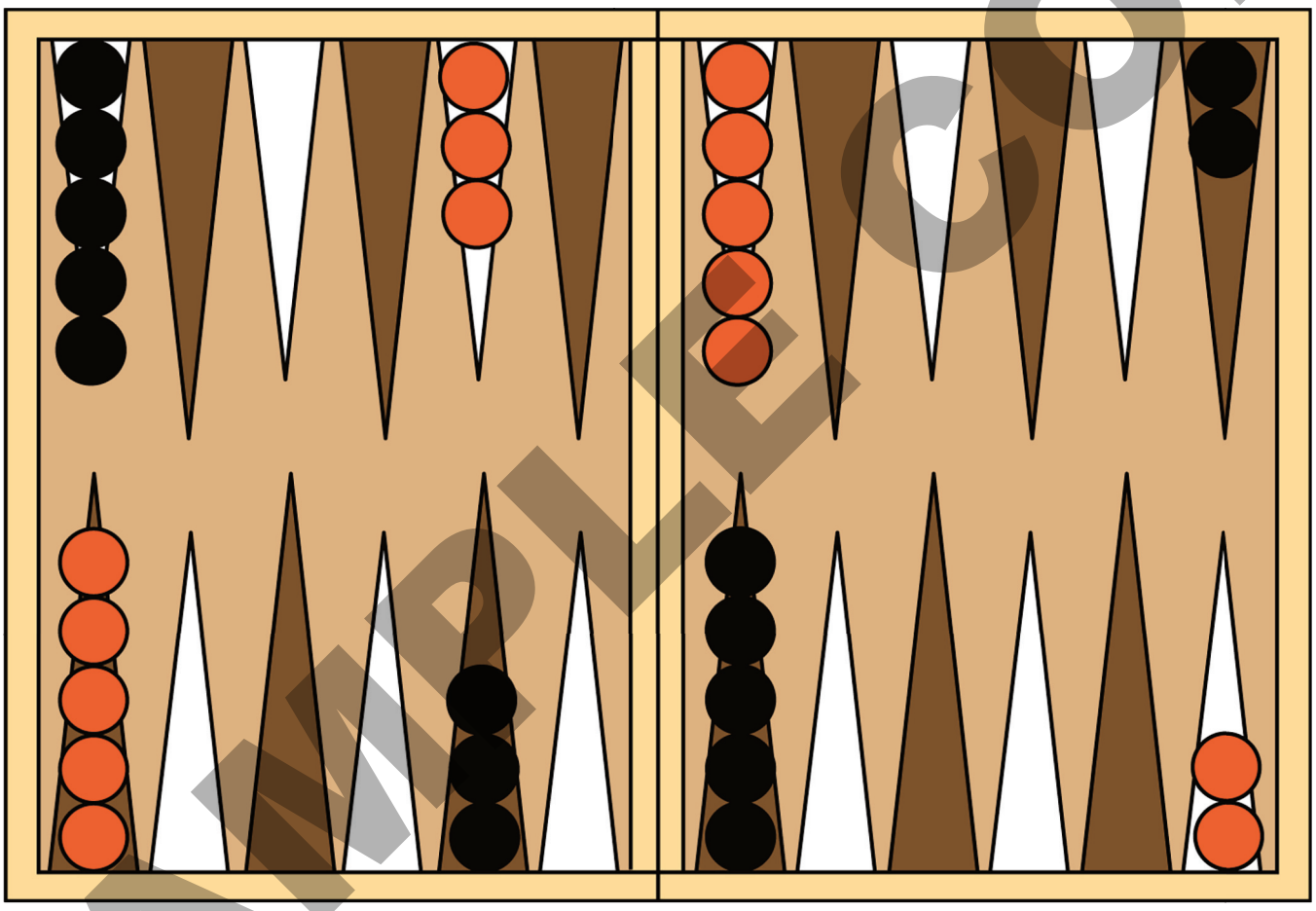
B



C

Activity 2

Shapes in a Picture



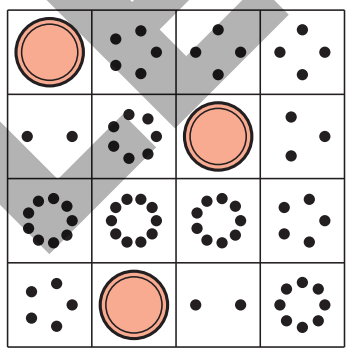
Activity 3

Centers: Choice Time

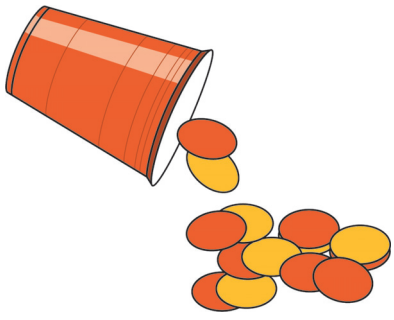
Choose a center.

Picture Books

Bingo



Shake and Spill



Addressing CA CCSSM K.G.1-2; building on K.MD.3; building towards K.G.1; practicing MP4

Match Shapes

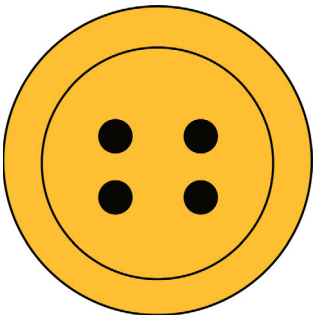
Let's find shapes that are the same.

Warm-up

Which Three Go Together: Buttons

Which 3 go together?

A



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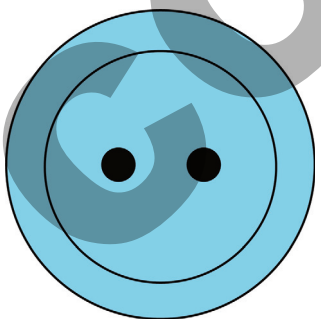

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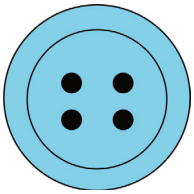
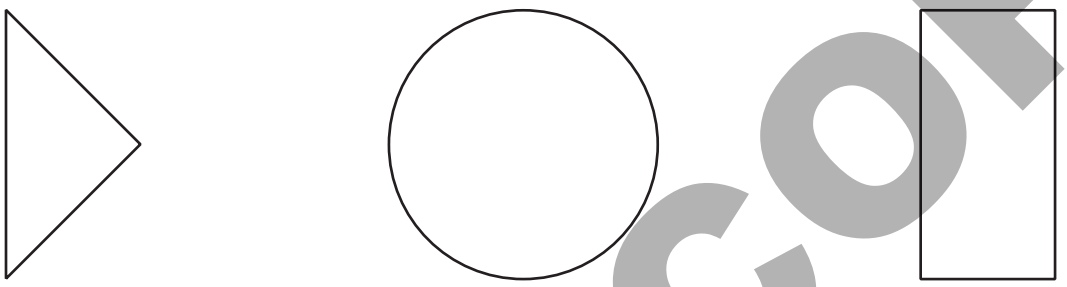
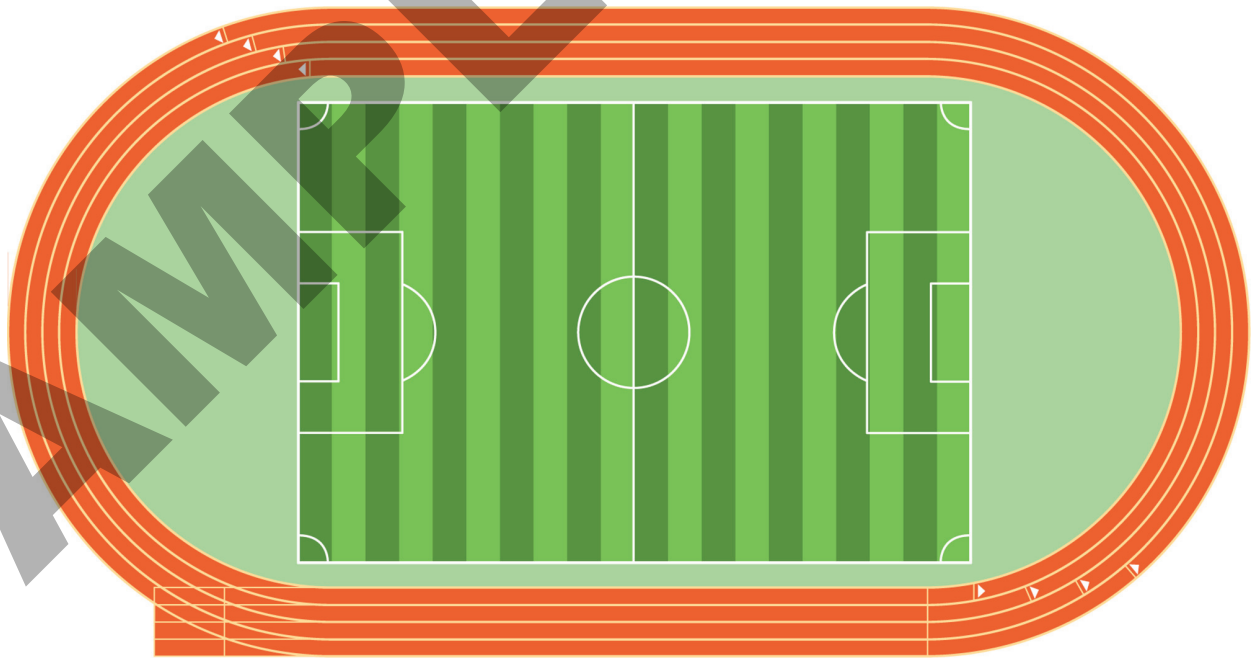


Activity 1

Match Objects and Shapes

Match the shape. Draw a line.



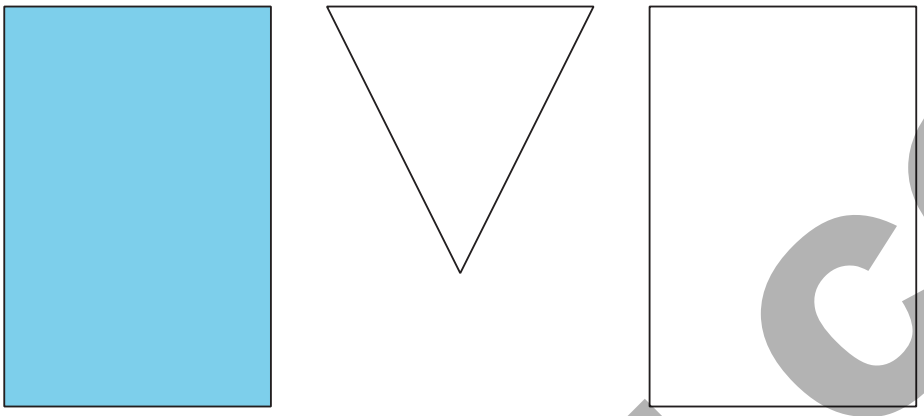


Activity 2

Which Shape Is the Same?

Color the same shape as the one at the beginning.

1.



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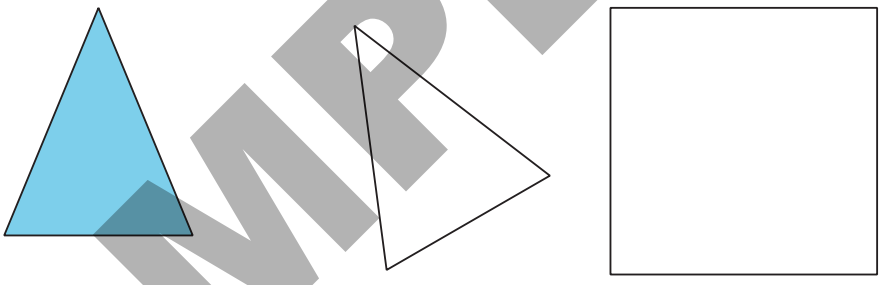
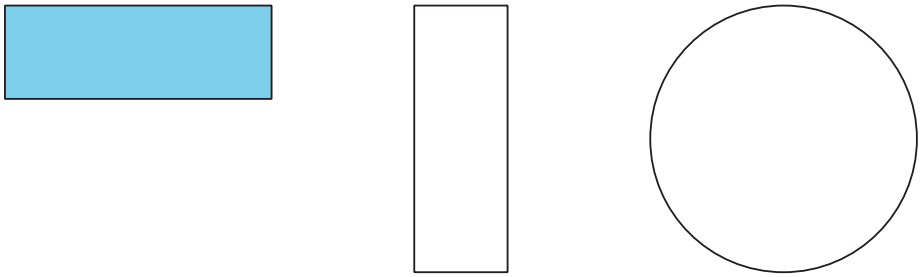
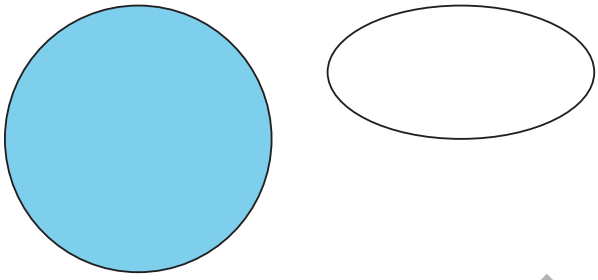
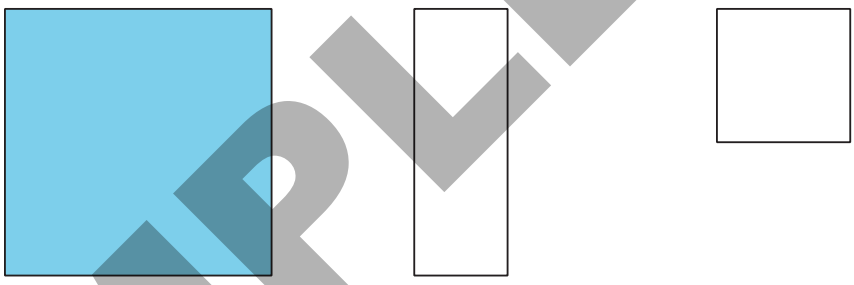
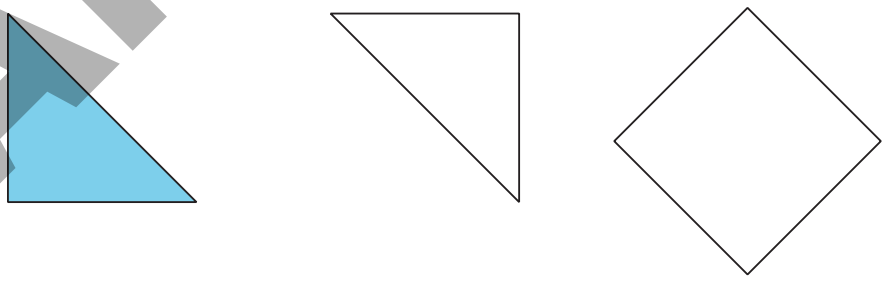


3. 

4. 

5. 

6. 

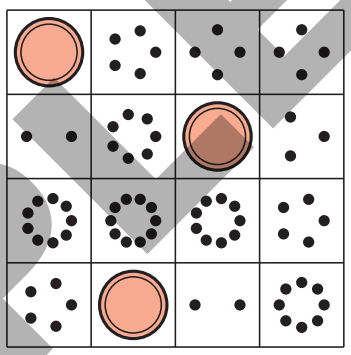
Activity 3

Centers: Choice Time

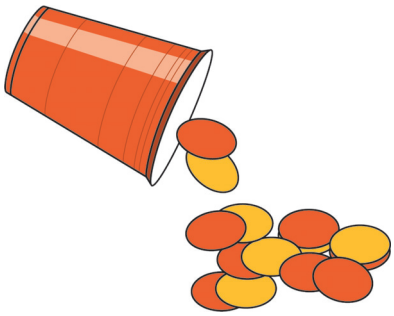
Choose a center.

Picture Books

Bingo



Shake and Spill



Unit 3, Lesson 3

Addressing CA CCSSM K.G.4; practicing MP8

Describe and Compare Shapes

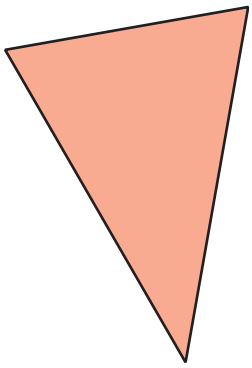
Let's compare shapes.

Warm-up

Which Three Go Together: Shapes

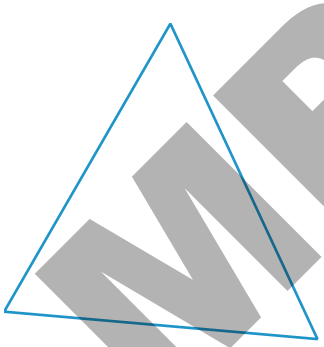
Which 3 go together?

A



B

C



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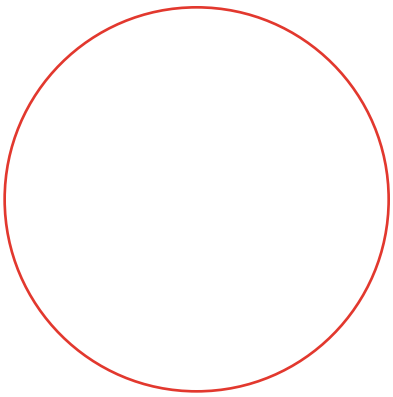


Activity 3

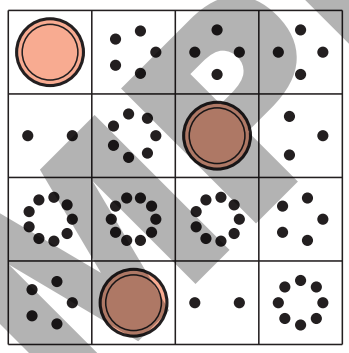
Introduce Which One—Grade K Shapes

Choose a center.

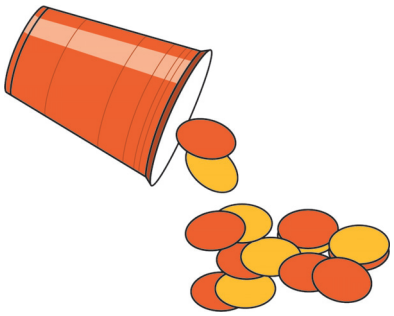
Which One?

Picture Books

Bingo



Shake and Spill



Unit 3, Lesson 4

Addressing CA CCSSM K.CC.1, K.G.1, K.G.4, and K.MD.3; practicing MP6

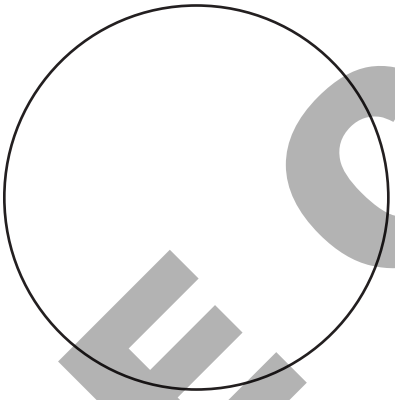
Describe, Compare, and Sort Shapes

Let's describe and sort shapes.

Activity 1

Classroom Shape Hunt

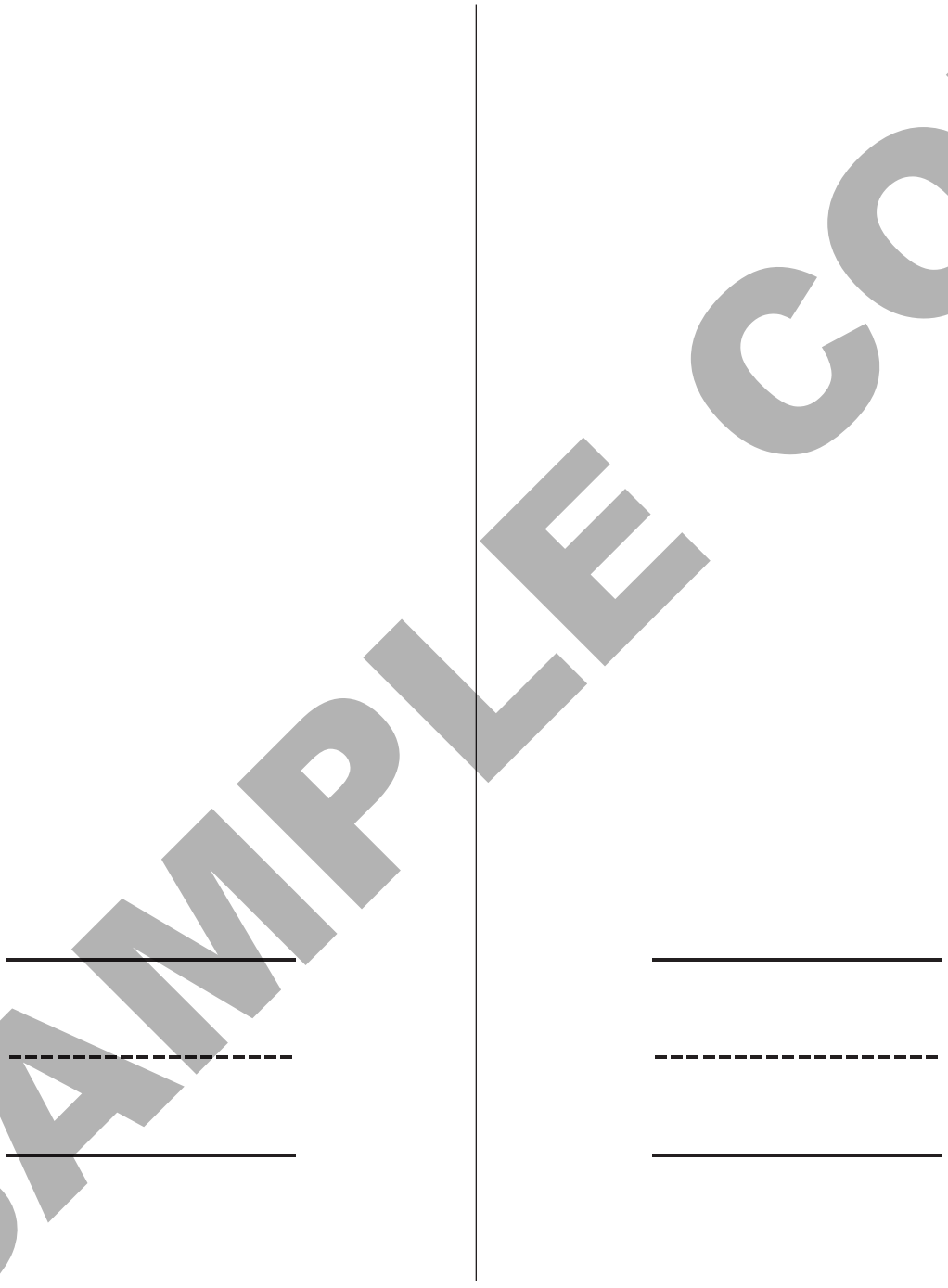
Shape A



Shape B

Activity 2

Shape Sort



Activity 3

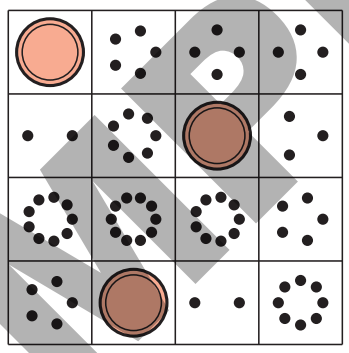
Centers: Choice Time

Choose a center.

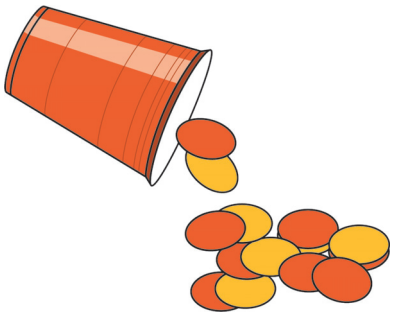
Which One?

Picture Books

Bingo



Shake and Spill



Addressing CA CCSSM K.CC.3, K.CC.4-5, and K.G.4; practicing MP5, MP6, and MP7

Circles and Triangles

Let's learn the names of some shapes.

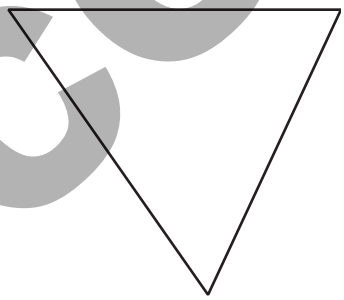
Warm-up

Which Three Go Together: More Shapes

Which 3 go together?

A

B



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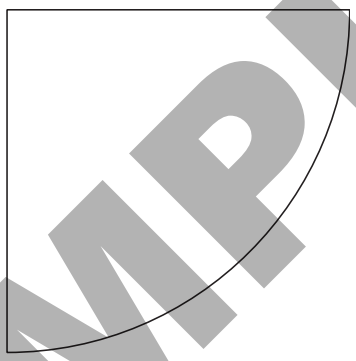

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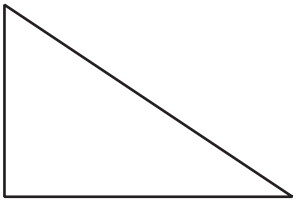
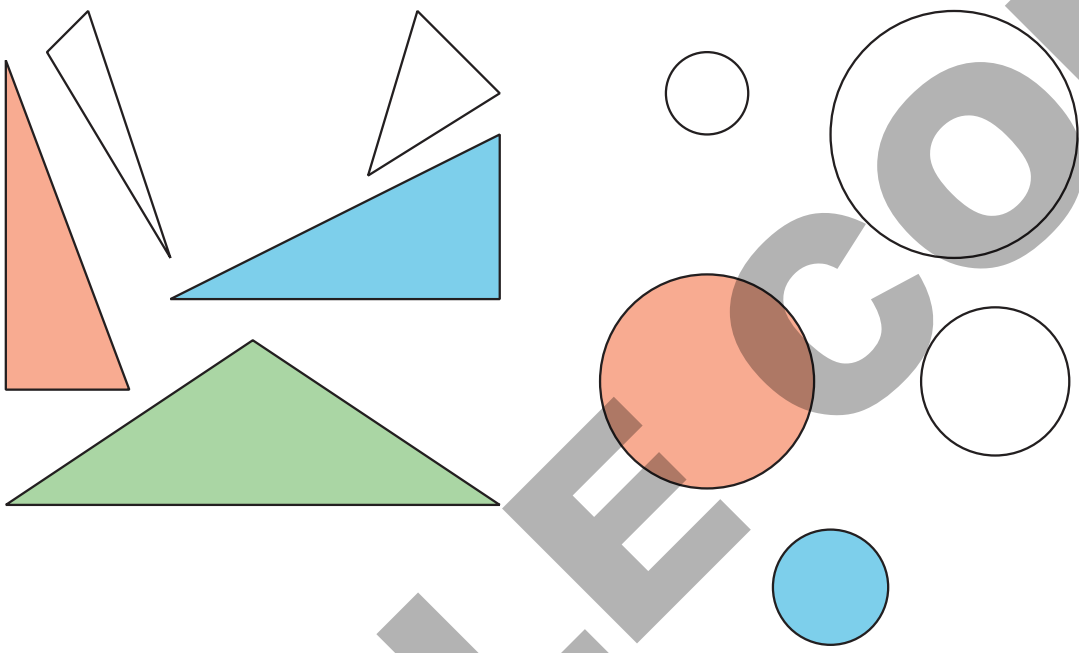
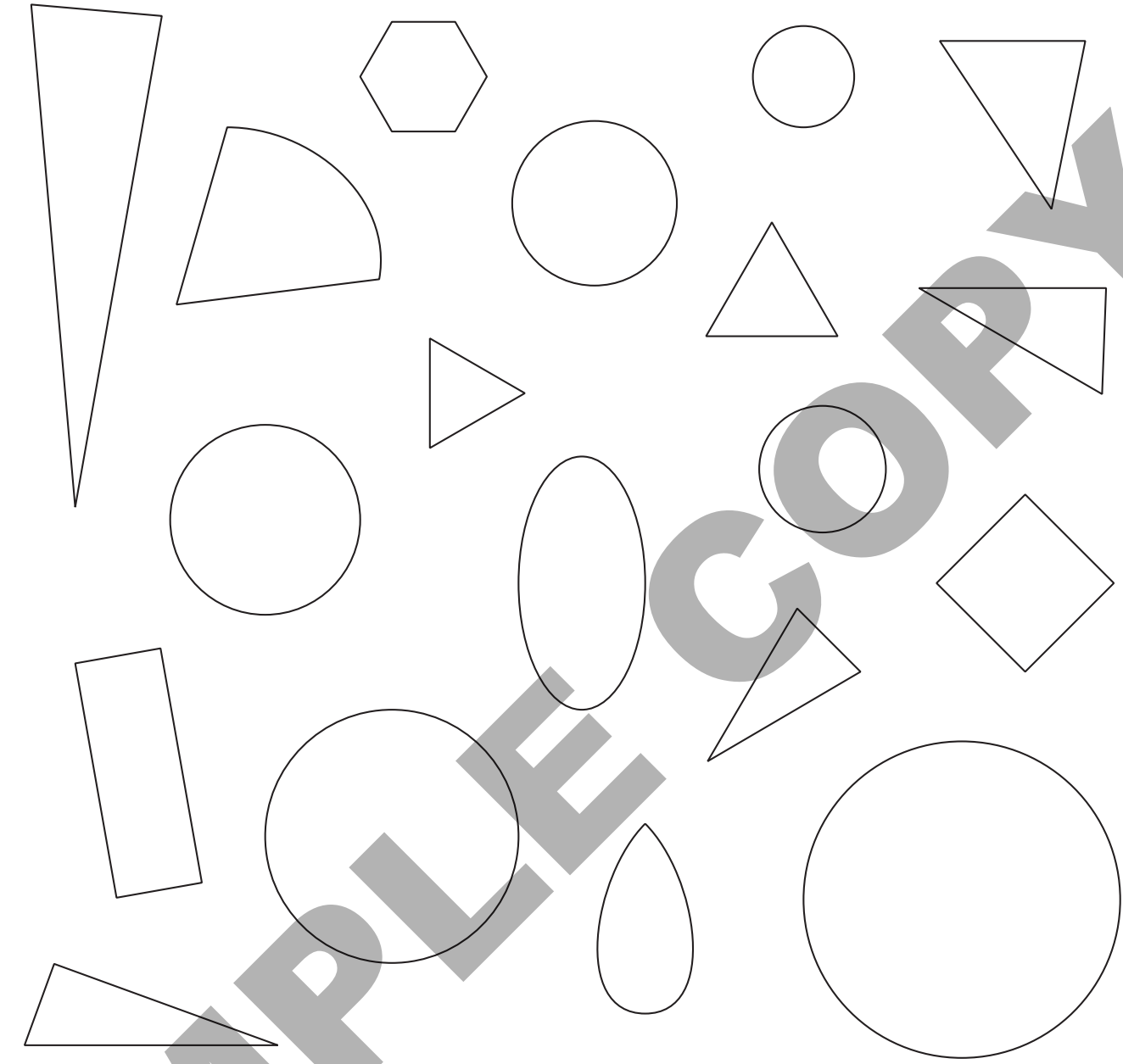
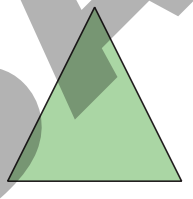


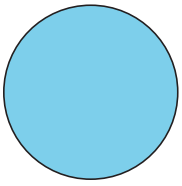
Activity 1

Color Circles and Triangles



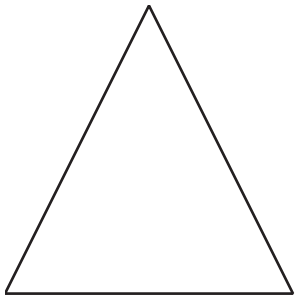
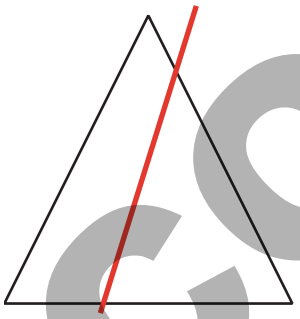






Activity 2

Card Sort: Triangles

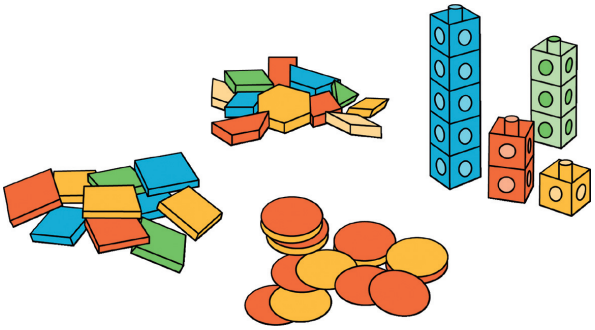
Triangle	Not a Triangle
	

Activity 3

Introduce Counting Collections—Up to 20

Choose a center.

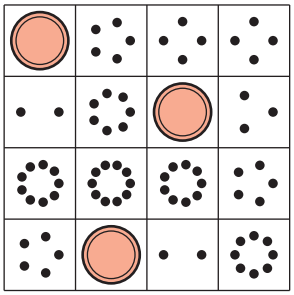
Counting Collections



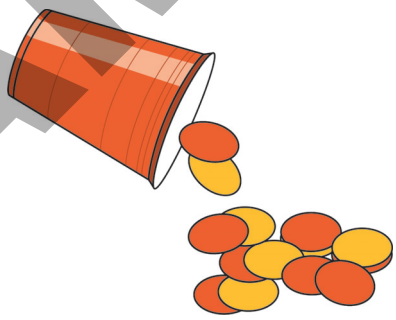
Which One?

Picture Books

Bingo



Shake and Spill



Addressing CA CCSSM K.G.4 and K.MD.2; practicing MP6 and MP7

Rectangles and Squares

Let's name more shapes.

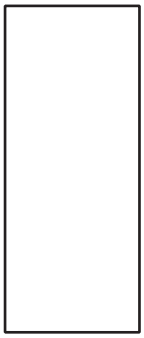
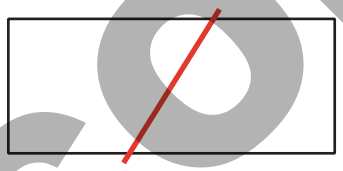
Warm-up

What Do You Know about Triangles?

What do you know about triangles?

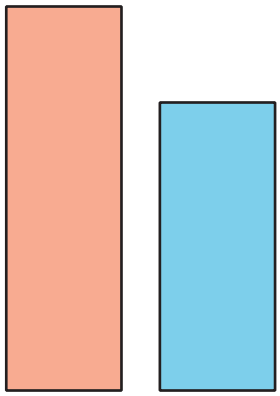
Activity 1

Card Sort: Rectangles

Rectangle	Not a Rectangle
	

Activity 2

Compare Rectangle Lengths



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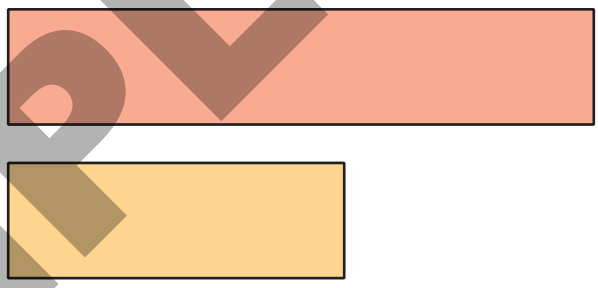

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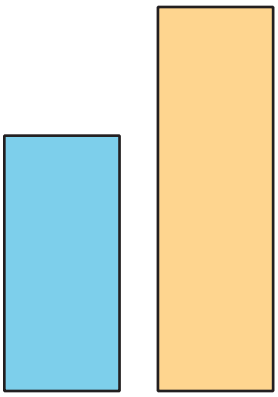

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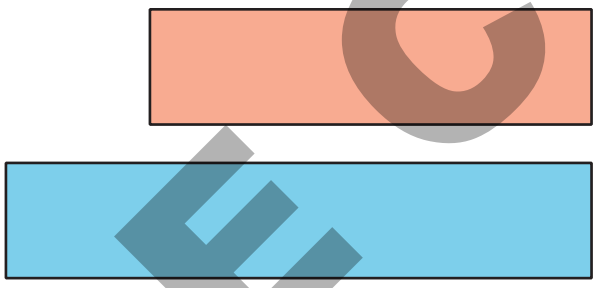

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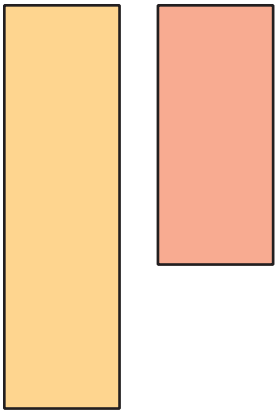
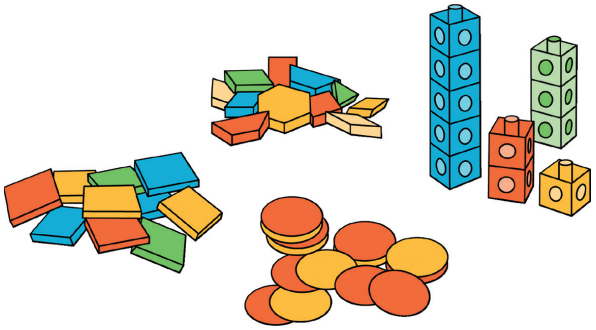


Activity 3

Centers: Choice Time

Choose a center.

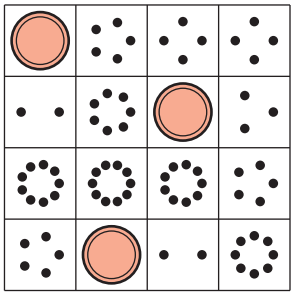
Counting Collections



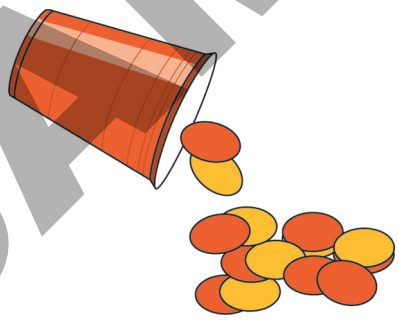
Which One?

Picture Books

Bingo



Shake and Spill



Addressing CA CCSSM K.CC.1, K.G.5, and K.MD.2; practicing MP3 and MP6

Build with Straws

Let's make shapes with straws.

Activity 1

Compare Lengths of Straws

Let's put straws into 2 groups.

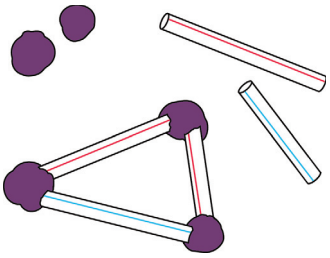
shorter than	longer than
	

Activity 3

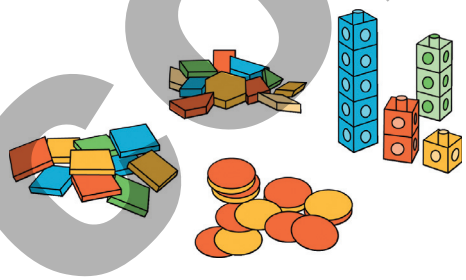
Introduce Build Shapes—Match the Flat Shape

Choose a center.

Build Shapes



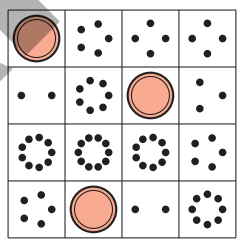
Counting Collections



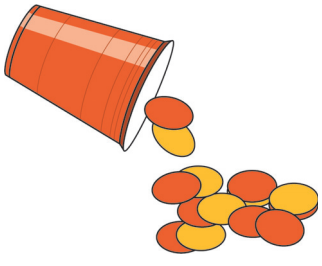
Which One?

Picture Books

Bingo



Shake and Spill



Addressing CA CCSSM K.G.2 and K.G.4-5; practicing MP4, MP6, and MP8

Draw Shapes

Let's draw shapes.

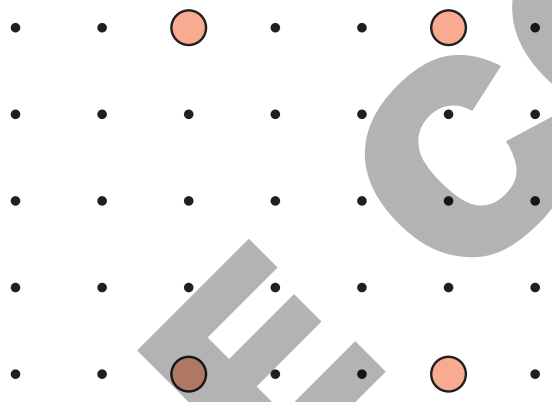
Warm-up

What Do You Know about Rectangles?

What do you know about rectangles?

Activity 1

Connect the Dots



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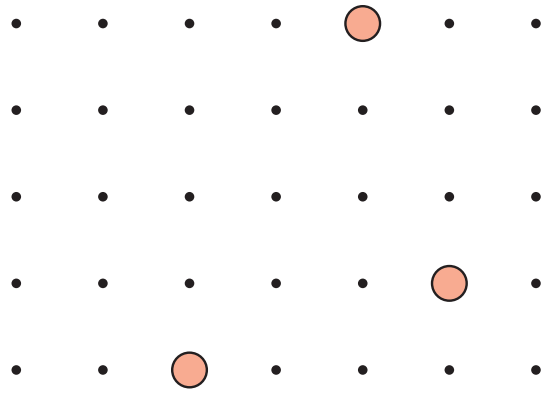

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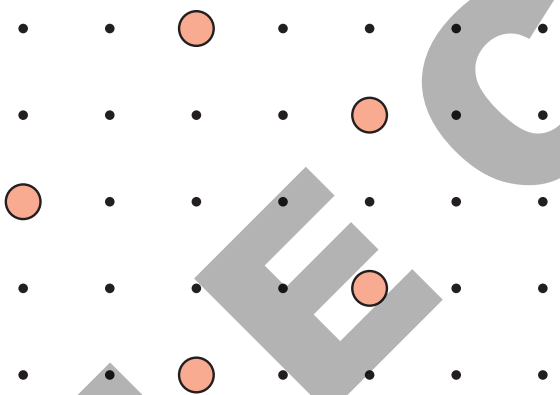

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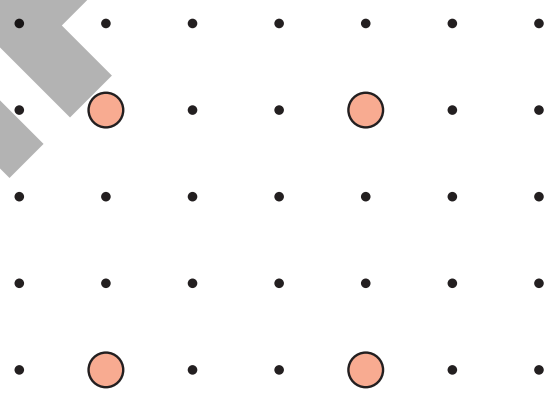

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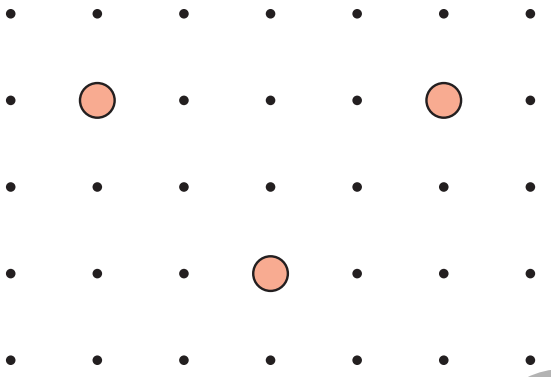

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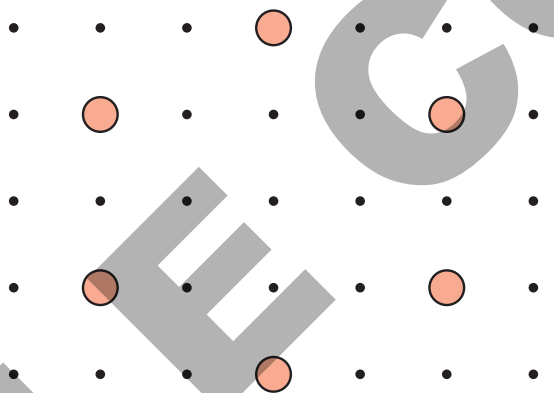

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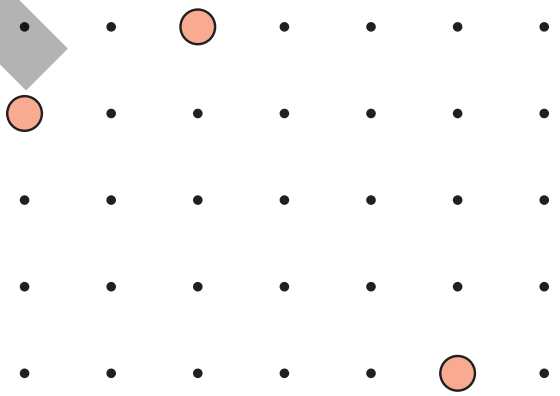
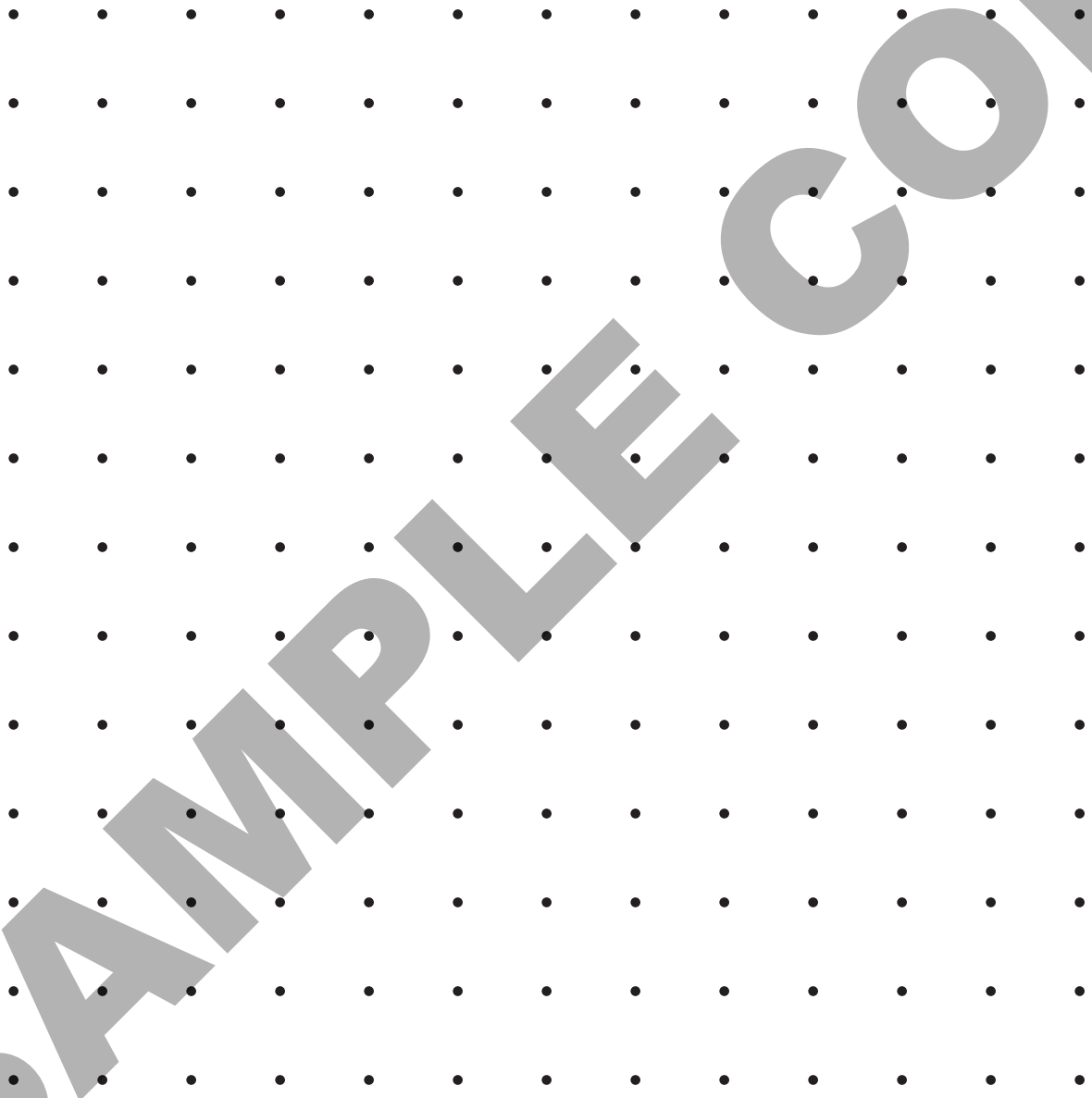
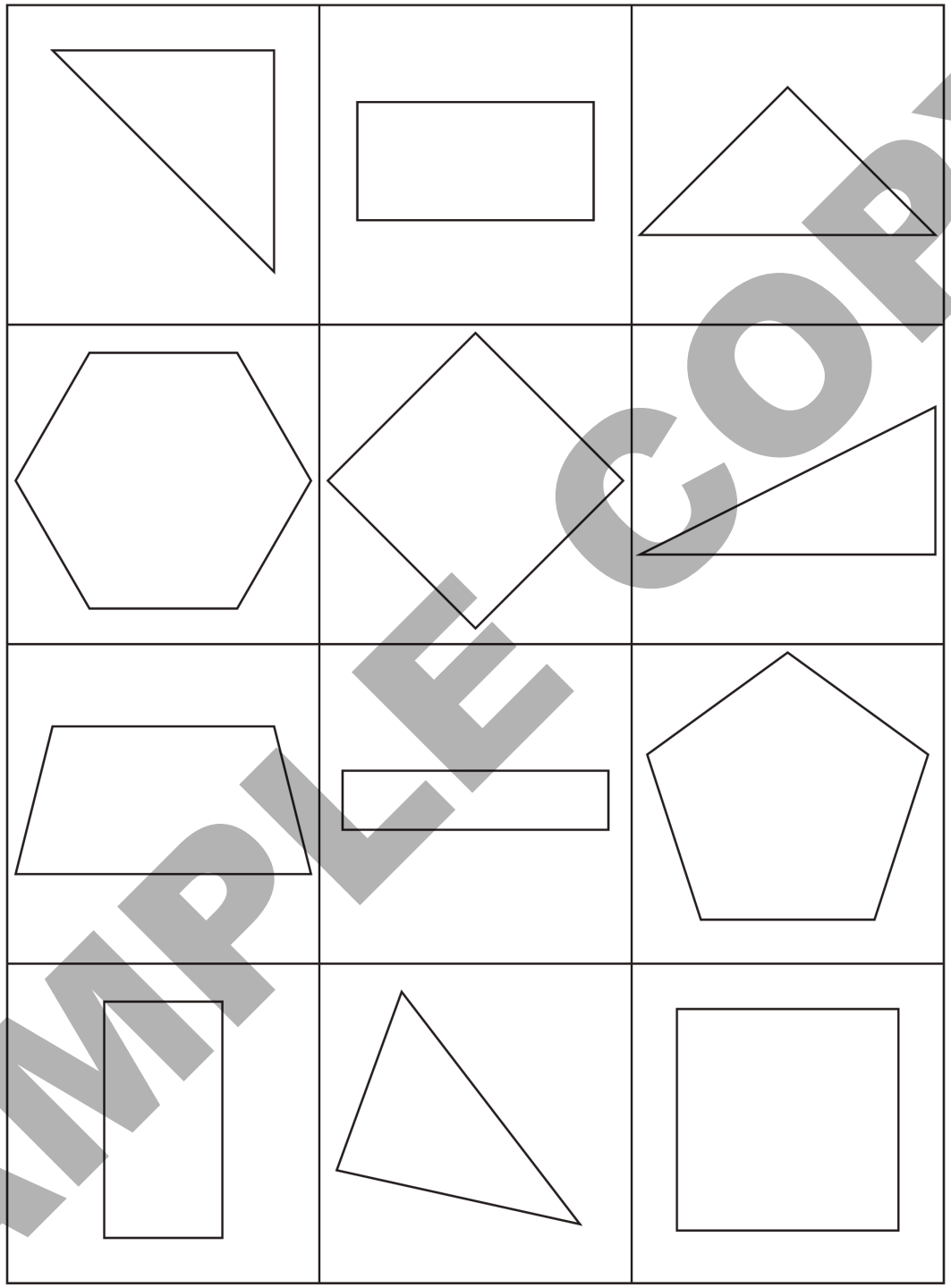
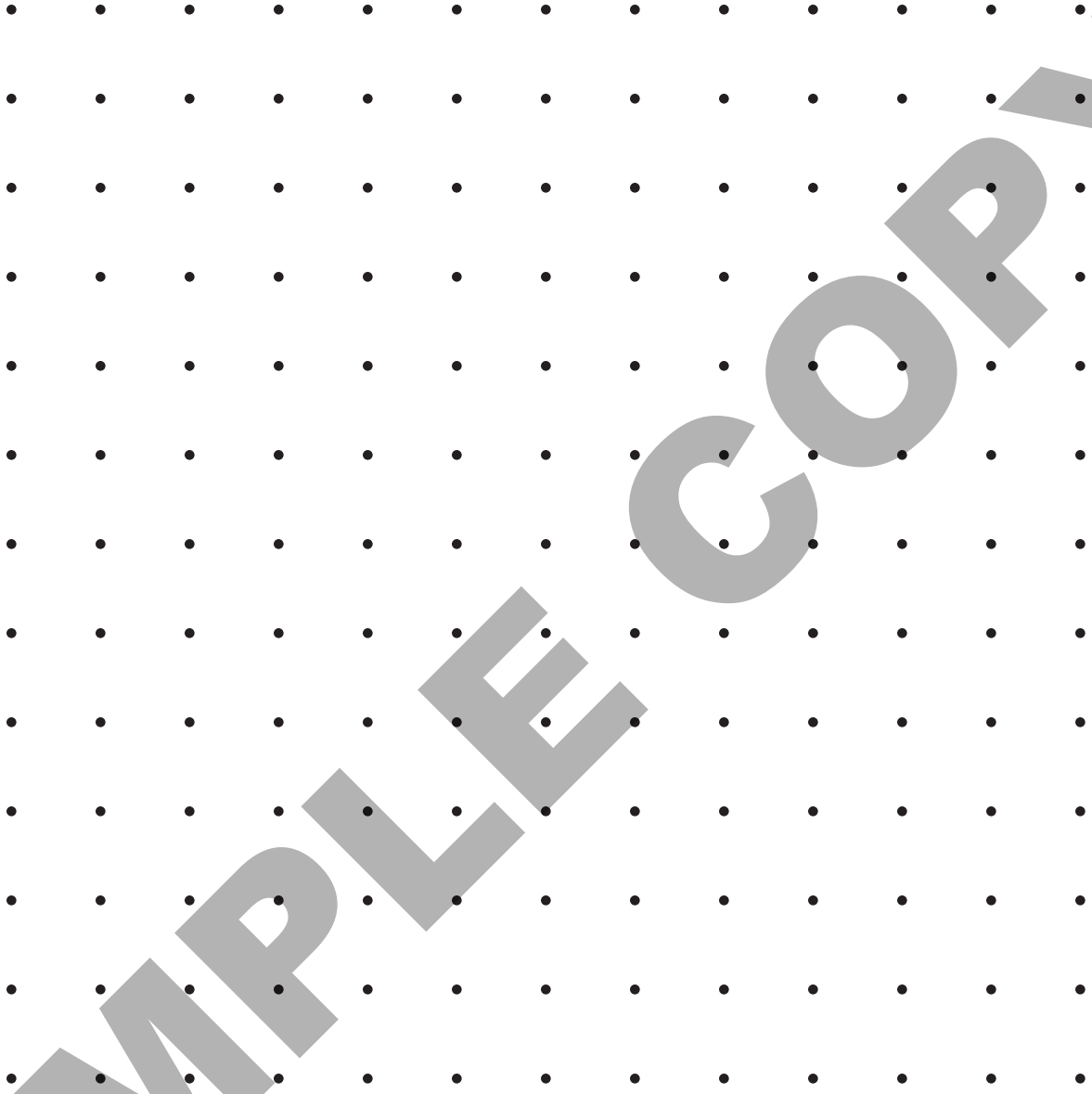


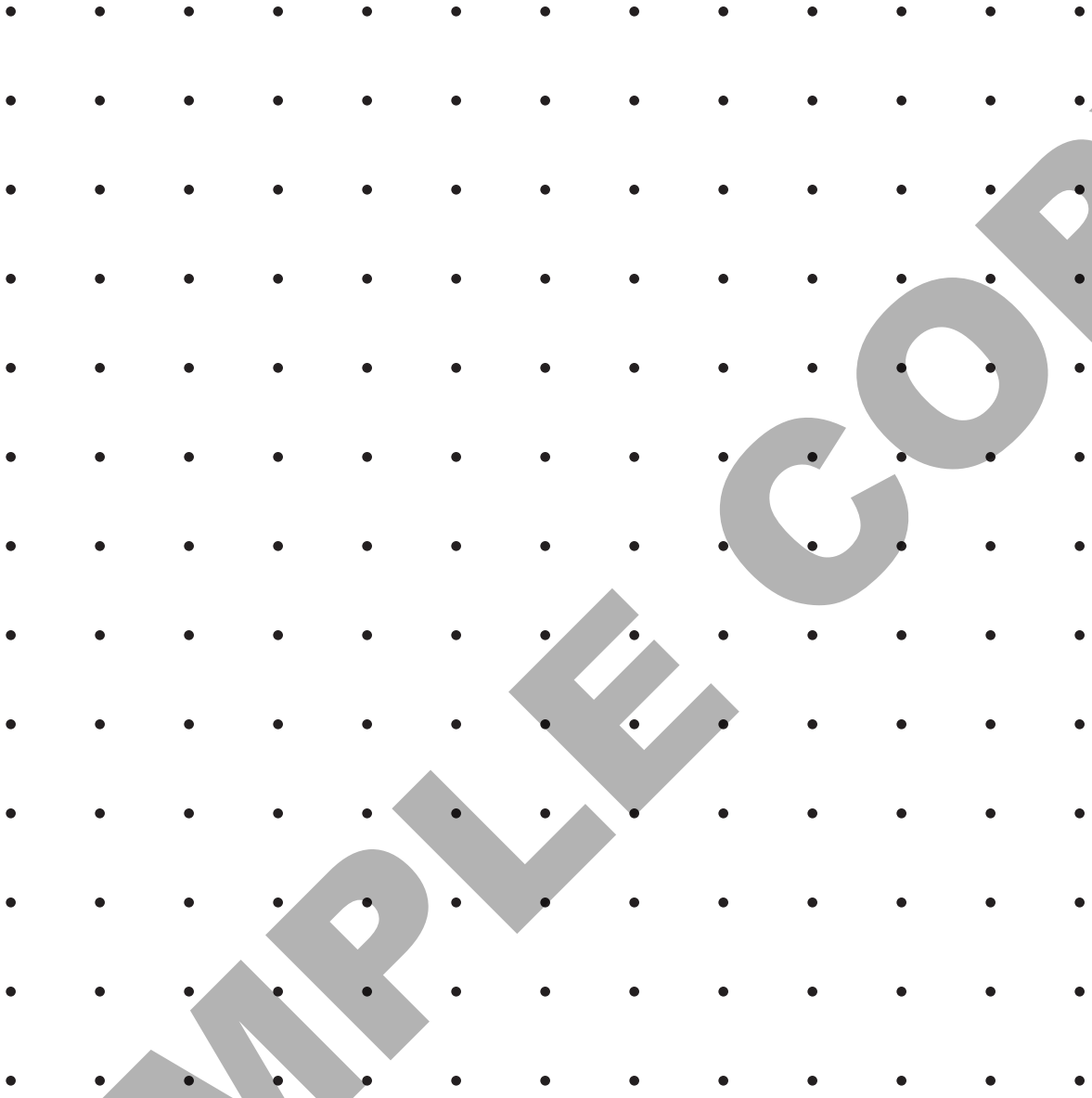
Activity 2

Describe and Draw Shapes







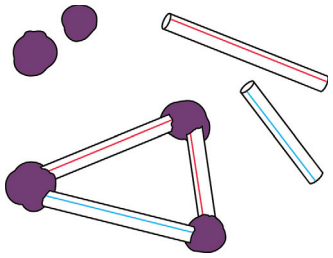


Activity 3

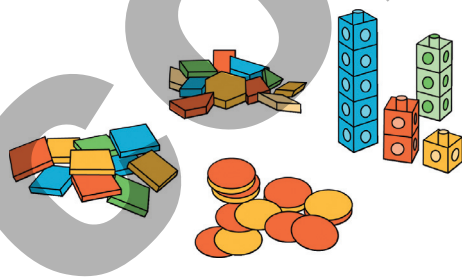
Introduce Build Shapes—Describe the Flat Shape

Choose a center.

Build Shapes



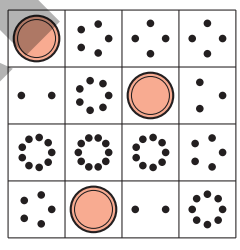
Counting Collections



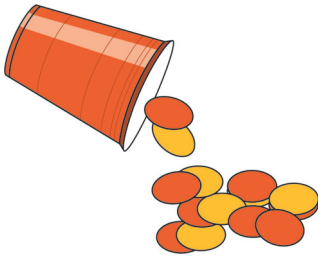
Which One?

Picture Books

Bingo



Shake and Spill



Addressing CA CCSSM K.G.1-2 and K.G.4-5; practicing MP4

Shapes Are Everywhere

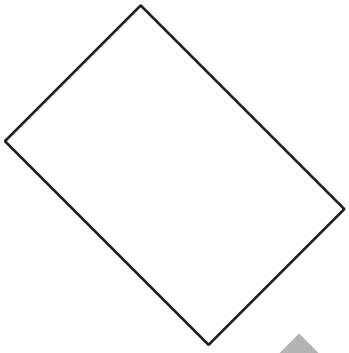
Let's find shapes in our world.

Warm-up

Which Three Go Together: Rectangles, Squares, and Triangles

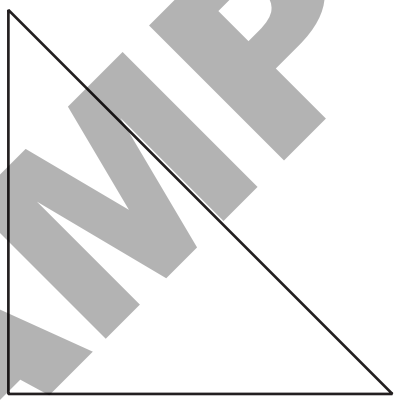
Which 3 go together?

A

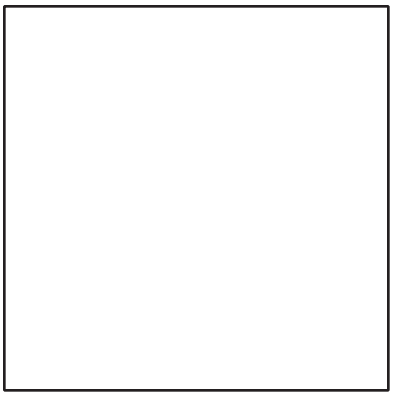


B

C

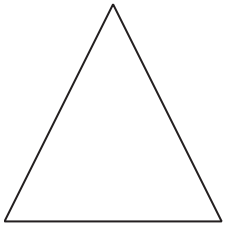


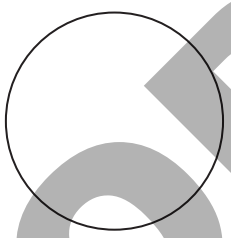
D



Activity 1

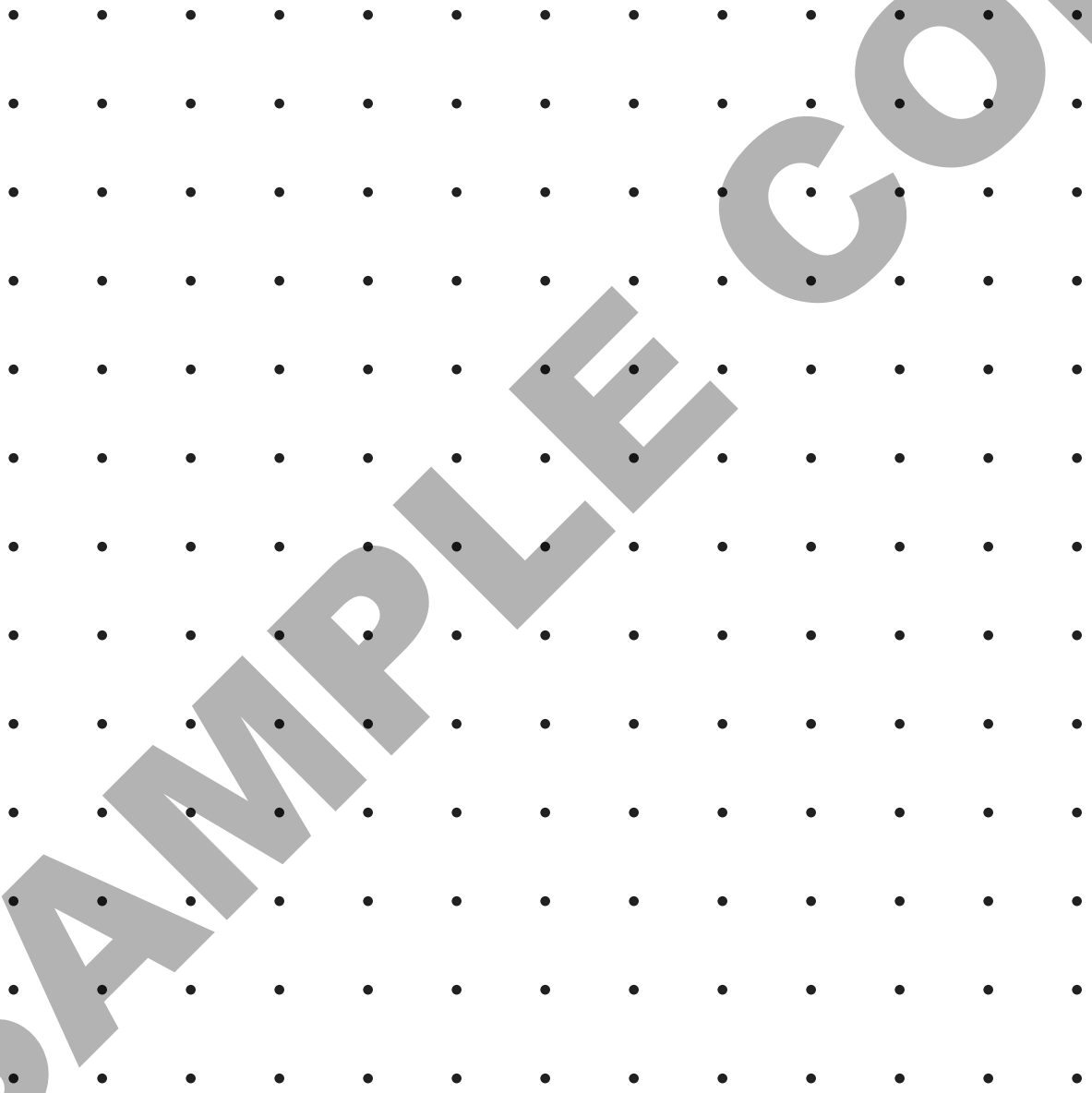
School Shape Walk





Activity 2

Create the Shape



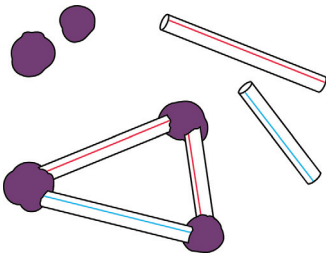
Activity 3

Centers: Choice Time

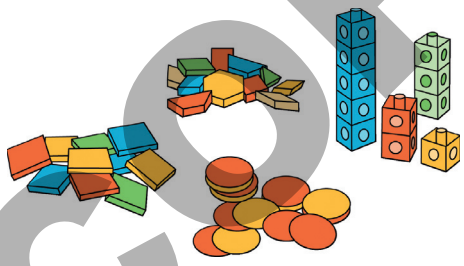
Choose a center.

Sec A

Build Shapes



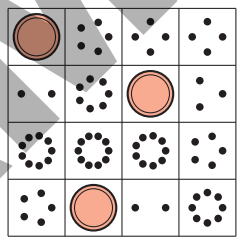
Counting Collections



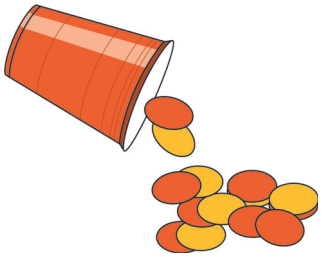
Which One?

Picture Books

Bingo



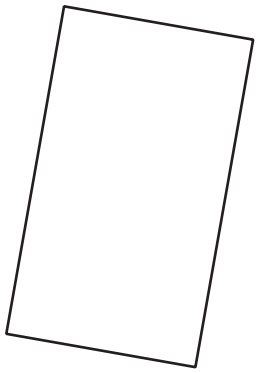
Shake and Spill



Section A Summary

We can notice shapes in our world.

We can compare shapes.



This shape has 4 corners.

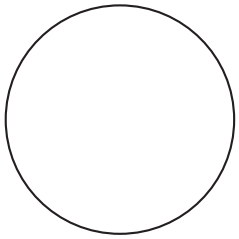
This shape has 2 long sides and 1 shorter side.

Both have straight sides.

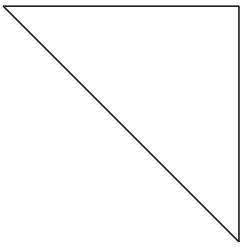
One has 4 sides, and the other has 3 sides.

We learned shape names:

circle

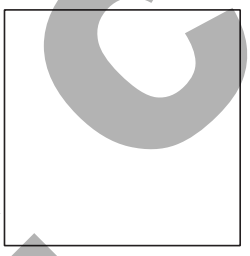


triangle



rectangle

square

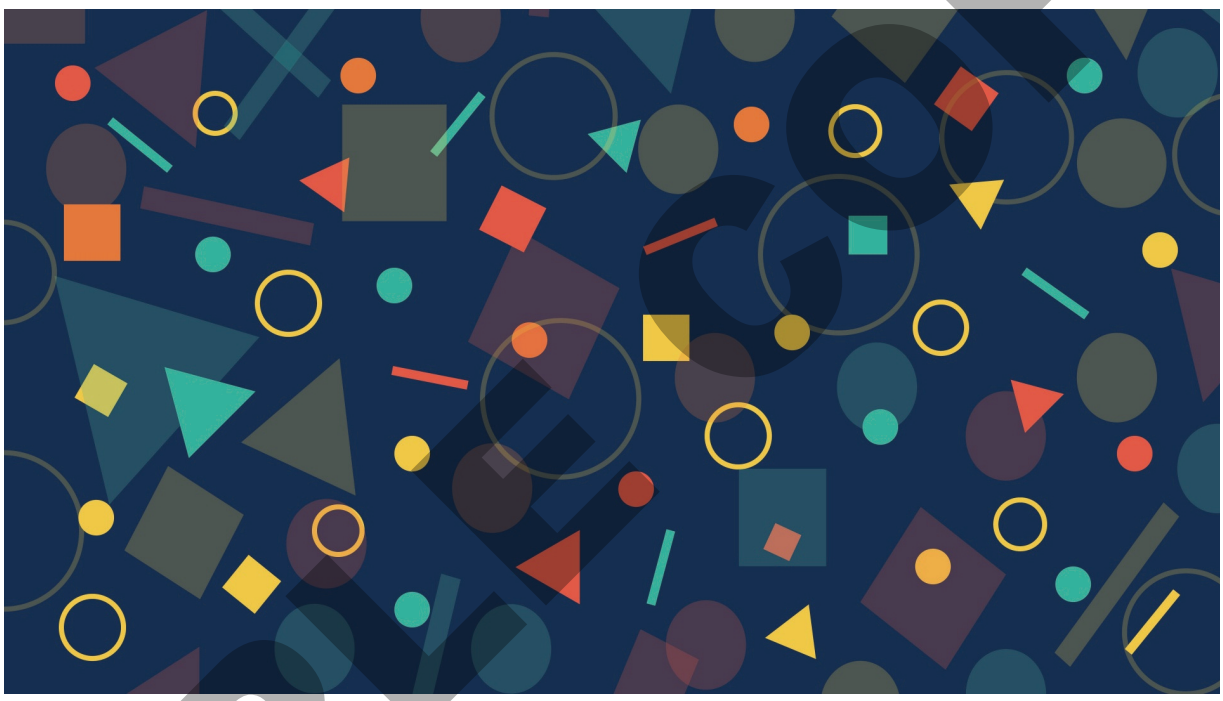


Practice Problems

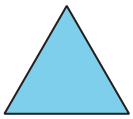
11 Problems

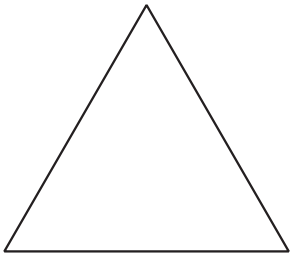
1 from Unit 3, Lesson 1

What shapes do you see?

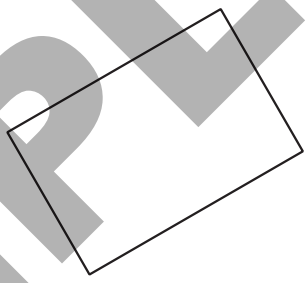


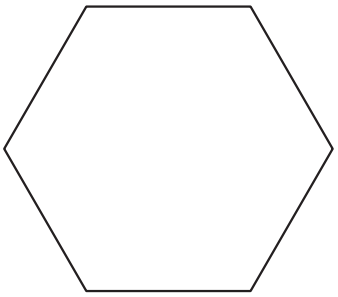
a. Circle the same shape.





b. Circle the same shape.

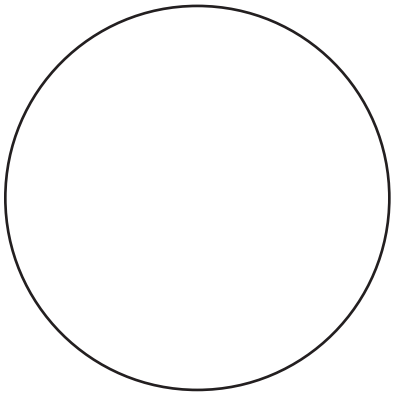


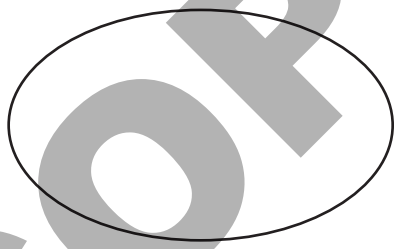


3 from Unit 3, Lesson 3

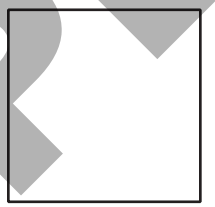
How are they the same?
How are they different?

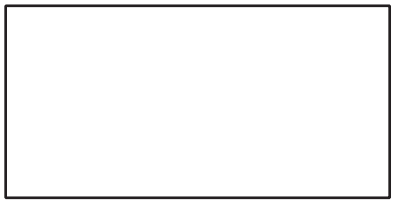
a.





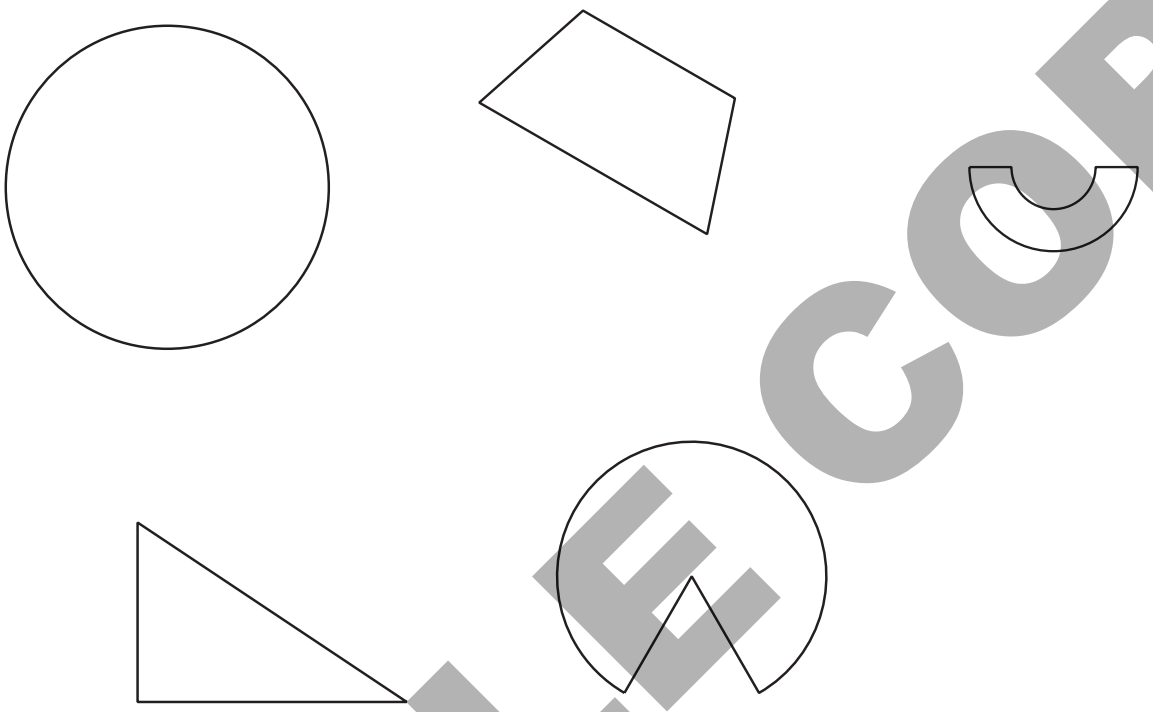
b.





4 from Unit 3, Lesson 4

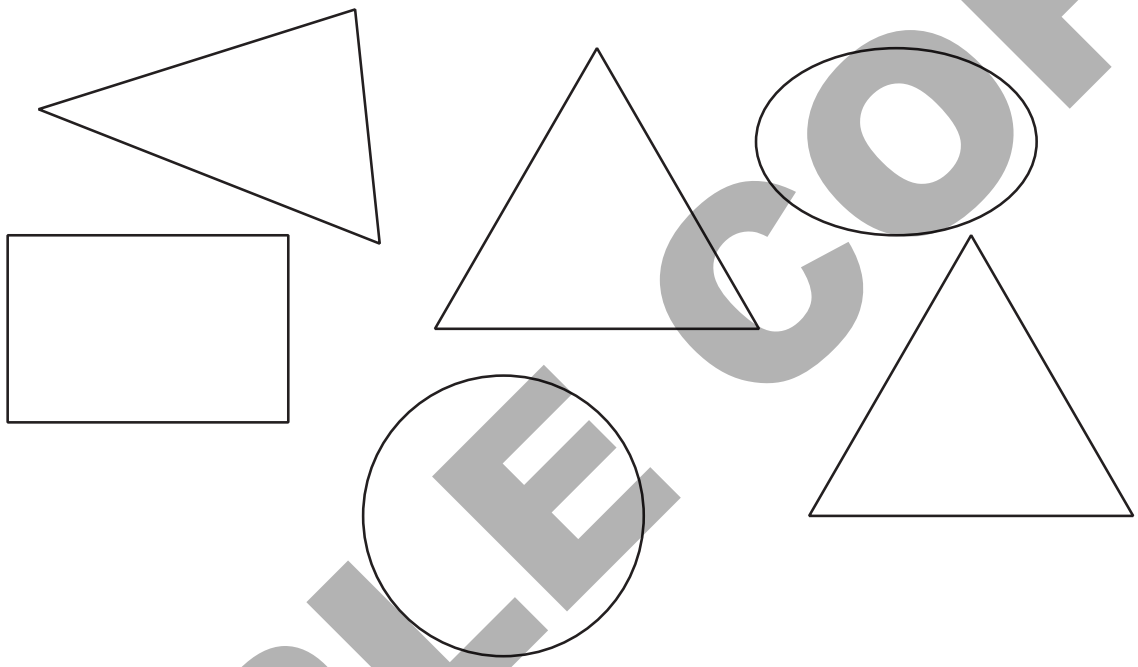
Circle the curved shapes.



5 from Unit 3, Lesson 5

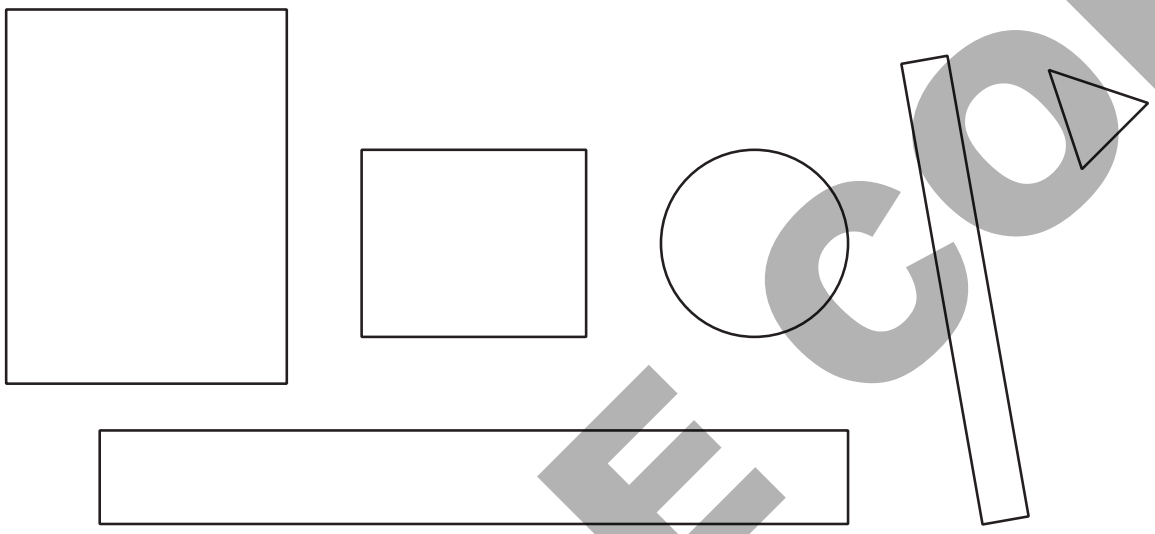
Color the triangles.

Cross out other shapes.



Color the rectangles.

Cross out other shapes.



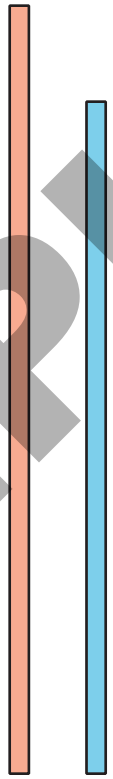
7 from Unit 3, Lesson 7

Circle the longer rectangles.

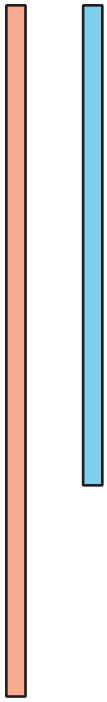
a.

b.

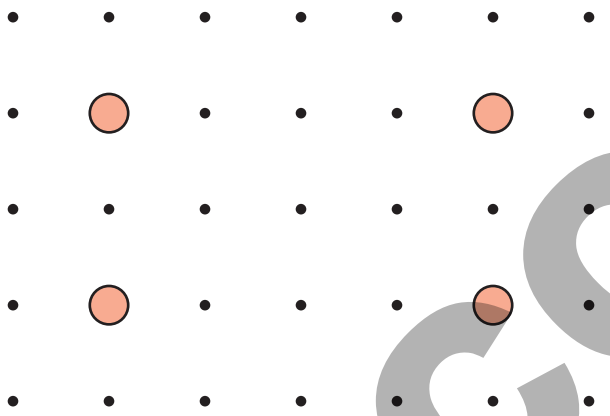
c.



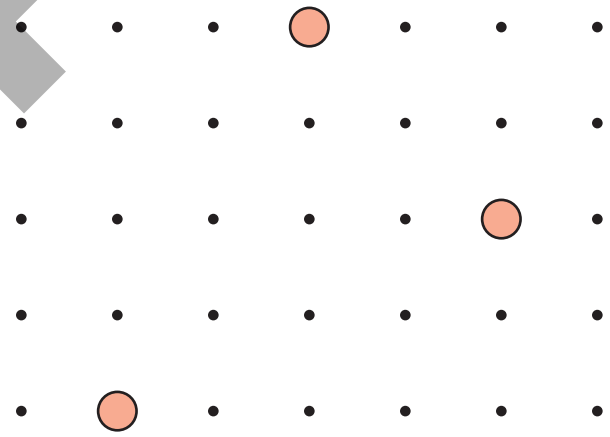
d.



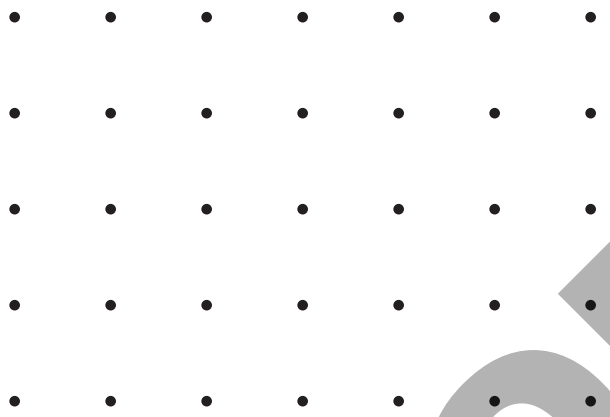
a. Connect the red dots.
What shape is it?



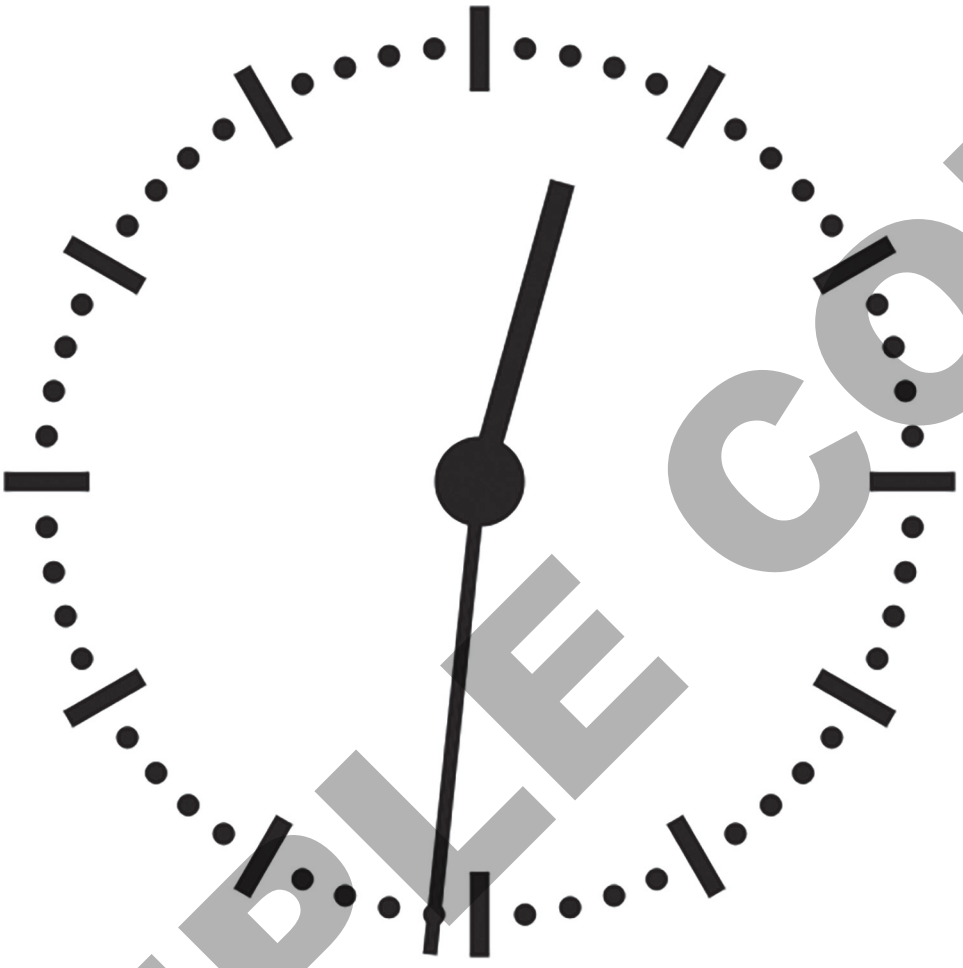
b. Connect the red dots.
What shape is it?



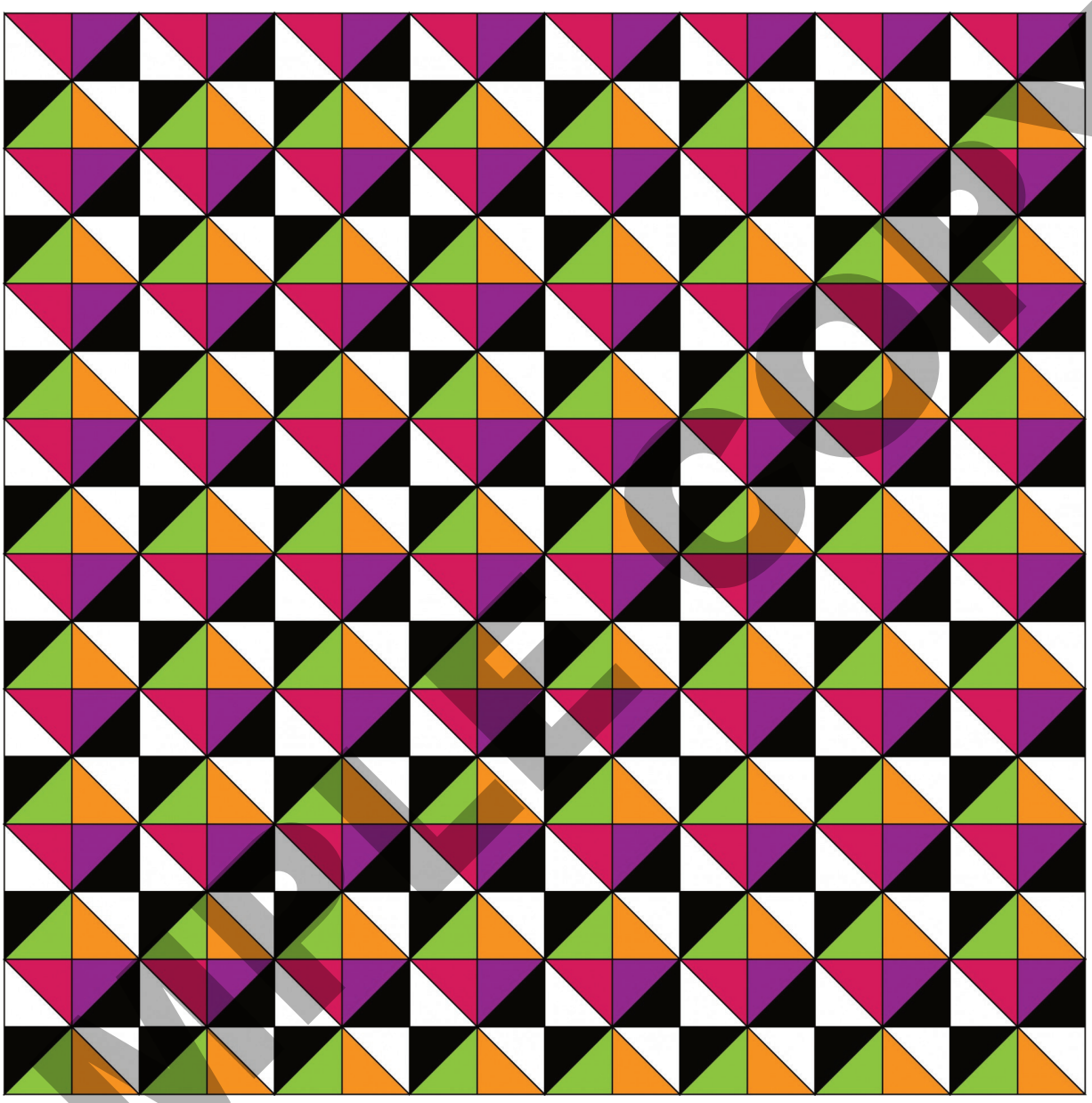
c. Draw a shape with 4 sides and 4 corners.



What shapes do you see?

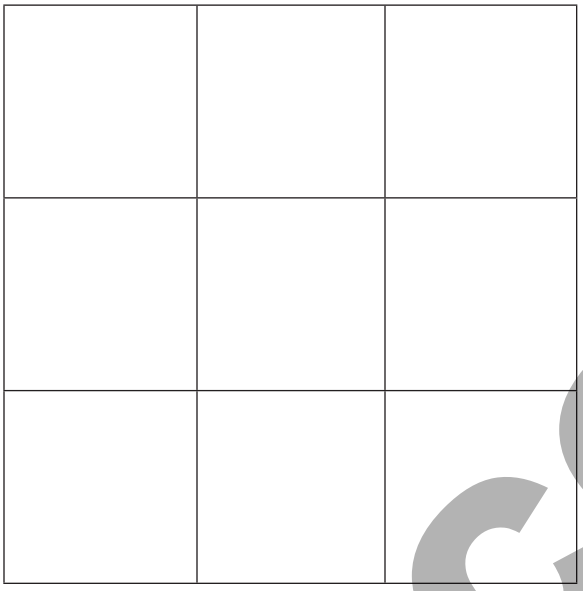


10 Exploration



a. Find triangles.

b. Find rectangles.



a. Find different square sizes.

b. How many squares?

Unit 3, Lesson 10

Addressing CA CCSSM K.CC.5, K.CC.6-7, and K.G.6; building towards K.G.6; practicing MP2

Put Together Pattern Blocks

Let's put together pattern blocks.

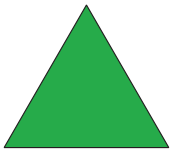
Warm-up

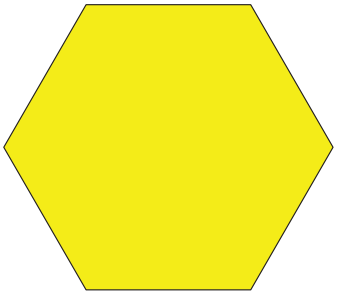
Notice and Wonder: Quilts

What do you notice?
What do you wonder?

Synthesis:

Introduce Pattern Blocks—Count Out and Build

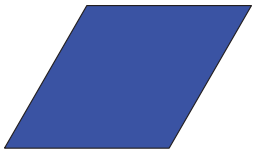
3  green triangles

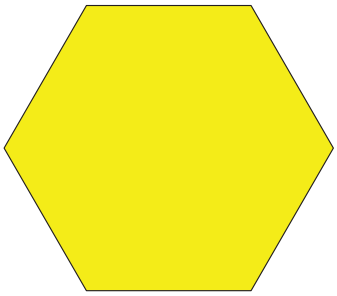
6  yellow hexagons

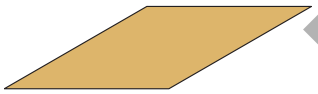
8  blue rhombuses

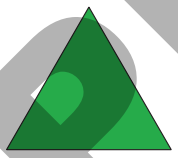
4  orange squares

I used more _____ than _____.

5  blue rhombuses

2  yellow hexagons

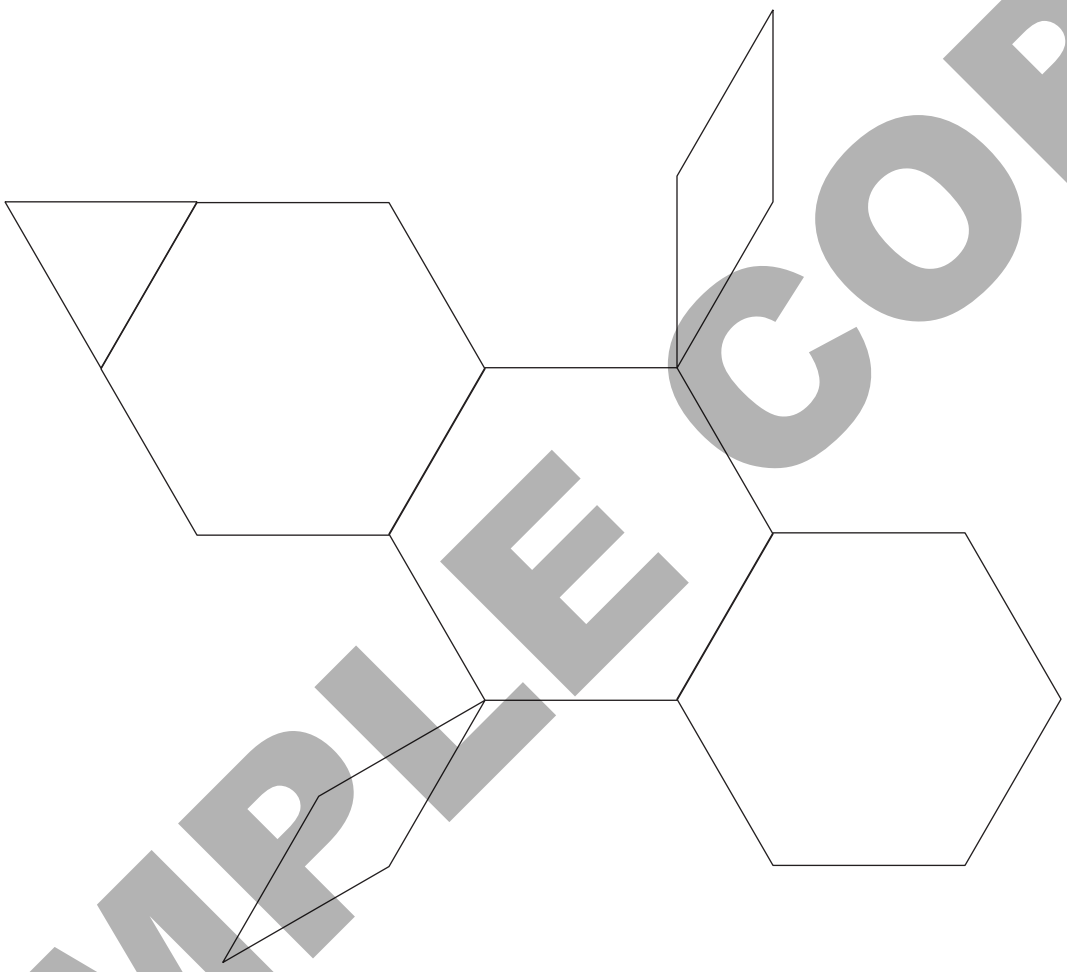
4  tan rhombuses

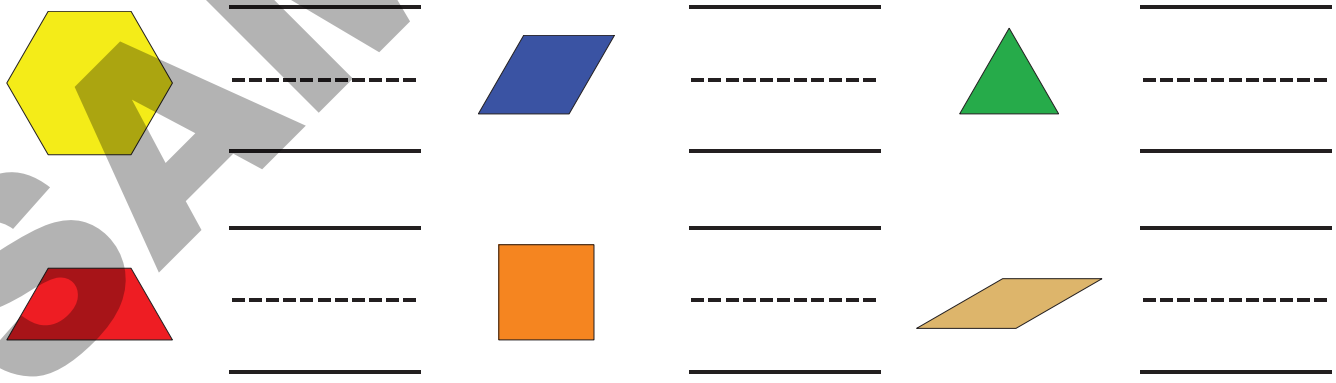
7  green triangles

I used more _____ than _____.

Activity 2

Pattern Block Puzzles



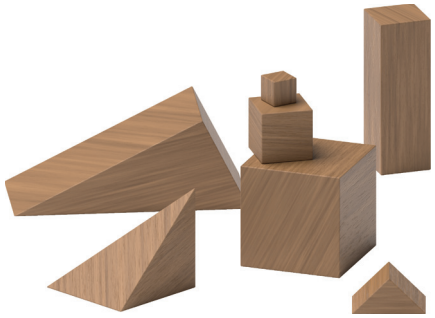


Activity 3

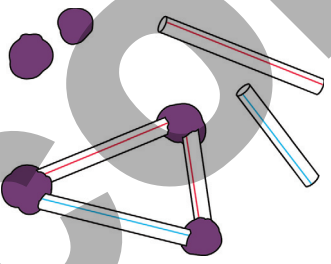
Centers: Choice Time

Choose a center.

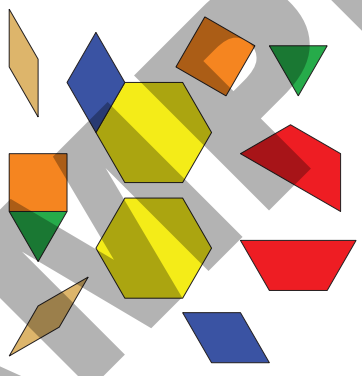
Geoblocks



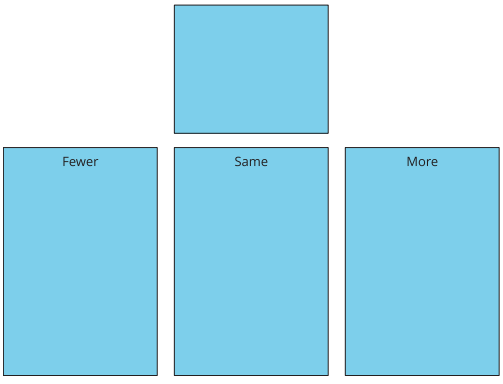
Build Shapes



Pattern Blocks



Fewer, Same, More



Unit 3, Lesson 11

Addressing CA CCSSM K.CC.3, K.CC.4-5, and K.G.2; practicing MP7

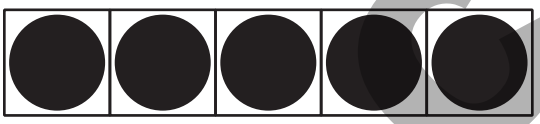
Same Shapes

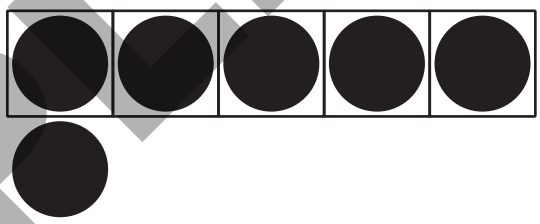
Let's find out which shapes are the same.

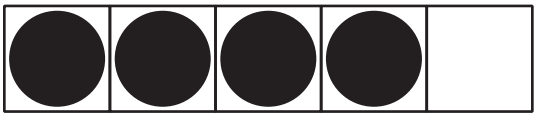
Warm-up

How Many Do You See: 1 More and 1 Less on 5-Frames

How many do you see?
How do you see them?

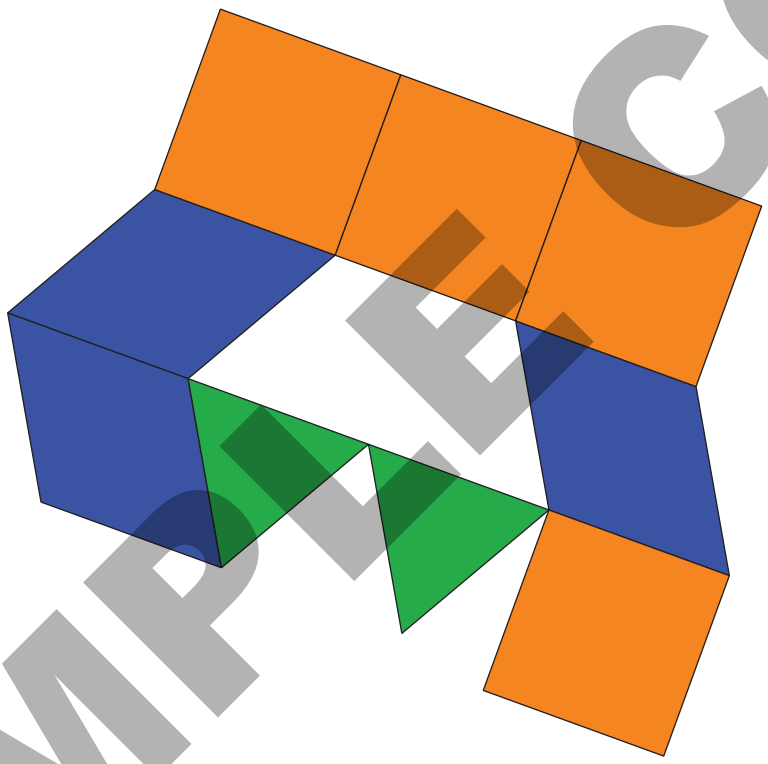


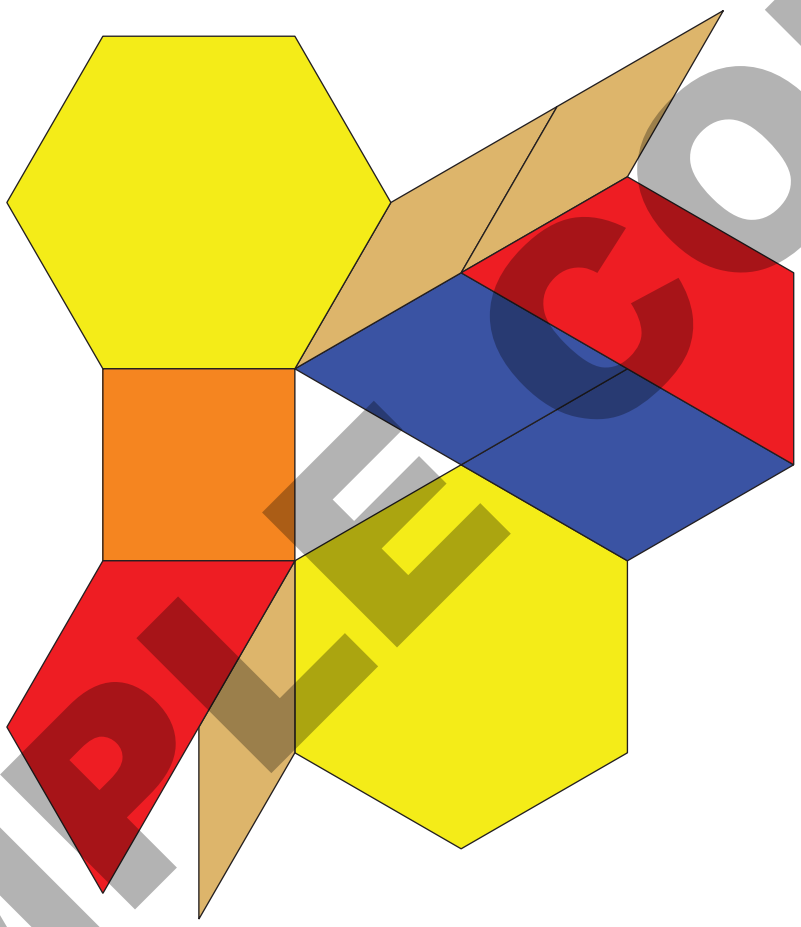


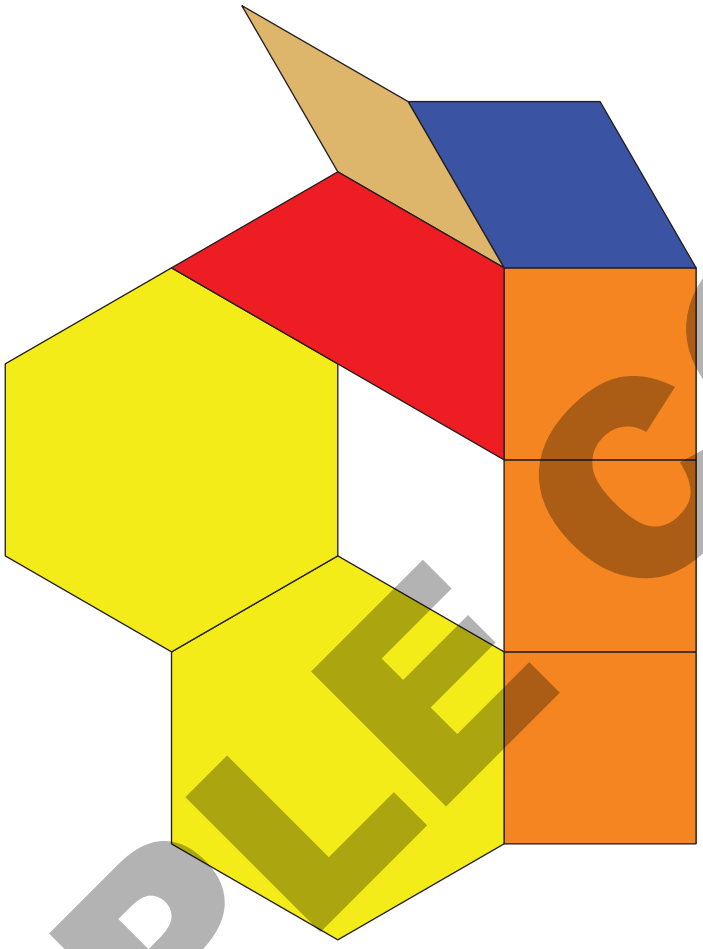


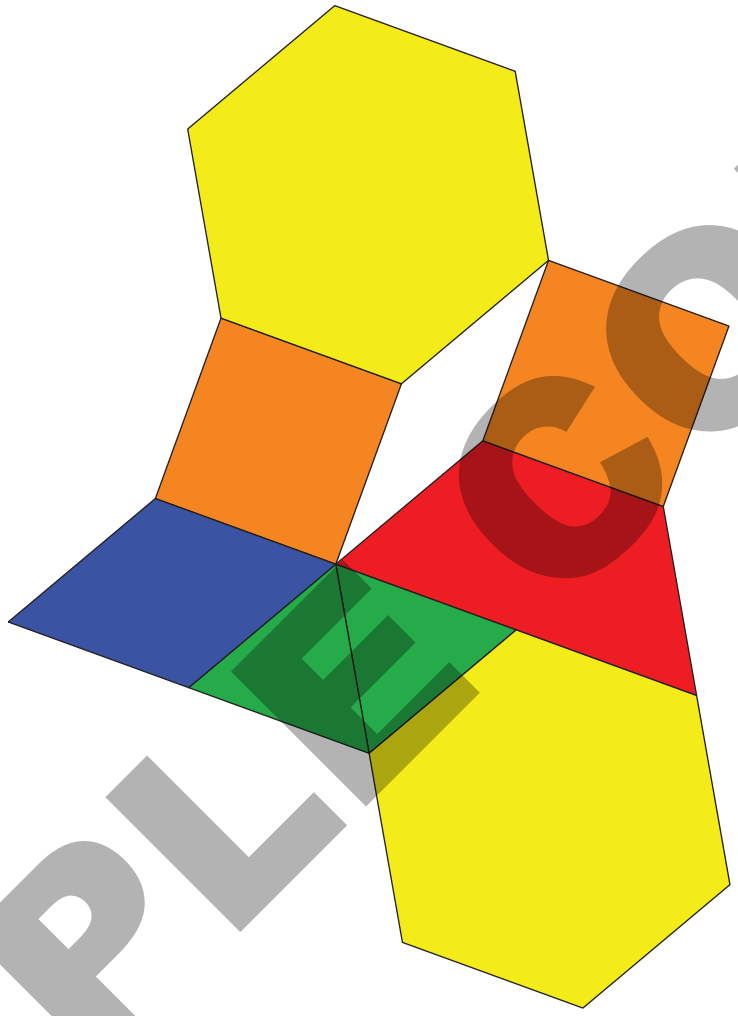
Activity 1

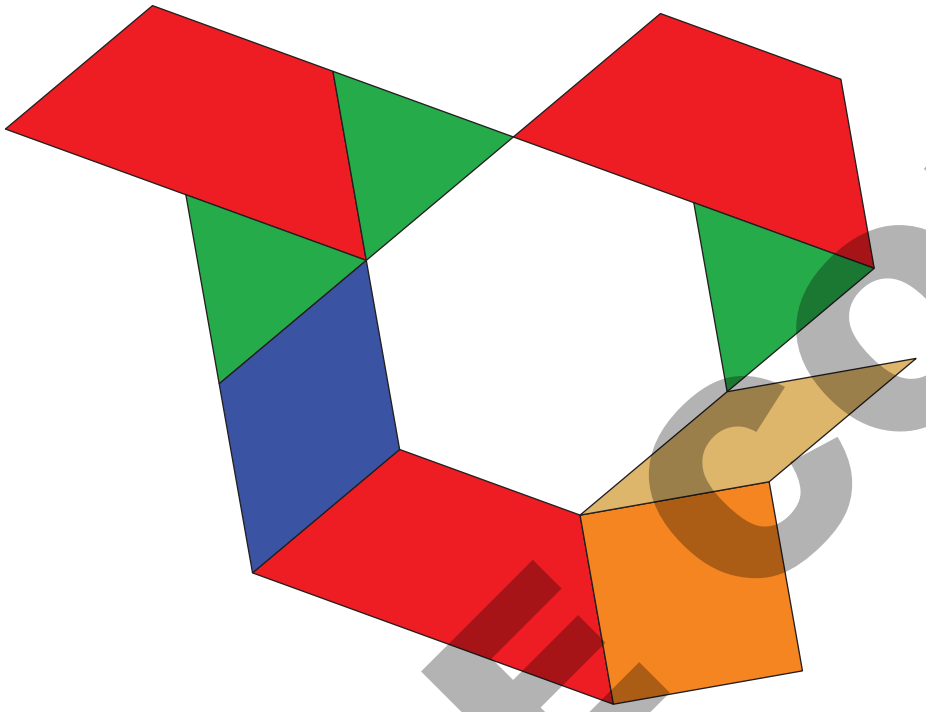
Missing Shapes

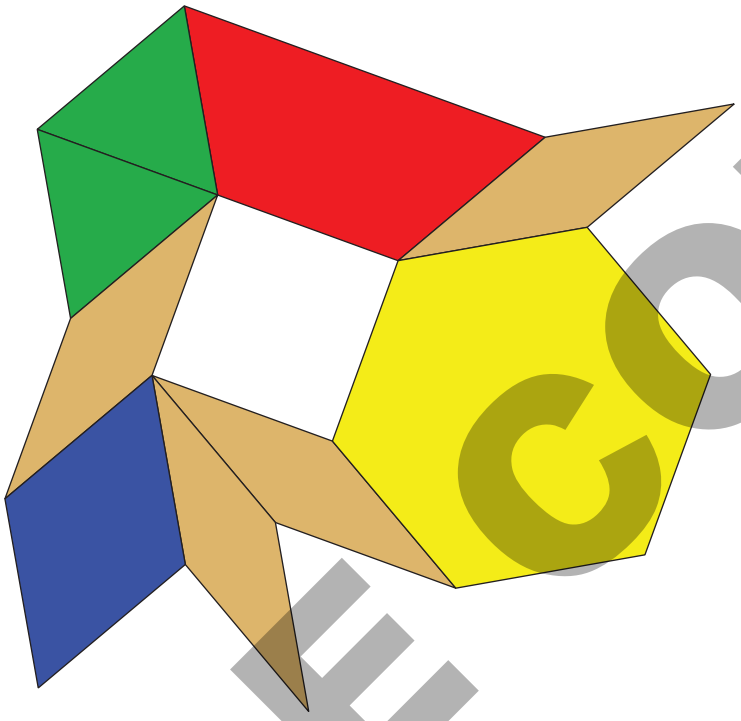






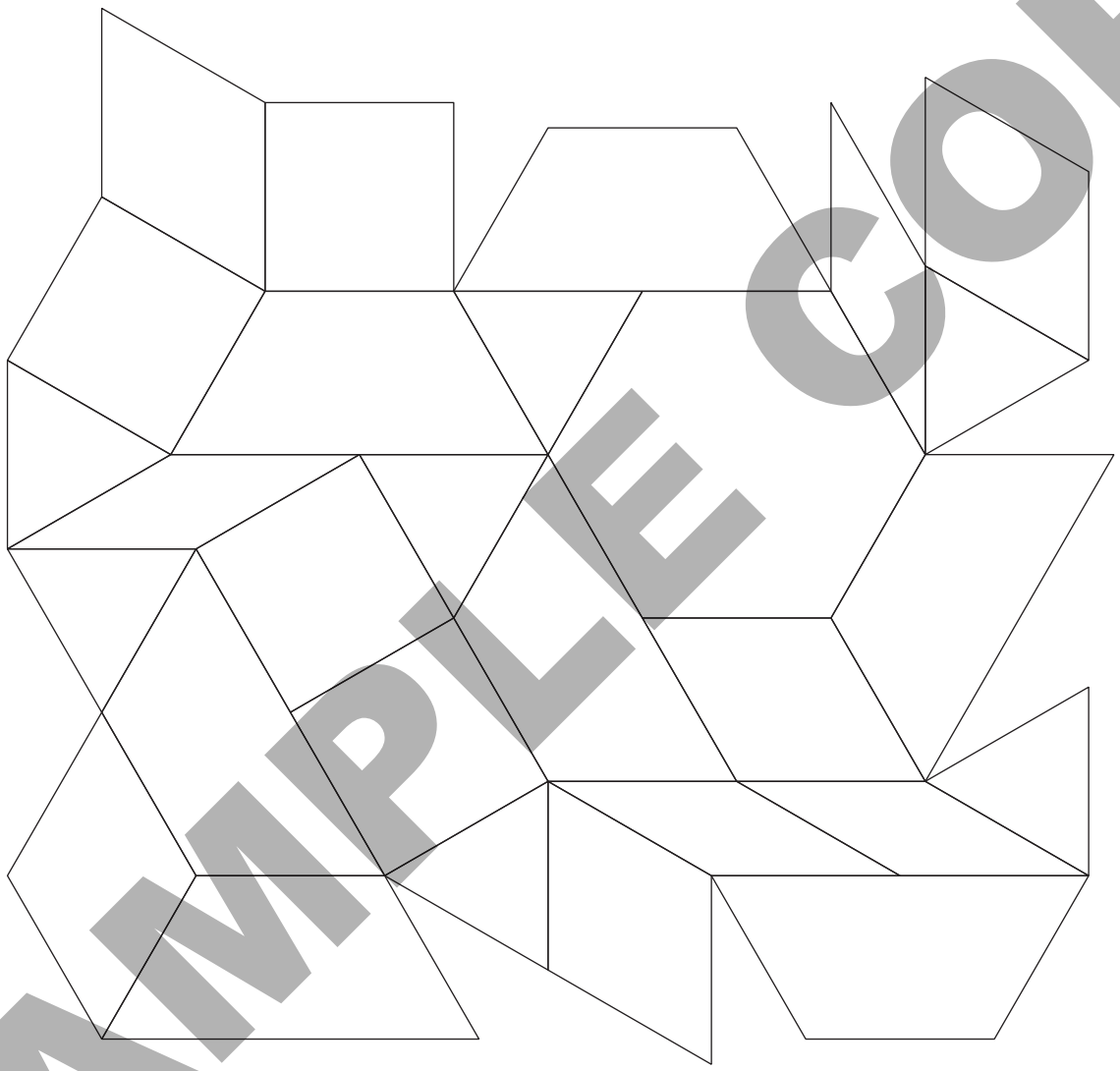


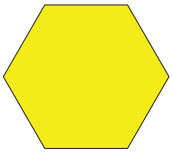




Activity 2

Find the Shape





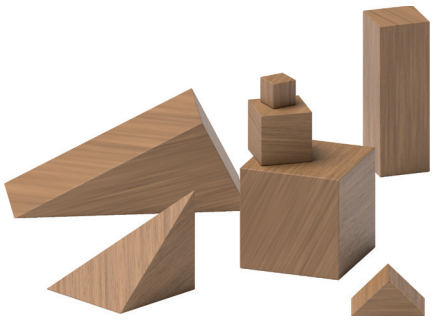
Activity 3

Centers: Choice Time

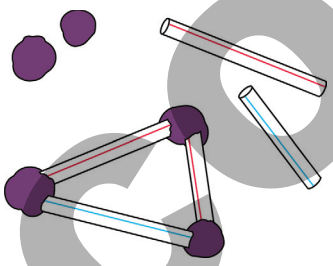
Choose a center.

Sec B

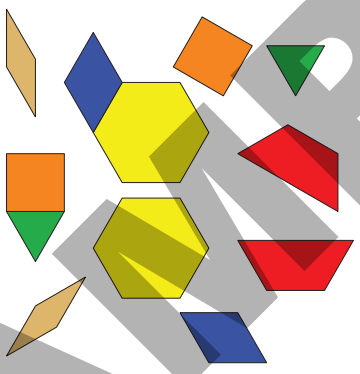
Geoblocks



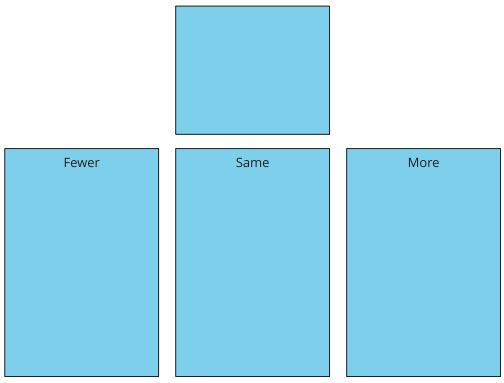
Build Shapes



Pattern Blocks



Fewer, Same, More



Unit 3, Lesson 12

Addressing CA CCSSM K.CC.3, K.CC.5, K.CC.6, and K.G.6; practicing MP1 and MP3

More than 1 Way to Make a Shape

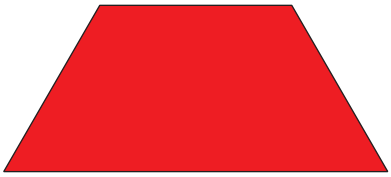
Let's find different ways to make shapes.

Warm-up

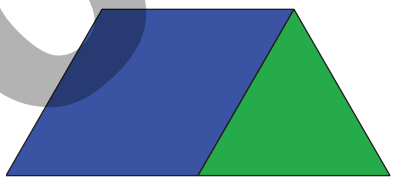
Which Three Go Together: Pattern Block Shapes

Which 3 go together?

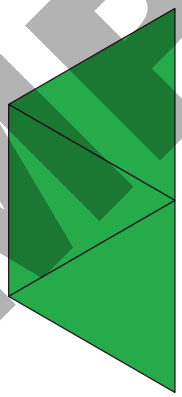
A



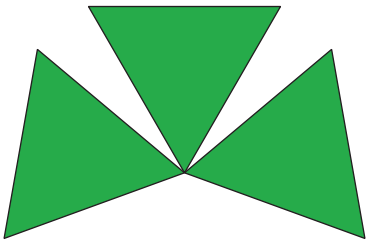
B



C

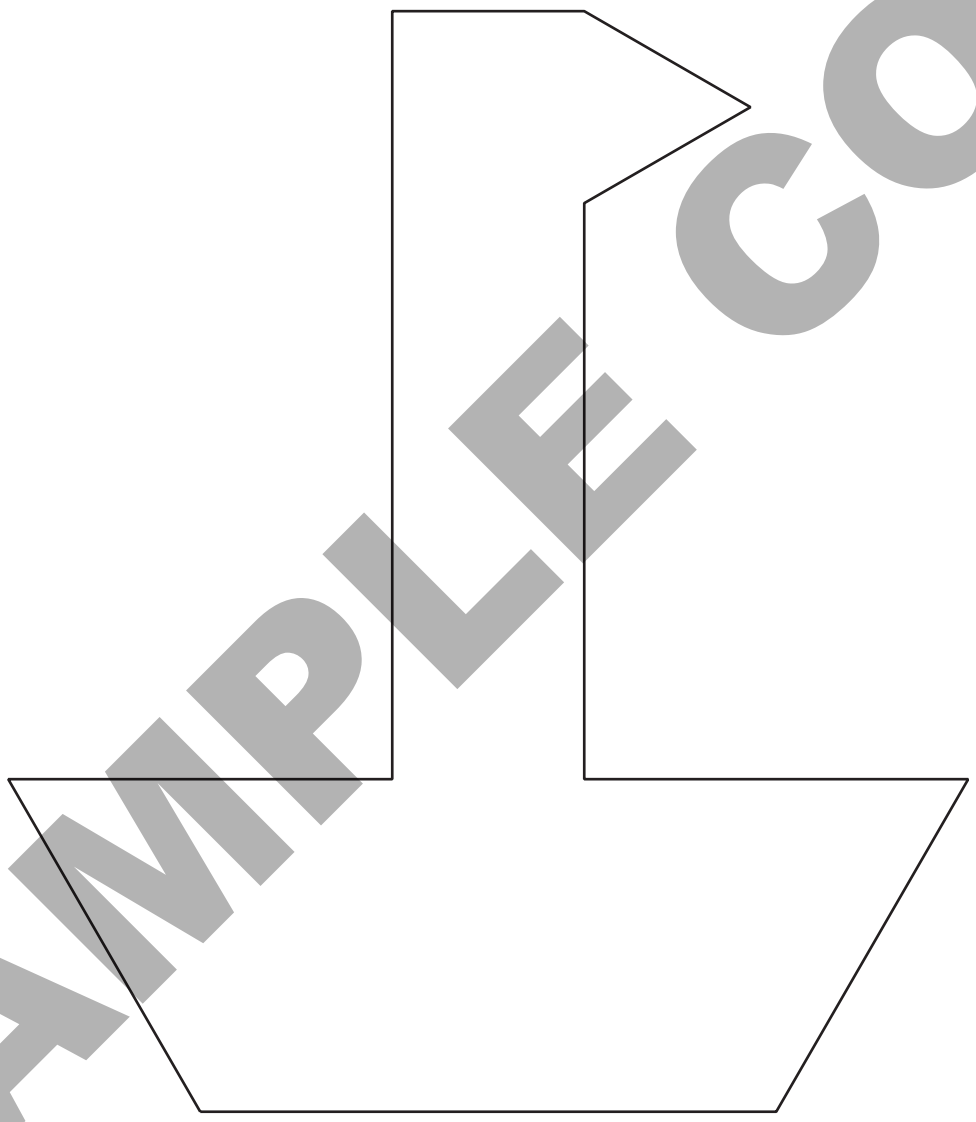


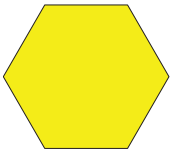
D



Activity 1

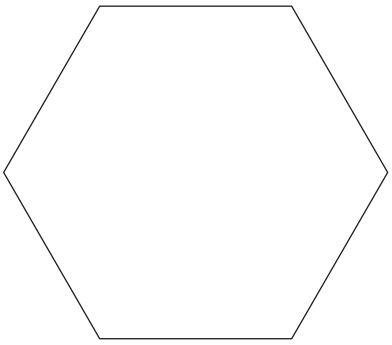
Introduce Pattern Blocks—Puzzle Challenge

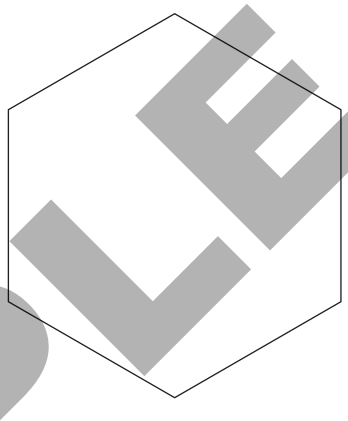


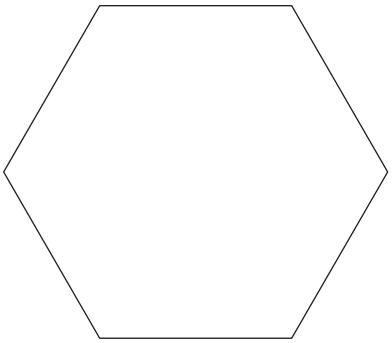


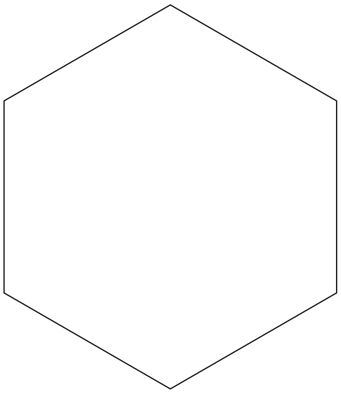
Activity 2

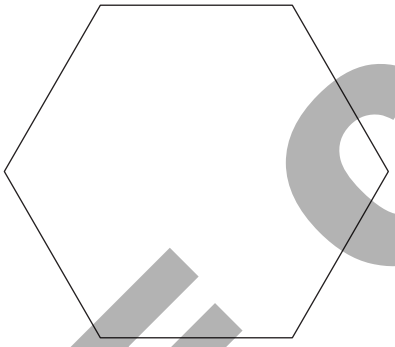
Many Ways to Make a Hexagon

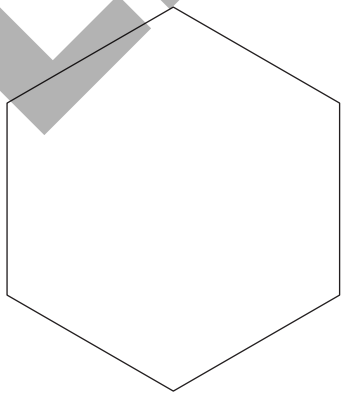












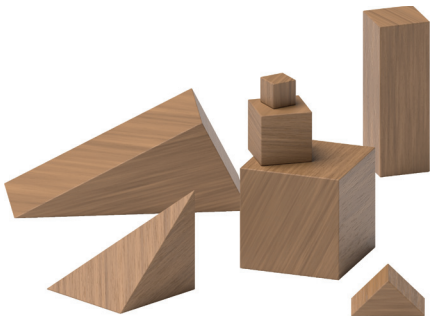
Activity 3

Centers: Choice Time

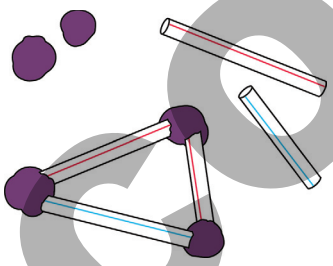
Choose a center.

Sec B

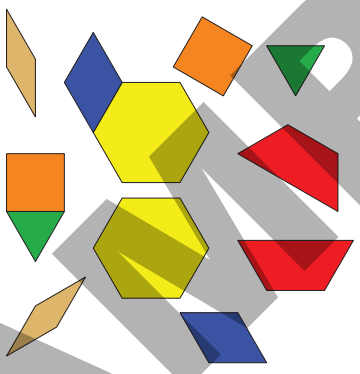
Geoblocks



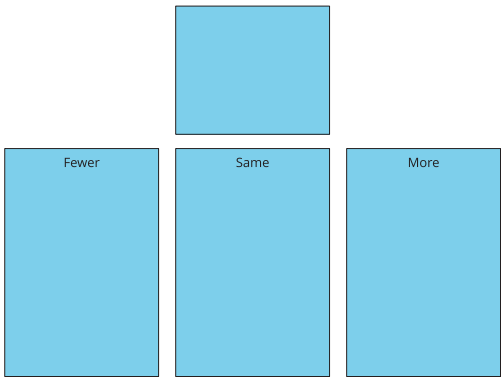
Build Shapes



Pattern Blocks



Fewer, Same, More



Unit 3, Lesson 13

Addressing CA CCSSM K.CC.4 and K.G.1; practicing MP3

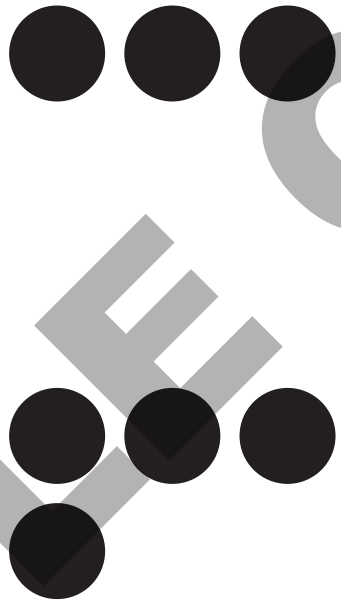
Describe and Match Shapes

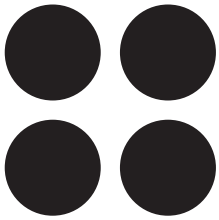
Let's build matching shapes.

Warm-up

How Many Do You See: Add On and Rearrange

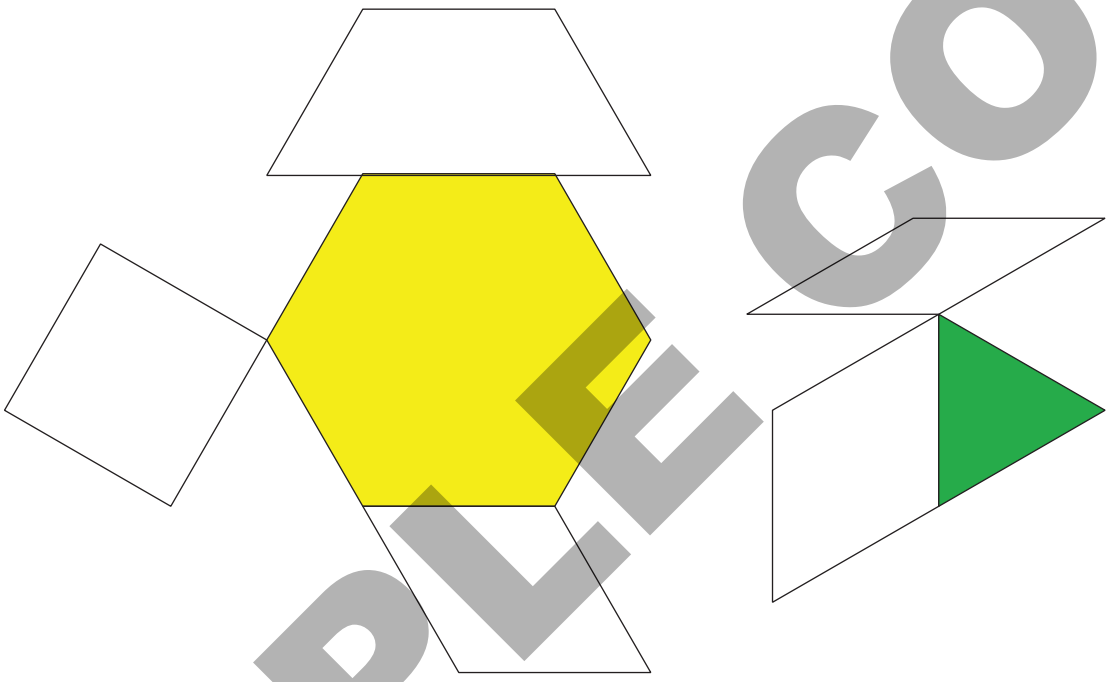
How many do you see?
How do you see them?



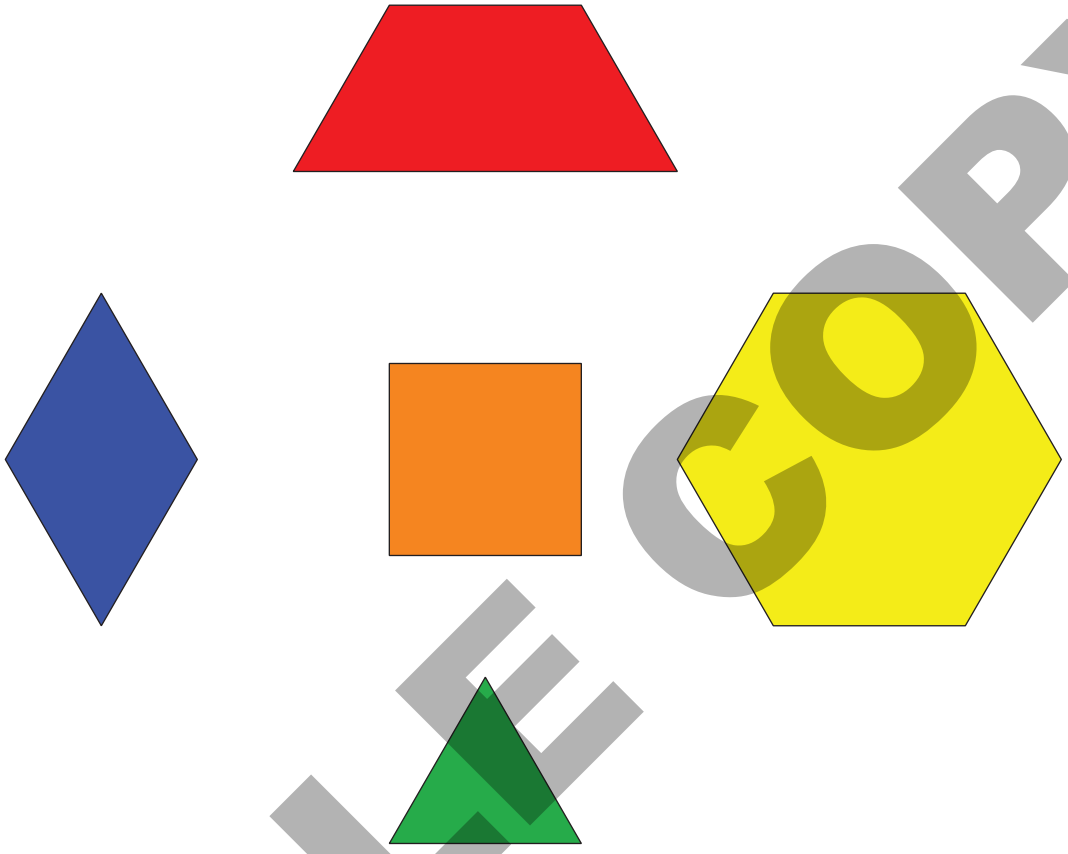


Activity 1

Where Are the Pattern Blocks?



Synthesis:



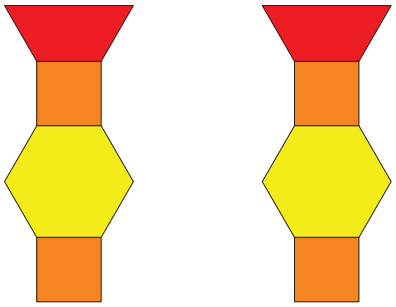
Activity 3

Centers: Choice Time

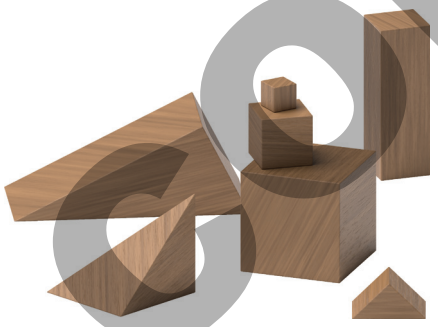
Choose a center.

Sec B

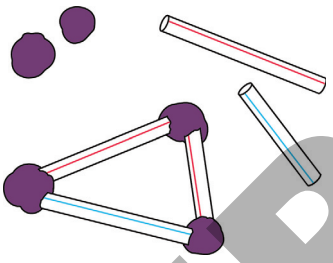
Match Mine



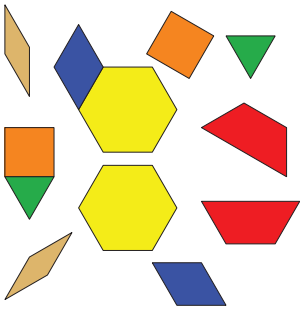
Geoblocks



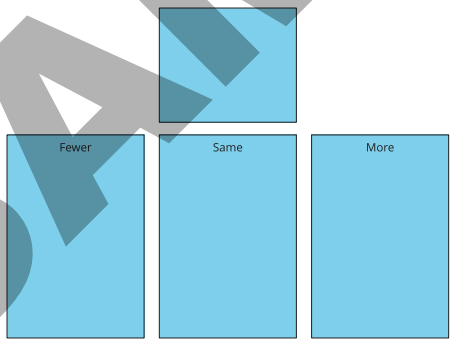
Build Shapes



Pattern Blocks



Fewer, Same, More



Unit 3, Lesson 14

Addressing CA CCSSM K.G.1-2 and K.G.6; practicing MP4

Shapes in Art

Let's learn about shapes in art.

Warm-up

Notice and Wonder: Shapes in Art

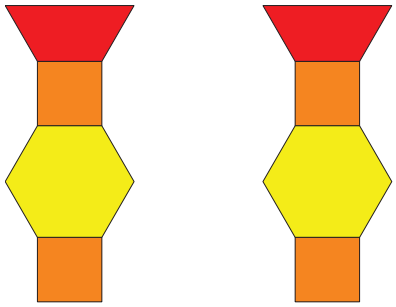
What do you notice?
What do you wonder?

Activity 3

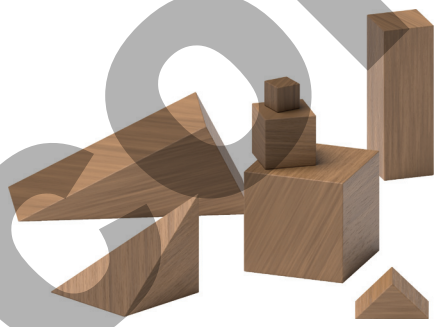
Centers: Choice Time

Choose a center.

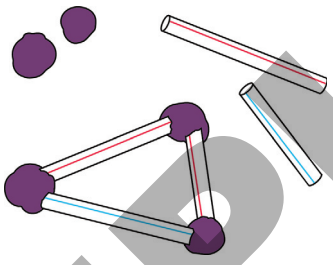
Match Mine



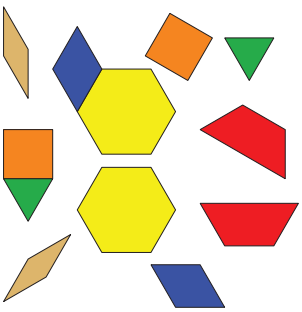
Geoblocks



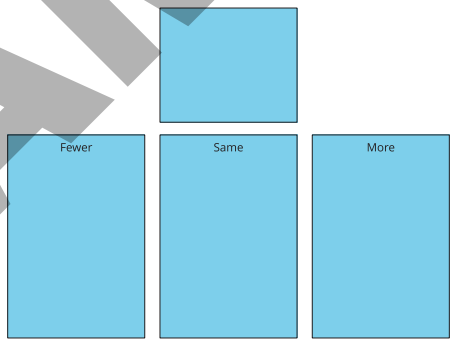
Build Shapes



Pattern Blocks



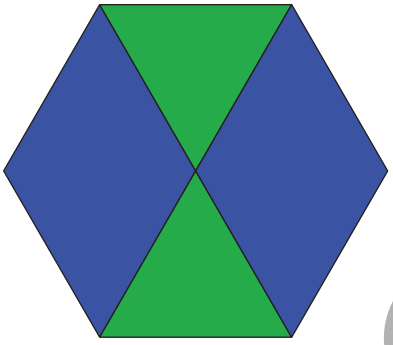
Fewer, Same, More

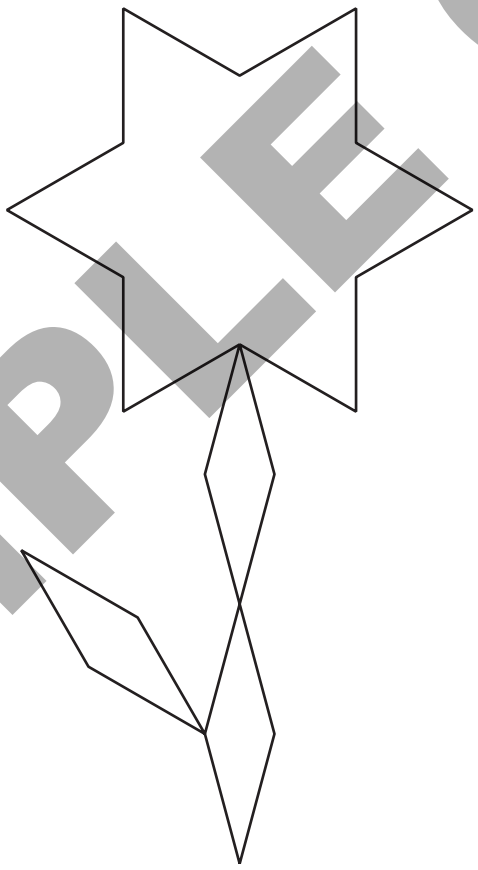


Section B Summary

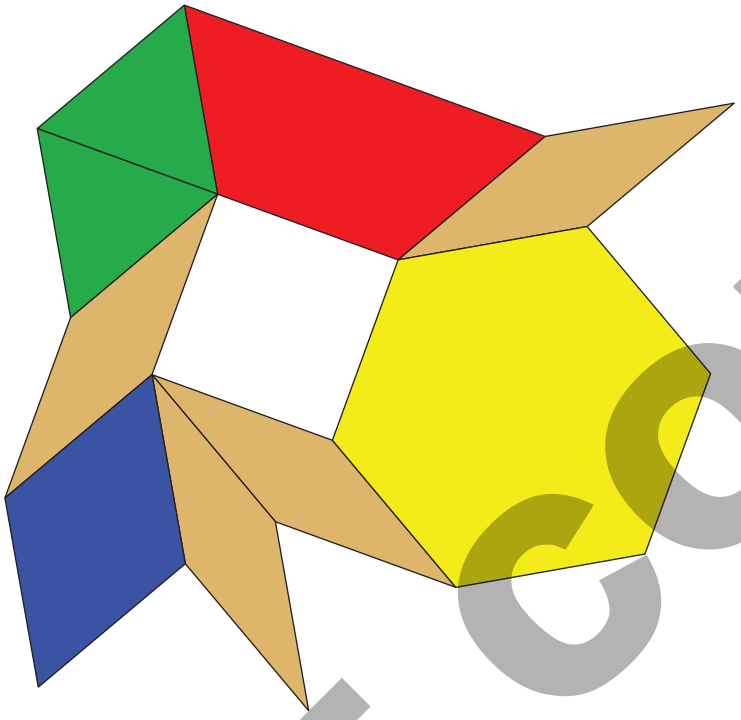
We can put shapes together to make larger shapes.

We can put shapes together to make different shapes.





A shape can look different if we move it.



The missing shape is a square. It looks different.

We can say, “above,” “below,” “beside,” and “next to” about shapes.

The green triangle is next to the red trapezoid.
The green triangle is above the blue rhombus.

Addressing CA CCSSM K.CC.5, K.CC.6, K.G.1-2, and K.G.4-6; building towards K.G.1-2 and K.G.6; practicing MP4

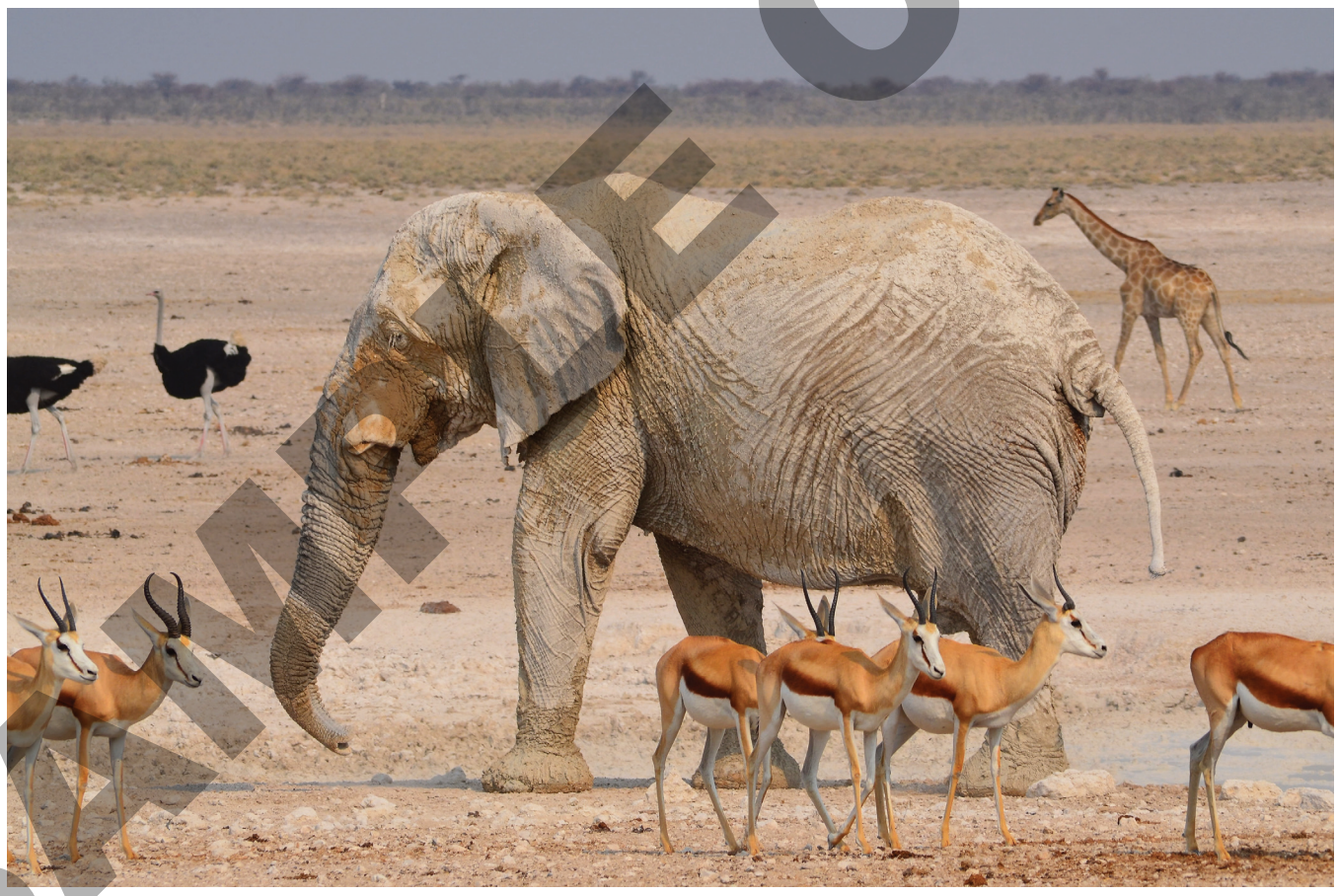
Animal Shape Stamp Art

Let's make animals out of shapes.

Warm-up

Notice and Wonder: Animals at the Watering Hole

What do you notice?
What do you wonder?



Activity 1

Make Animal Prints

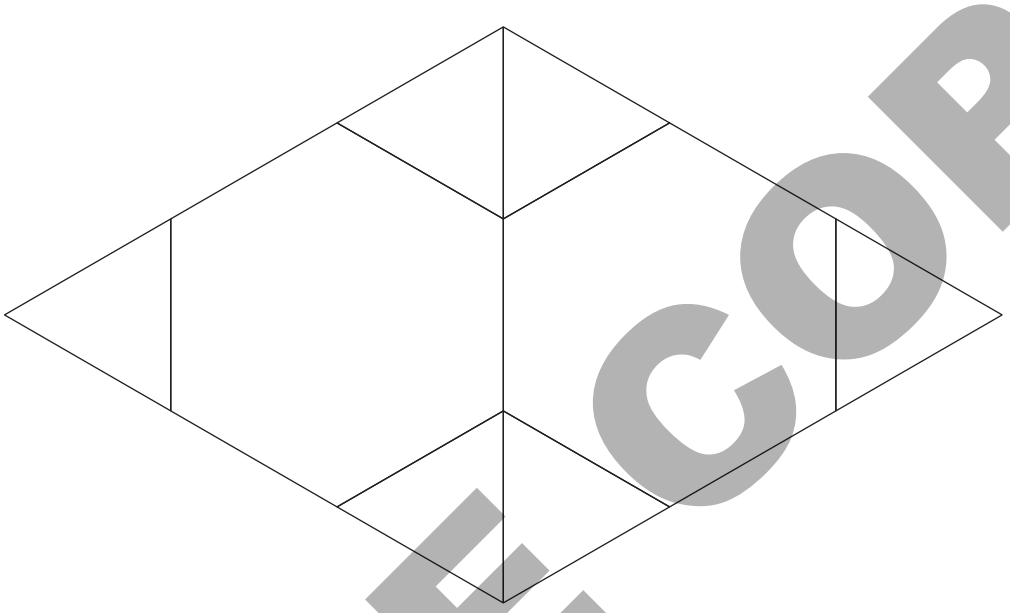
Make an animal with shape stamps.

Practice Problems

7 Problems

1 from Unit 3, Lesson 10

a. Fill in the pattern block puzzle.

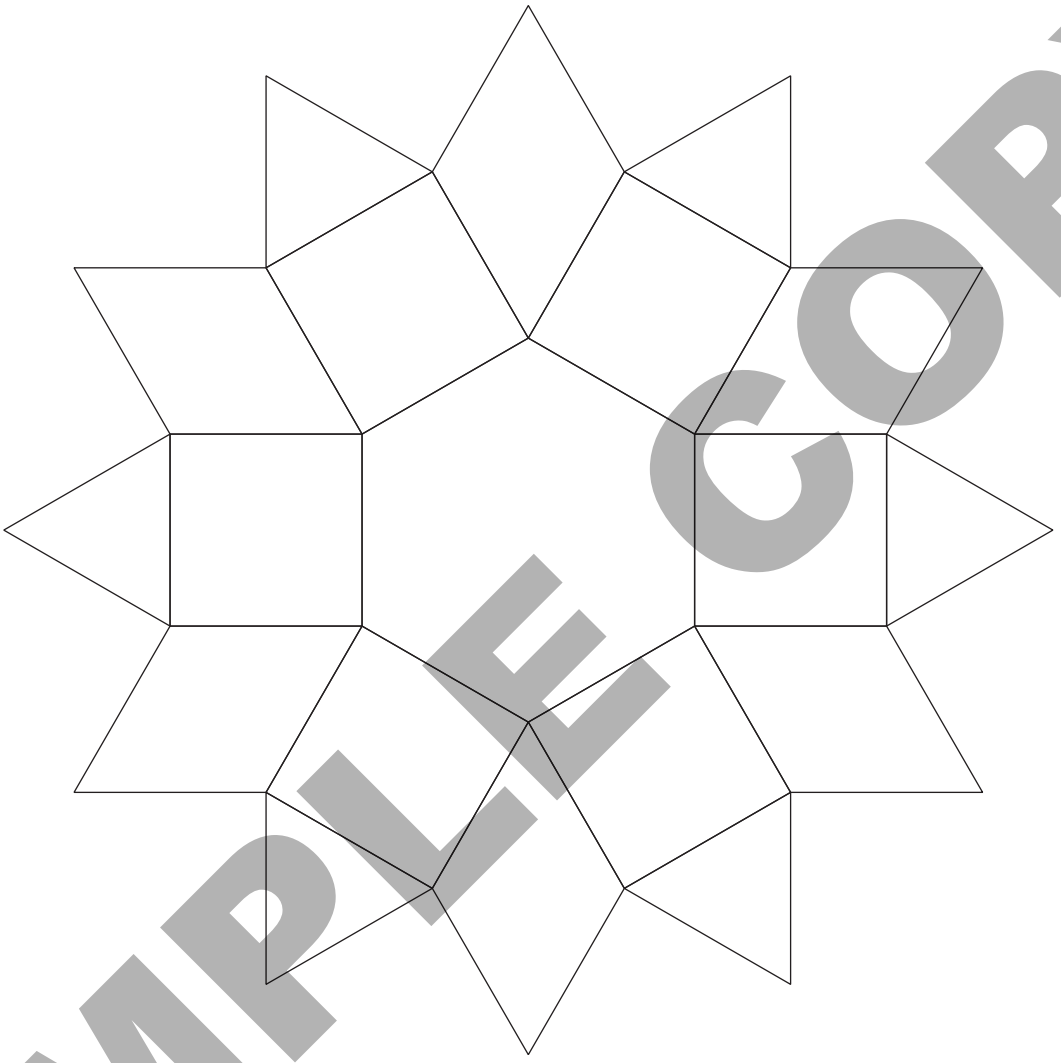


b. How many green triangles?

c. How many yellow hexagons?

2 from Unit 3, Lesson 11

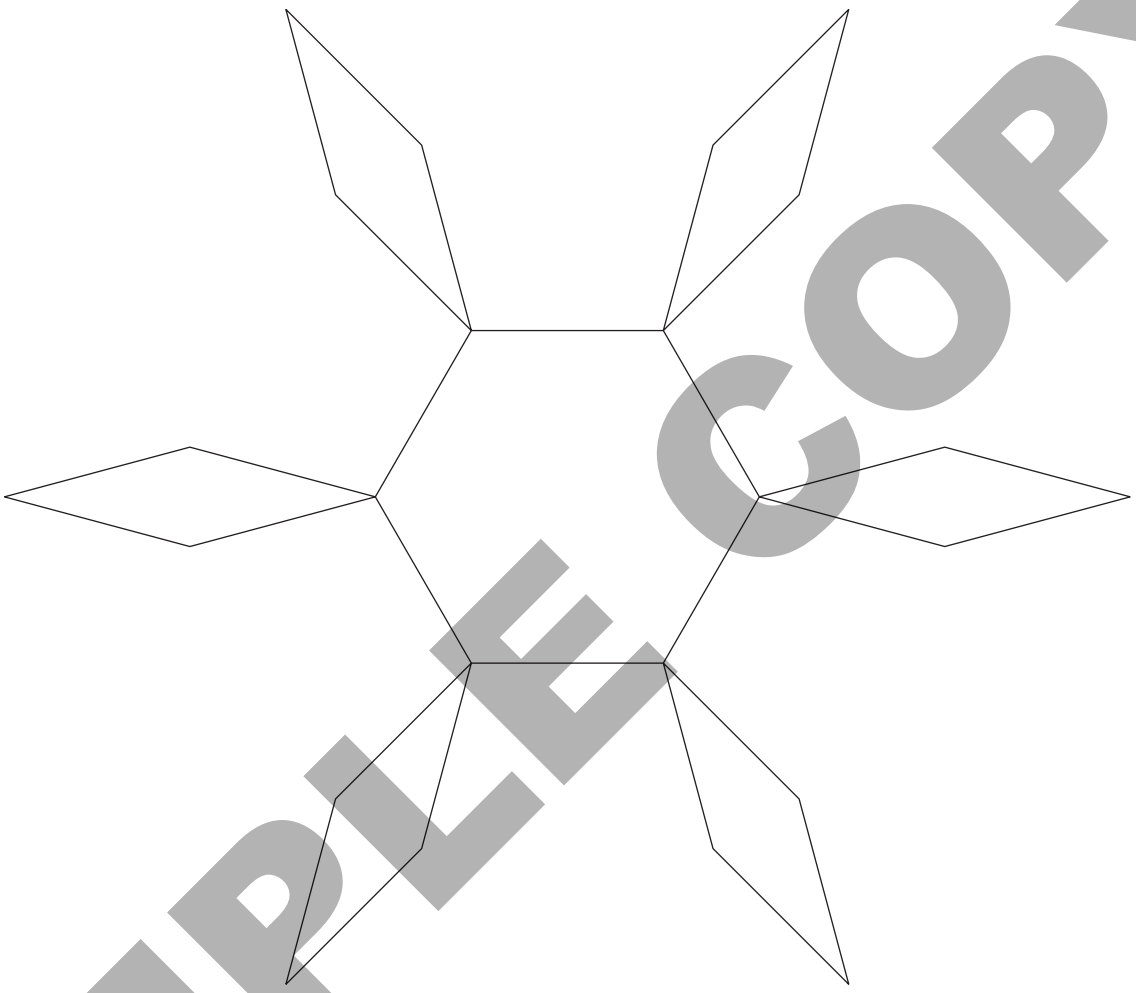
a. Color the squares.



b. How many squares did you color? _____

3 from Unit 3, Lesson 12

Fill in the puzzle.



Can you fill in the puzzle a different way?

4 from Unit 3, Lesson 13

a. Build a shape with 1 hexagon, 3 triangles, and 1 square.

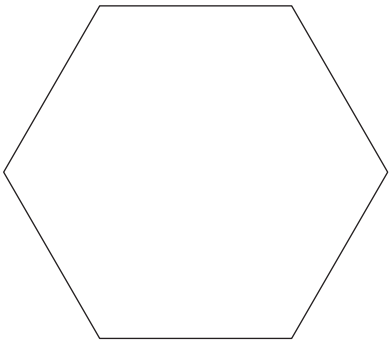
b. Where is the square?

5 from Unit 3, Lesson 14

What shapes do you see?

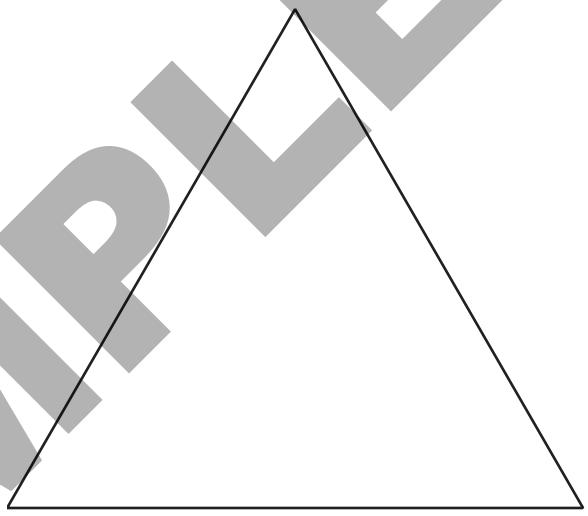
6 Exploration

How many ways can you do the puzzle?



7 Exploration

a. Fill in the puzzle in different ways.



b. Jada used 9 pattern blocks.
   Which shapes did Jada use?
c. Can you fill in the puzzle with 3 pattern blocks?

KINDERGARTEN

UNIT

Understanding Addition and Subtraction

Content Connections

In this unit you will use counting skills to solve addition and subtraction story problems. You will make connections by:

- **Taking Wholes Apart, Putting Parts Together** while making 10, add and subtract within 10, and using fingers, manipulatives, and other models to represent story problems.

- **Exploring Changing Quantities** while using previously learned counting skills to add to or take away from to find the total.
- **Reasoning with Data** while comparing expressions and the use of pictures and other representations to solve story problems.

Addressing the Standards

As you work your way through **Unit 4 Understanding Addition and Subtraction,** you will use some mathematical practices that you may have started using in kindergarten and have continued strengthening over your school career. These practices describe types of thinking or behaviors that you might use to solve specific math problems.

Mathematical Practices	Where You Use these MPs
MP1 Make sense of problems and persevere in solving them.	Lesson 7
MP2 Reason abstractly and quantitatively.	Lesson 9, 10, 11, 12, 14, 16
MP3 Construct viable arguments and critique the reasoning of others.	
MP4 Model with mathematics.	Lesson 13, 18
MP5 Use appropriate tools strategically.	Lesson 4, 8

Mathematical Practices	Where You Use these MPs
MP6 Attend to precision.	Lesson 1, 2, 3, 5, 6, 7, 10
MP7 Look for and make use of structure.	Lesson 15, 17
MP8 Look for and express regularity in repeated reasoning.	Lesson 17

The California Common Core State Standards for Mathematics (CA CCSSM) describe the topics you will learn in this unit. Many of these topics build upon knowledge you already have and challenge you to expand upon that knowledge. The table below shows what standards are being addressed in this unit.

Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Being Flexible within 10 • Model with Numbers	**K.OA.1** Represent addition and subtraction with objects, fingers, mental images, drawings,2 sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.	Lesson 1, 2, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, and 18

Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Being Flexible within 10 • Model with Numbers	**K.OA.2** Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.	Lesson 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, and 18
• How Many?	**K.CC.1** Count to 100 by ones and by tens.	Lesson 3, 12, and 18
• How Many?	**K.CC.2** Count forward beginning from a given number within the known sequence (instead of having to begin at 1).	Lesson 14 and 18
• How Many? • Place and position of numbers	**K.CC.3** Write numbers from 0 to 20. Represent a number of objects with a written numeral 0–20 (with 0 representing a count of no objects).	Lesson 9, 13, 15, and 17

Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Sort and Describe Data • How Many? • Bigger or Equal?	**K.CC.4** Understand the relationship between numbers and quantities; connect counting to cardinality. a. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted. c. Understand that each successive number name refers to a quantity that is one larger.	Lesson 5 and 9

Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Sort and Describe Data • How Many? • Bigger or Equal?	**K.CC.4c** Understand the relationship between numbers and quantities; connect counting to cardinality. c. Understand that each successive number name refers to a quantity that is one larger.	Lesson 17
• Sort and Describe Data • How Many? • Bigger or Equal?	**K.CC.5** Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.	Lesson 1, 2, 3, 4, 5, 6, 7, 9, 10, and 13

Unit 4, Lesson 1

Addressing CA CCSSM K.CC.5 and K.OA.1; building towards K.OA.2; practicing MP6

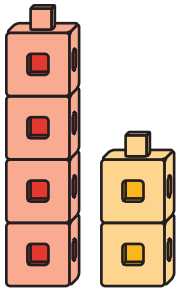
Count 2 Groups of Objects

Let's count objects in 2 groups.

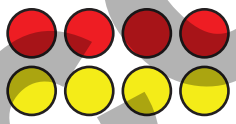
Which Three Go Together: Groups

Which 3 go together?

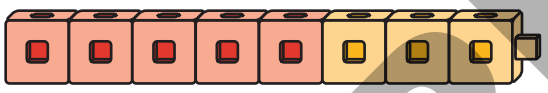
A



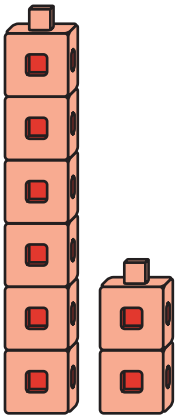
B



C



D



Activity 1

Put Together Pattern Blocks

How many do you have?

I have _____ pattern blocks.

Activity 2

Put Together Connecting Cubes

How many cubes do you have?

We have _____ cubes.

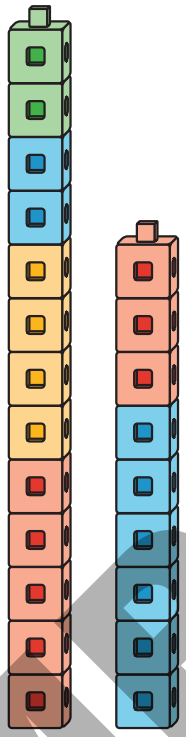
We have _____ cubes.

Activity 3

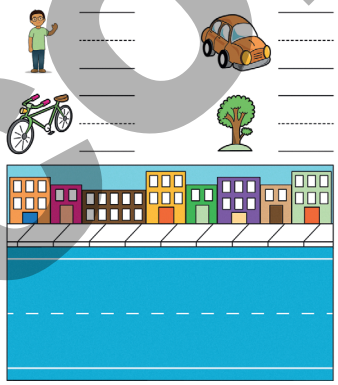
Introduce Tower Build—Count and Build to 10

Choose a center.

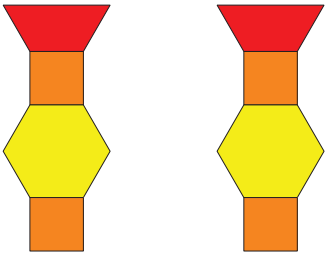
Tower Build



Math Libs



Match Mine



Addressing CA CCSSM K.CC.5 and K.OA.1; building towards K.OA.2; practicing MP6

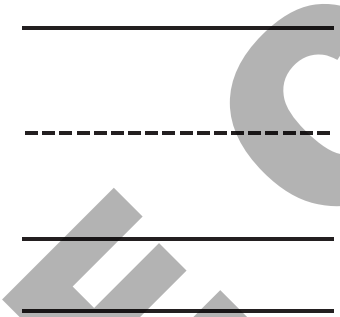
Count 2 Groups of Images

Let's count things in 2 groups.

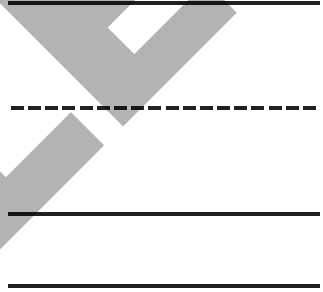
Activity 1

Put Together Dots on 5-Frames

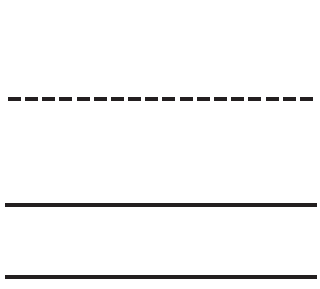
There are _____ dots.



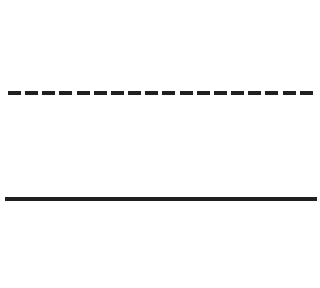
There are _____ dots.



There are _____ dots.



There are _____ dots.

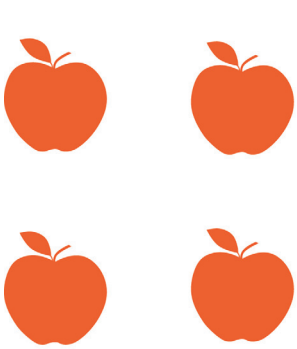


There are _____ dots.

Activity 2

How Many Apples?

1.

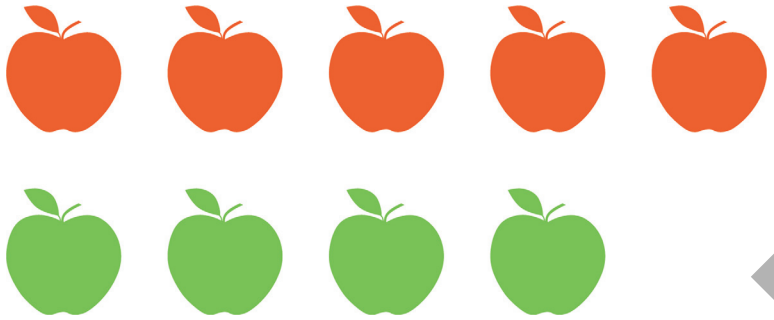


There are _____ apples.

2.

There are _____ apples.

3.



There are _____ apples.

4.

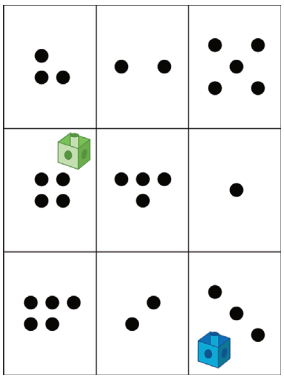
There are _____ apples.

Activity 3

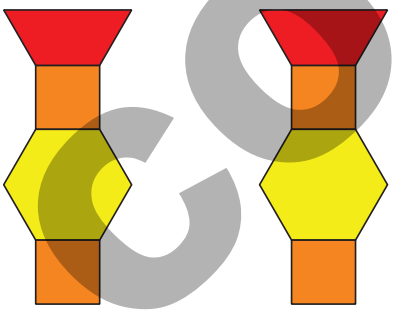
Introduce Roll and Add—Dots

Choose a center.

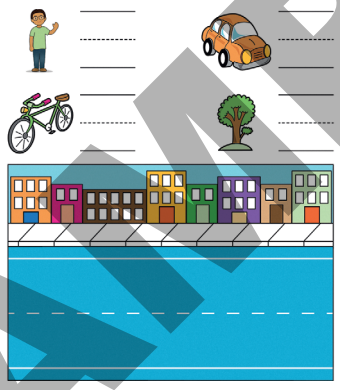
Roll and Add



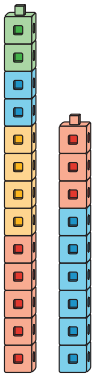
Match Mine



Math Libs



Tower Build



Unit 4, Lesson 3

Addressing CA CCSSM K.CC.1 and K.CC.5; practicing MP6

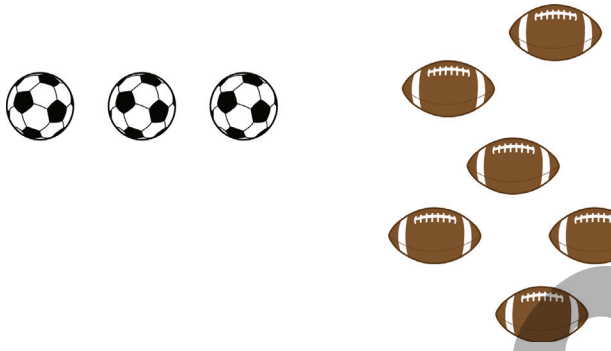
Count 2 Groups of Scattered Images

Let's count things in 2 groups.

Activity 1

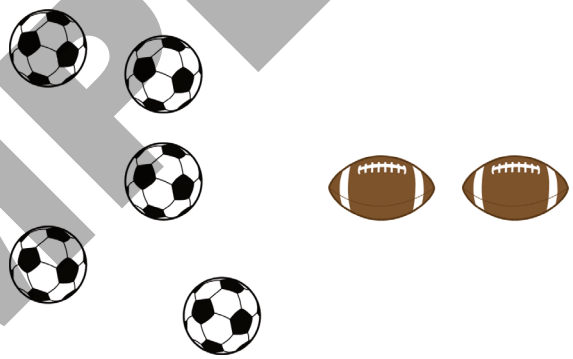
Count Organized and Scattered Images

1.



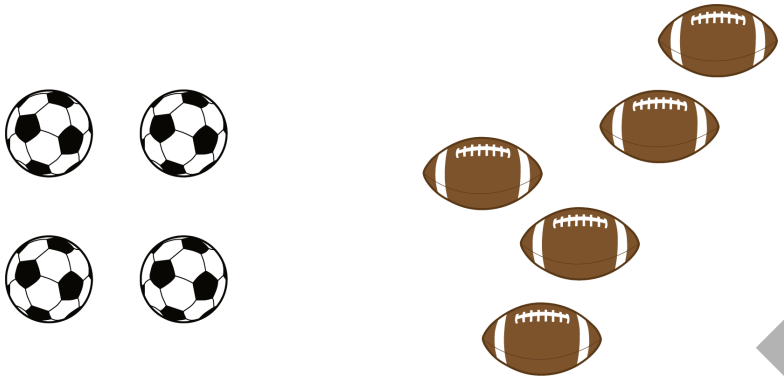
There are _____ balls.

2.



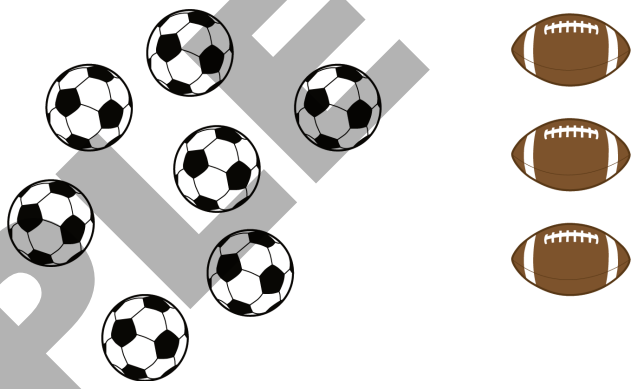
There are _____ balls.

3.



There are _____ balls.

4.

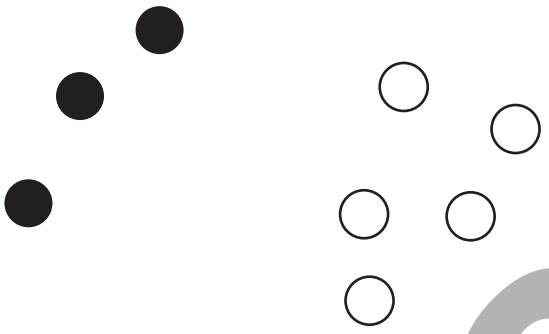


There are _____ balls.

Activity 2

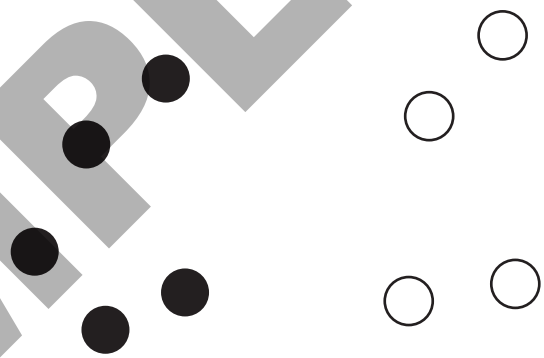
Count Scattered Images

1.



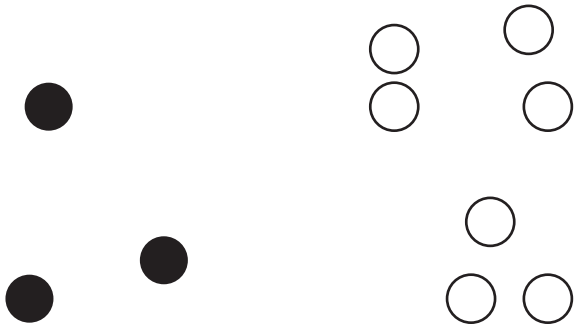
There are _____ circles.

2.



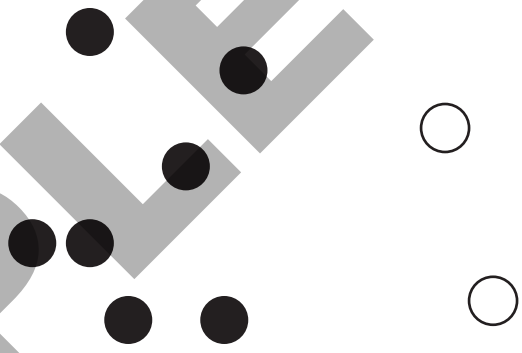
There are _____ circles.

3.



There are _____ circles.

4.



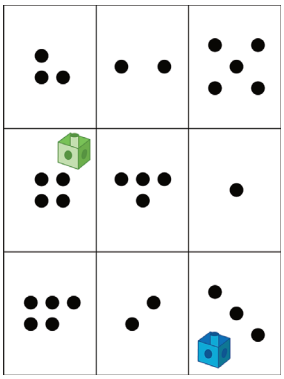
There are _____ circles.

Activity 3

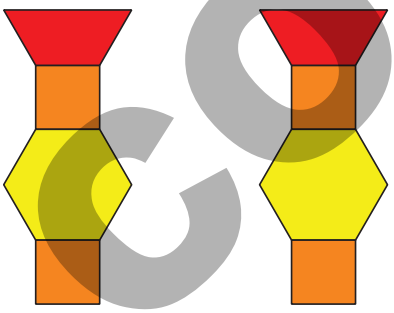
Centers: Choice Time

Choose a center.

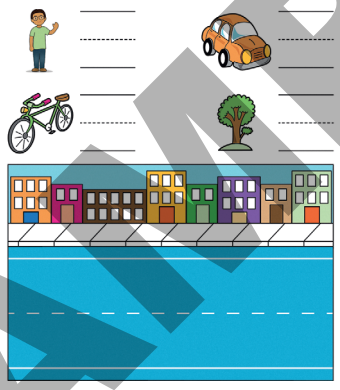
Roll and Add



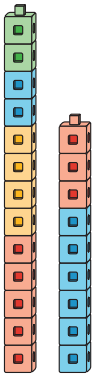
Match Mine



Math Libs



Tower Build



Addressing CA CCSSM K.CC.5 and K.OA.1; building towards K.OA.2; practicing MP5

Add with Objects

Let's use counters to add.

Activity 1

Add Counters

1. Count 2 counters.
   Add 2 more.

   _____

   There are _____ counters.

2. Count 5 counters.
   Add 3 more.

   _____

   There are _____ counters.

3. Count 2 counters.
   Add 4 more.

   There are _____ counters.

4. Count 6 counters.
   Add 3 more.

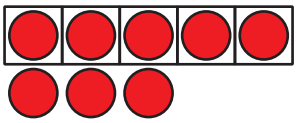
   There are _____ counters.

Activity 3

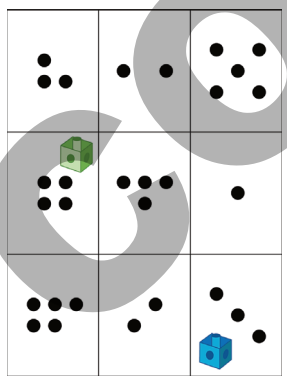
Centers: Choice Time

Choose a center.

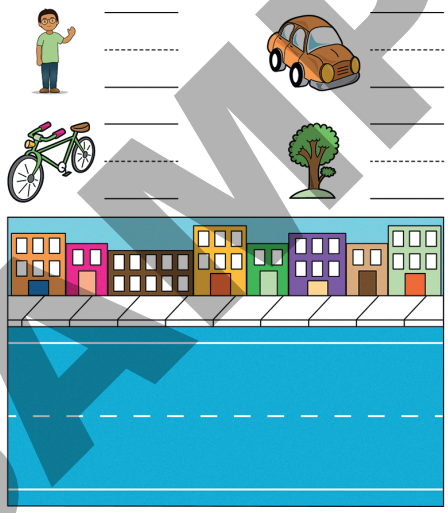
5-Frames



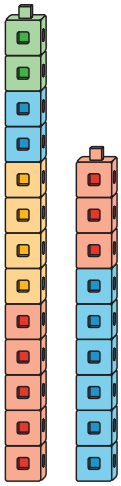
Roll and Add



Math Libs



Tower Build



Unit 4, Lesson 5

Addressing CA CCSSM K.CC.4-5 and K.OA.1; practicing MP6

Sec A

Subtract with Objects

Let's subtract with counters.

Warm-up

How Many Do You See: Subtraction

How many do you see?
How do you see them?

Activity 1

Subtract Counters

1. Count 8 counters.
   Take away 3.

   _____

   There are _____ counters left.

2. Count 10 counters.
   Take away 6.

   _____

   There are _____ counters left.

3. Count 7 counters.
   Take away 1.

   There are _____ counters left.

4. Count 9 counters.
   Take away 3.

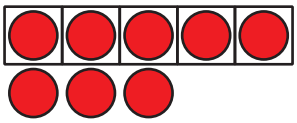
   There are _____ counters left.

Activity 3

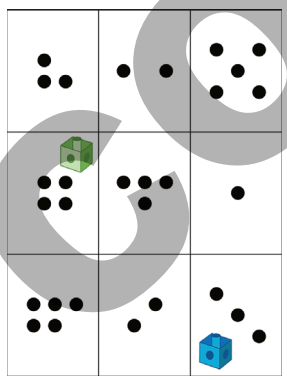
Centers: Choice Time

Choose a center.

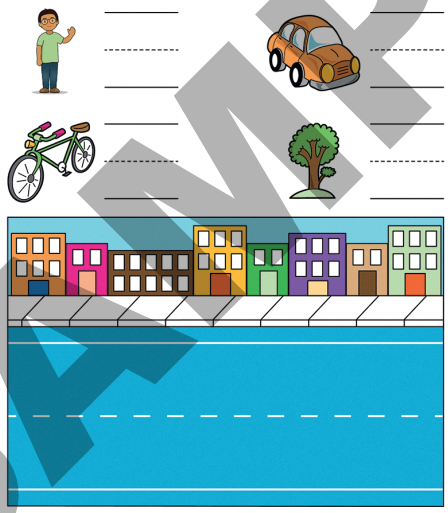
5-Frames



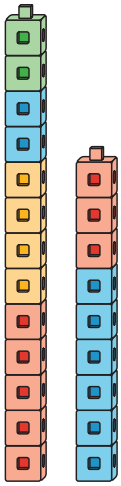
Roll and Add



Math Libs



Tower Build



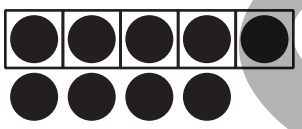
Section A Summary

We can put 2 groups together.

3 yellow counters and 4 red counters is 7 counters.

3 and 4 is 7.

We added things.



There are 5 counters on the 5-frame.
Add 4 more.

5 and 4 is 9.

We subtracted.

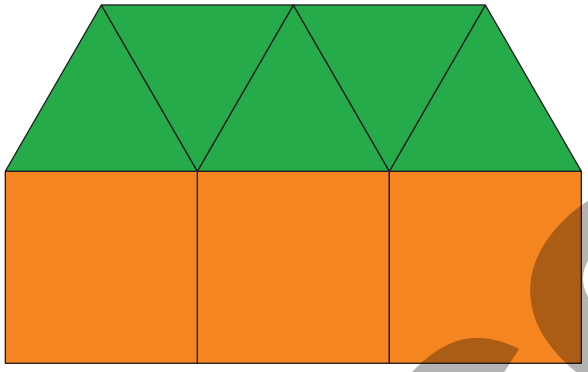
There are 5 counters on the 5-frame.
Take away 2.

5 take away 2 is 3.

Practice Problems

7 Problems

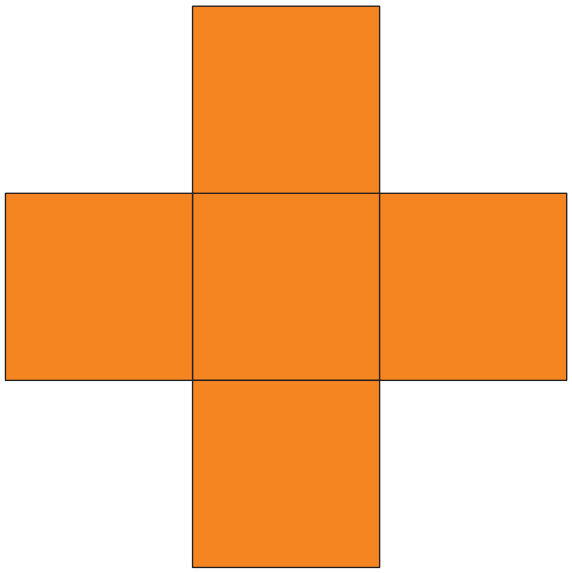
1 from Unit 4, Lesson 2

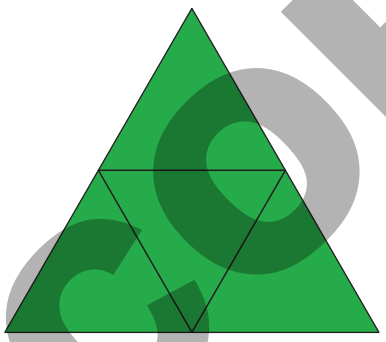


There are _____ squares.

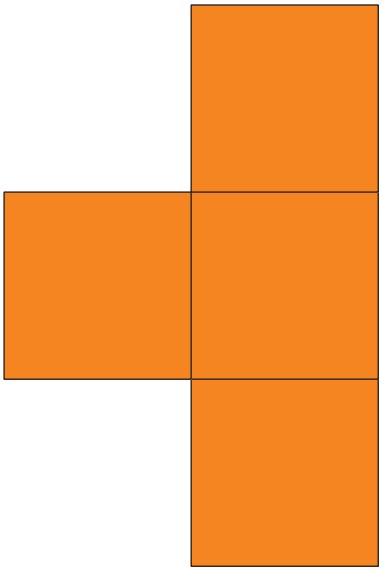
There are _____ triangles.

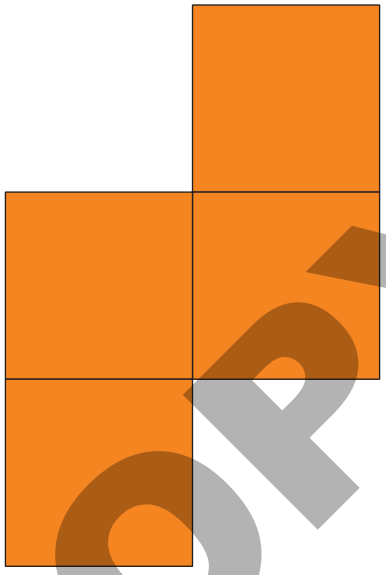
There are _____ shapes.



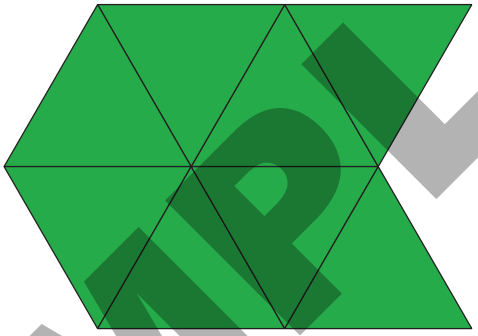


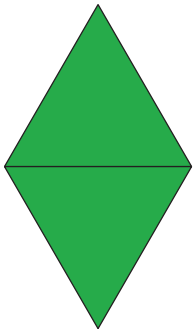
There are _____ shapes.





There are _____ squares.



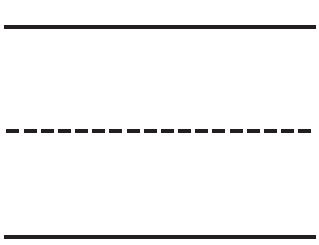


There are _____ triangles.

3 from Unit 4, Lesson 4

Sec A

Count 6 counters.
Add 1 more.



There are _____ counters.

Count 4 counters.
Add 1 more.

There are _____ counters.

Count 8 counters.
Add 1 more.

There are _____ counters.

4 from Unit 4, Lesson 5

Count 8 counters.
Take away 2.

_____

There are _____ counters.

Count 6 counters.
Take away 2.

_____

There are _____ counters.

Count 4 counters.
Take away 2.

There are _____ counters.

_____

5 Exploration

Use a full 5-frame.
Player 1: roll a cube on the number mat.
Take away or add counters while Player 2 is not looking.
Player 2 finds out what Player 1 did.
Take turns.

6 Exploration

Roll a cube.
Count that many counters.
Roll a cube again.
Count that many counters.
How many do you have now?

7 Exploration

Pick a number from the list.

2 7 6 3

Solve the problem you made.

Count 8 counters.

Take away _____ counters.

How many are left?

Try again.
Will your answer be the same or different? Why?

Unit 4, Lesson 6

Addressing CA CCSSM K.CC.5 and K.OA.1-2; building towards K.OA.1; practicing MP6

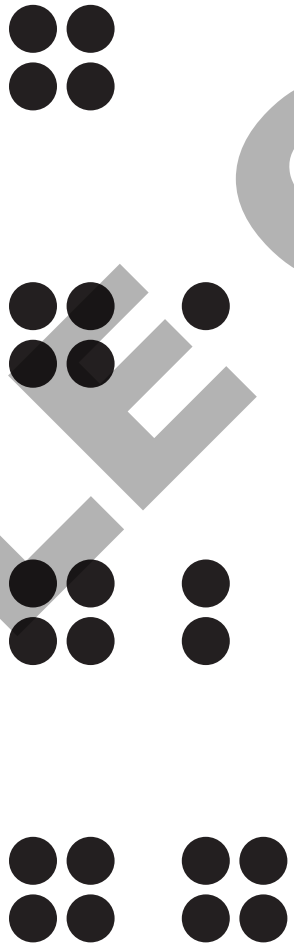
Tell and Act Out Stories

Let's tell and act out stories.

Warm-up

How Many Do You See: Add To

How many do you see?
How do you see them?



Activity 1

What is Happening?

Activity 2

Act Out a Story

1. 4 students jump rope.
   2 more come.

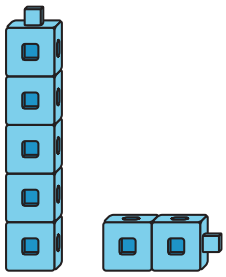
2. 6 students play soccer.
   3 go inside.

Activity 3

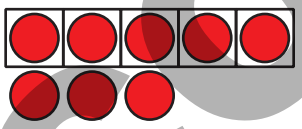
Introduce Subtraction Towers—Objects

Choose a center.

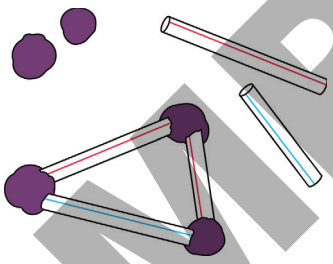
Subtraction Towers



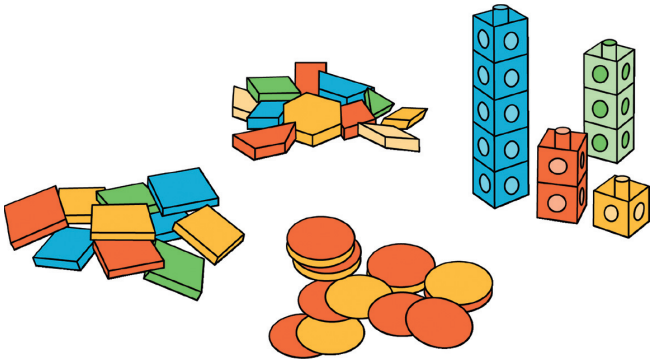
5-Frames



Build Shapes



Counting Collections



Addressing CA CCSSM K.CC.5 and K.OA.1-2; building towards K.OA.1; practicing MP1 and MP6

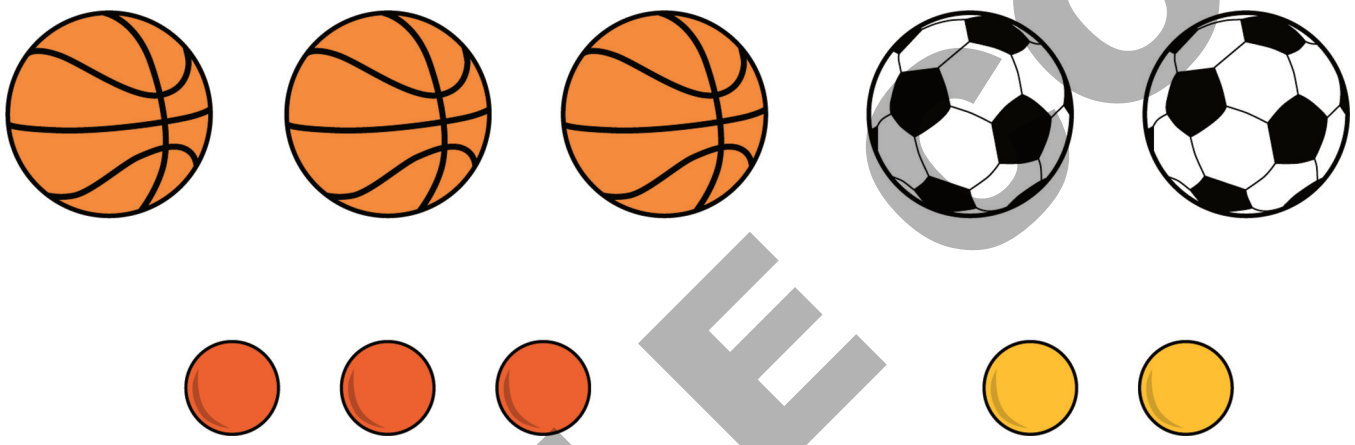
Use Objects to Represent Stories

Let's use objects to show a story.

Warm-up

Notice and Wonder: Balls and Counters

What do you notice?
What do you wonder?



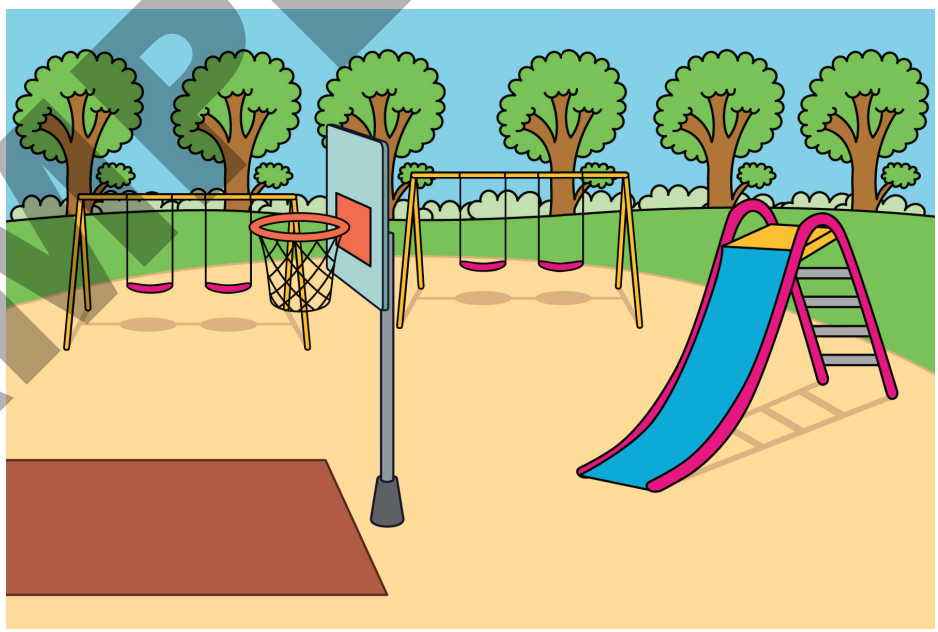
Activity 1

Playing on the Playground

1. 5 students play basketball at recess.
   2 students go inside to get water.

2. 3 students play on the swings at recess.
   1 more student comes to play on the swings.

3. 5 students play tag at recess.
   4 students go inside.



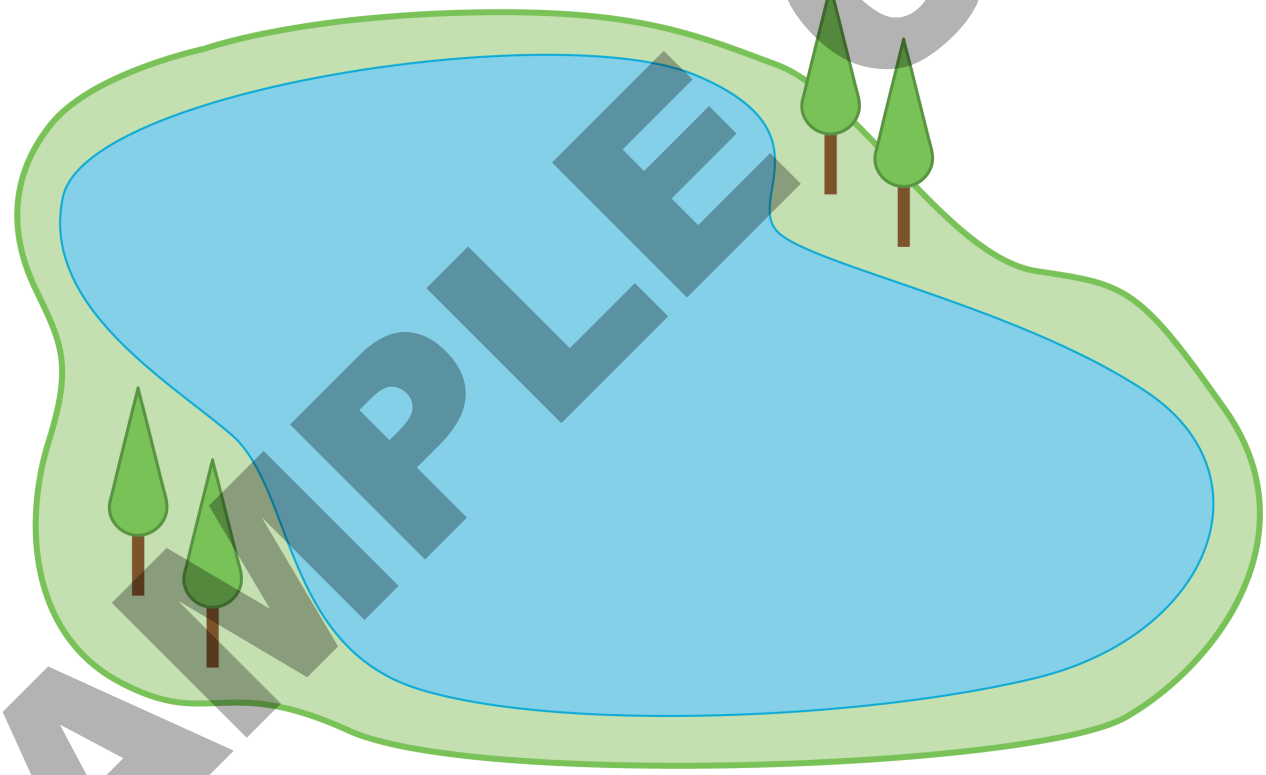
Activity 2

Finish the Story

1. 7 kids play on the field.

2. 2 kids eat.

3. 4 ducks swim.



4. 5 kids play.

Activity 3

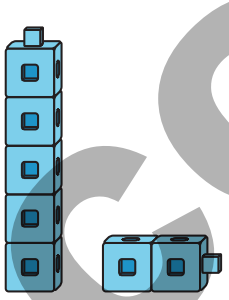
Introduce Math Stories—Act It Out

Choose a center.

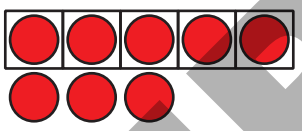
Sec B

Math Stories

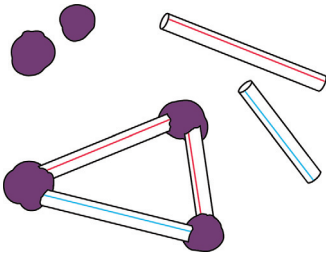
Subtraction Towers



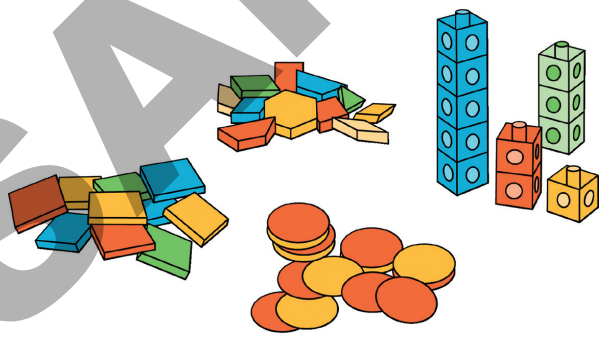
5-Frames



Build Shapes



Counting Collections



Unit 4, Lesson 8

Addressing CA CCSSM K.OA.1-2; building towards K.OA.1-2; practicing MP5

Represent and Solve Story Problems

Let's show what happens in a story problem and solve it.

Warm-up

Act It Out: Birds in a Fountain

8 birds were splashing in the fountain.

3 of the birds flew away.

Act out this story.

Activity 1

Questionless Story Problems

1. 8 birds were splashing in the fountain.
   3 of the birds flew away.

2. Priya planted 6 flowers in the neighborhood garden at the park.
   Diego planted 3 more flowers in the garden.

Activity 2

From a Story to a Story Problem

Noah had 5 crayons.

Jada gave him 4 more.

How many crayons does Noah have now?

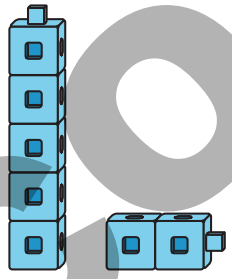
Activity 3

Centers: Choice Time

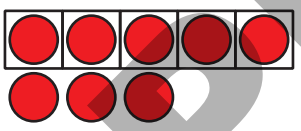
Choose a center.

Math Stories

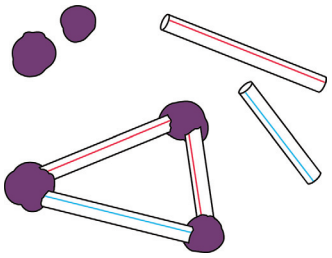
Subtraction Towers



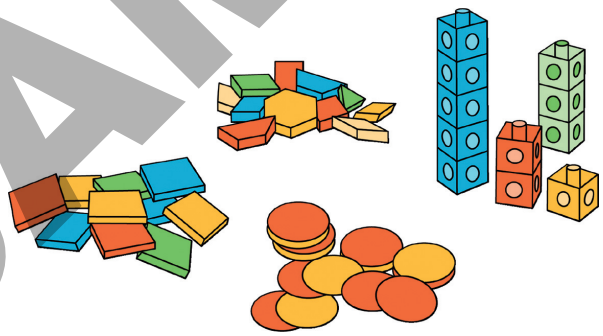
5-Frames



Build Shapes



Counting Collections



Addressing CA CCSSM K.CC.3, K.CC.4-5, and KOA.1-2; practicing MP2

Solve Story Problems

Let's solve story problems.

Warm-up

How Many Do You See: Finger Addition

How many fingers?
How do you see them?





Activity 1

Markers at School

There were 4 markers at school.
Elena brought 3 more markers to school.
How many markers are at school now?

Sec B

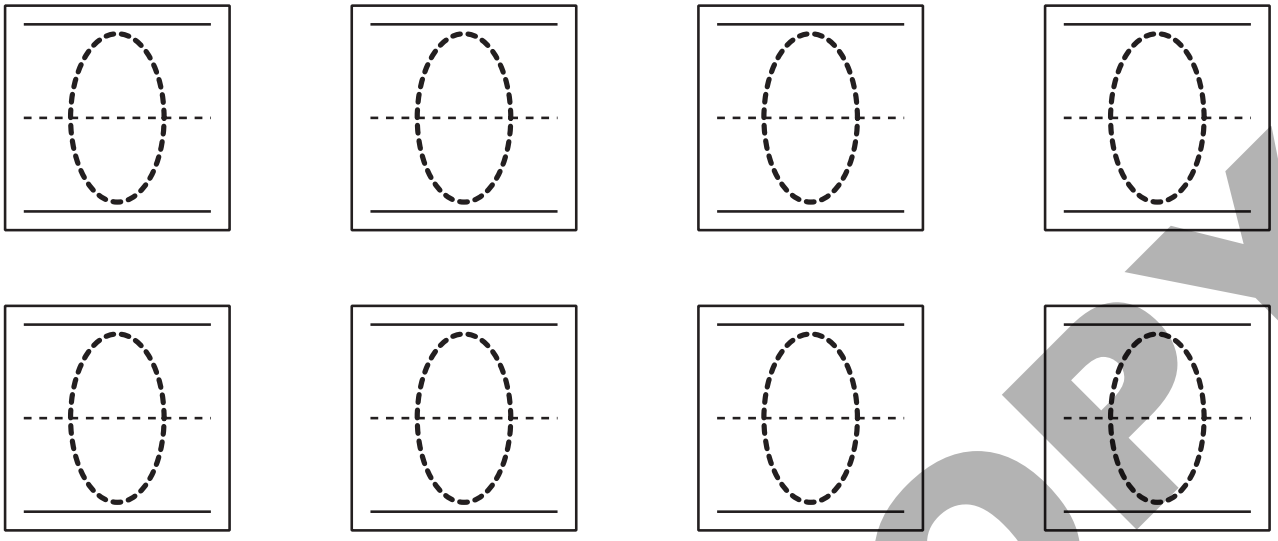
Activity 2

Balls at Recess

There are 5 balls on the playground.
Diego brought 5 inside.
How many now?

_____

_____



Unit 4, Lesson 10

Addressing CA CCSSM K.CC.5 and K.OA.1-2; practicing MP2 and MP6

Compare Drawings

Let's draw a story problem.

Sec B

Activity 1

Apple Slices for a Picnic

There are 3 apple slices at the picnic.

Tyler brought 5 more.

How many now?

_____

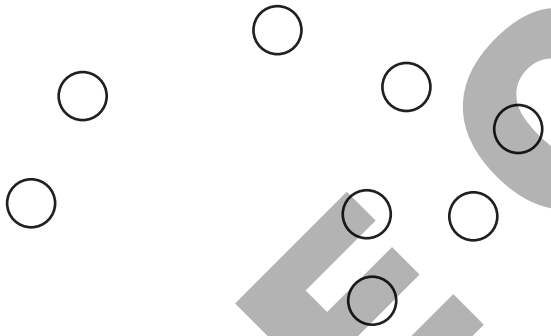
_____

Activity 2

Compare Drawings

Andre and Noah draw pictures.

Andre



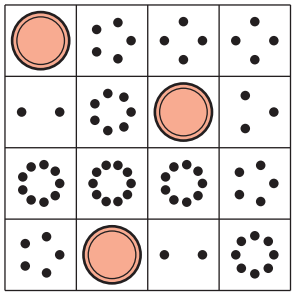
Noah

Activity 3

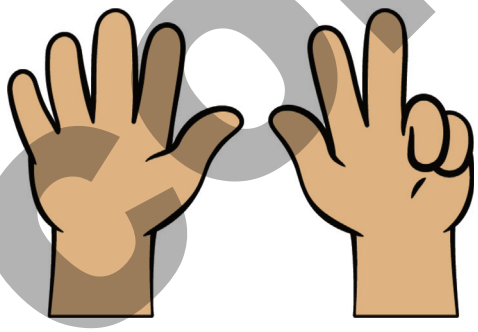
Introduce Bingo—Add and Cover

Choose a center.

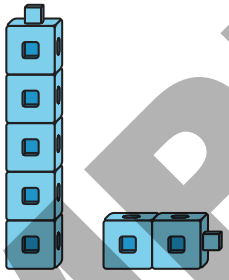
Bingo



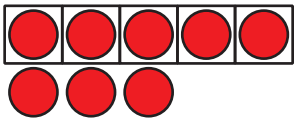
Math Fingers



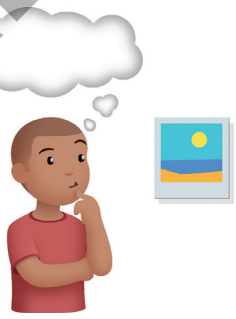
Subtraction Towers



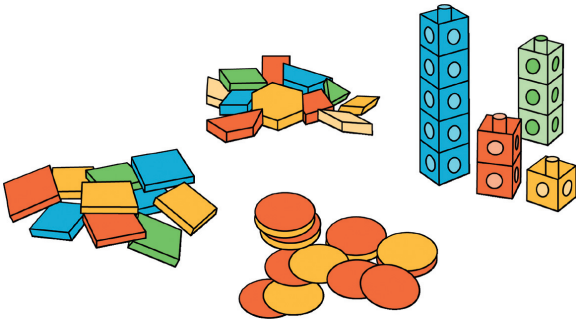
5-Frames



Math Stories



Counting Collections



Unit 4, Lesson 11

Addressing CA CCSSM K.OA.2; building towards K.OA.2; practicing MP2

Drawings to Represent Story Problems

Let's draw a picture of a story problem.

Warm-up

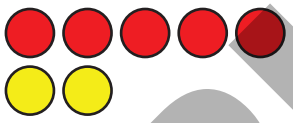
Which Three Go Together: Butterflies

Which 3 go together?

A

B

C



D

Activity 1

Draw a Picture

7 kids play soccer in the park.
3 kids leave to go play on the swings.
How many now?

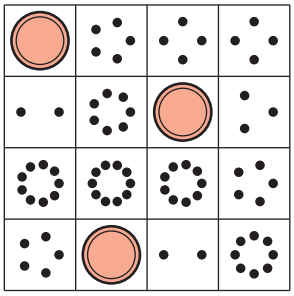
Activity 3

Centers: Choice Time

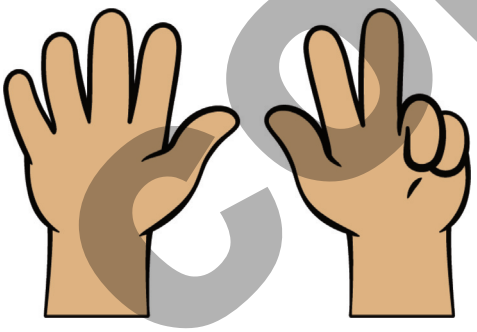
Choose a center.

Sec B

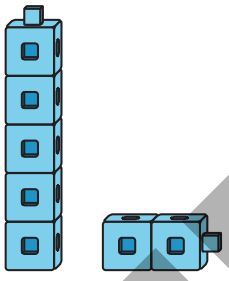
Bingo



Math Fingers



Subtraction Towers



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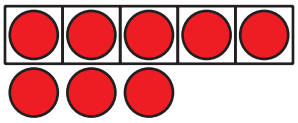
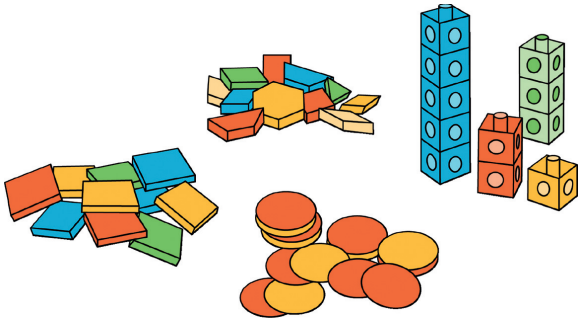


Math Stories

Counting Collections



Unit 4, Lesson 12

Addressing CA CCSSM K.CC.1 and K.OA.1-2; practicing MP2

Compare Addition and Subtraction Story Problems

Let's find out what's the same and what's different.

Activity 1

Ducks in the Pond

5 ducks swim in the pond.
4 more come.
How many now?

_____

_____

Activity 2

Ducks Swim Ashore

9 ducks swim in the pond.
4 ducks leave.
How many now?

_____

_____

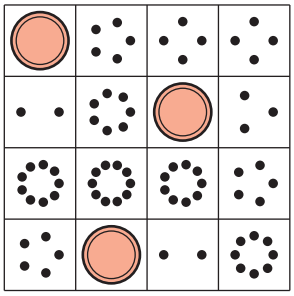
Activity 3

Centers: Choice Time

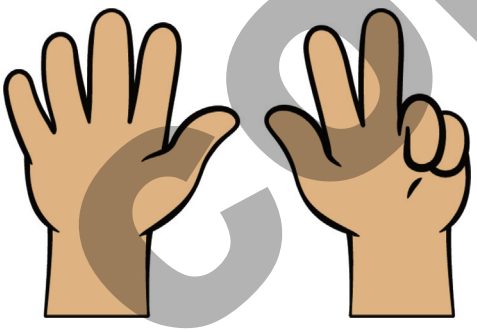
Choose a center.

Sec B

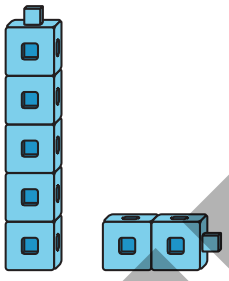
Bingo



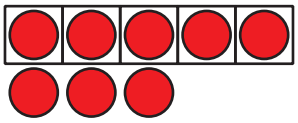
Math Fingers



Subtraction Towers

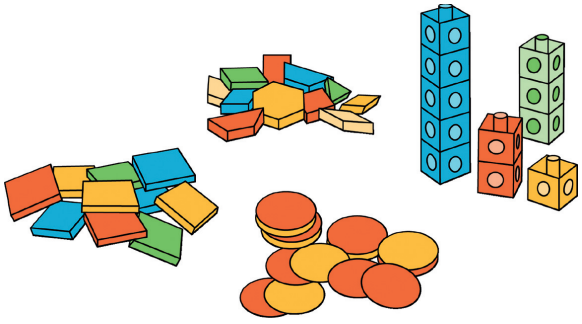


5-Frames



Math Stories

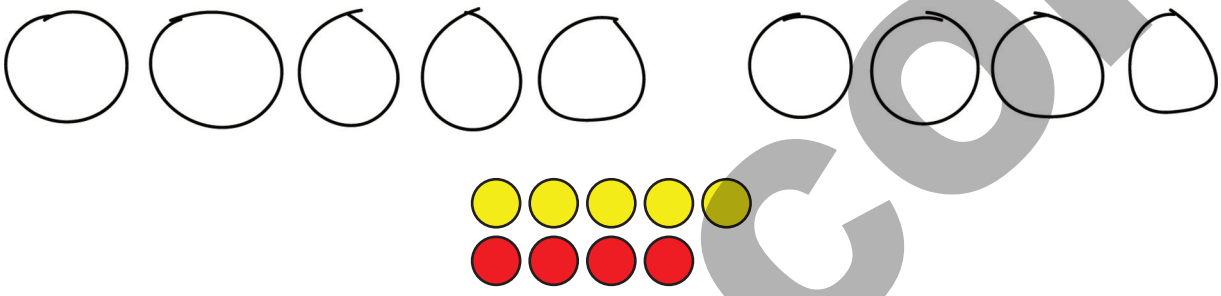
Counting Collections



Section B Summary

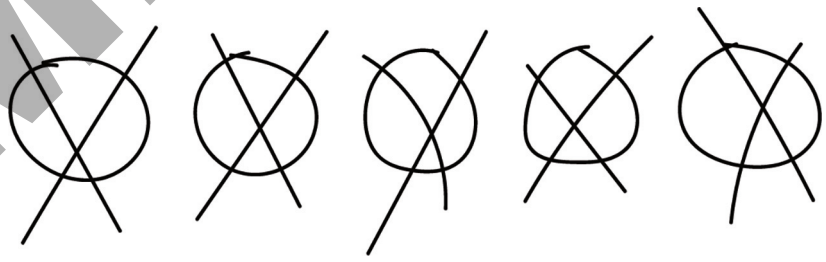
We can act out story problems and draw pictures.

There are 5 ducks swimming in the pond.
4 more come.
How many now?



We can subtract.

There are 5 balls on the playground.
Diego brought 5 inside.
How many now?



Unit 4, Lesson 13

Addressing CA CCSSM K.CC.3, K.CC.5, and K.OA.1-2; practicing MP4

Create Story Problems

Let's make story problems.

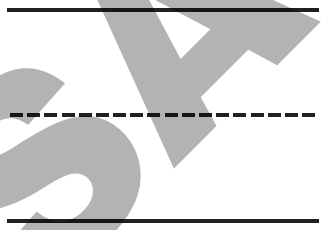
Sec B

Activity 1

Create a Story Problem

Activity 2

Switch the Operation

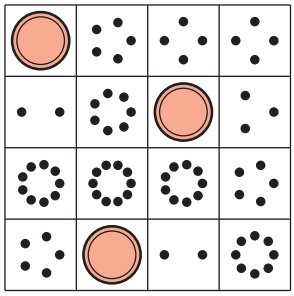


Activity 3

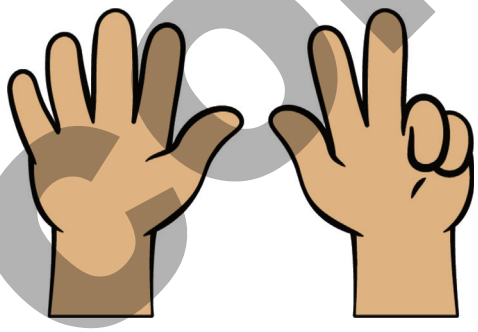
Revisit Math Stories—Act It Out

Choose a center.

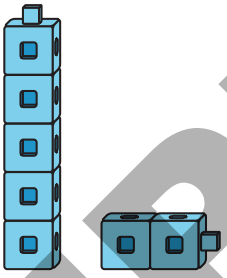
Bingo



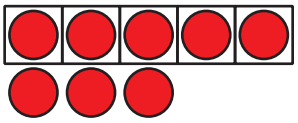
Math Fingers



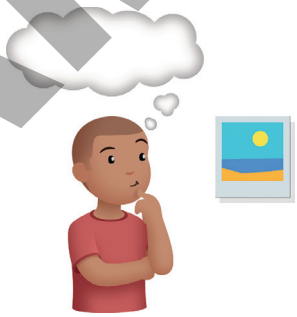
Subtraction Towers



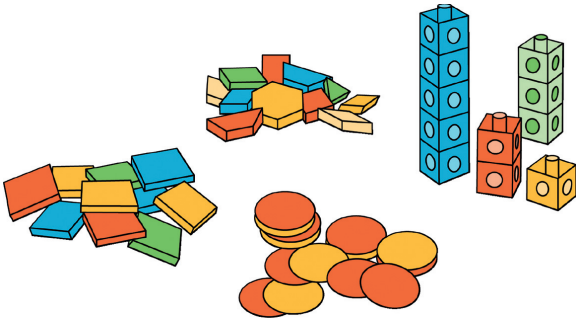
5-Frames



Math Stories



Counting Collections



Practice Problems

10 Problems

1 from Unit 4, Lesson 6

Tell a story about the picture.

2 from Unit 4, Lesson 7

Show the story with counters.

5 snails crawl.
3 more come.
Then 2 crawl away.

3 from Unit 4, Lesson 8

Jada has 5 connecting cubes.
Han gives Jada 2 more.
How many now?

_____

_____

_____

4 from Unit 4, Lesson 9

There are 8 cars.
All the cars leave.
How many now?

Sec B

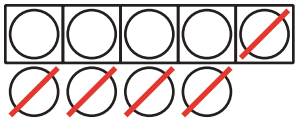
5 from Unit 4, Lesson 10

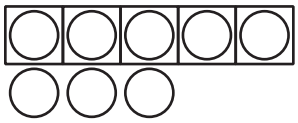
There are 9 crabs.
5 go away.
How many now?

_____

_____

Circle the picture that matches the story.





6 from Unit 4, Lesson 11

There are 4 cups of milk.
Jada adds 2 more.
How many now?
Make a drawing.

Sec B

7 from Unit 4, Lesson 12

There are 7 crows.

3 more come.

How many now?

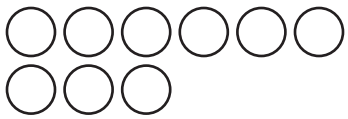
Show your thinking using objects, drawings, numbers, or words.

There are 6 dolphins.
Show the story 2 ways.
Solve your problems or solve your partner's problems.

9 Exploration

Tell a story problem about each drawing.

a.



b.

Make your own questions and solve them.

a. Noah had 4 erasers.
   Clare gave him 3.

b. Tyler had 3 pencils.
   Tyler found 2 more.

c. Elena had 6 markers.
   She lost 1.

Unit 4, Lesson 14

Addressing CA CCSSM K.CC.2 and K.OA.1-2; practicing MP2

Expressions and Story Problems

Let's match expressions with story problems.

Activity 1

Expression for a Story Problem

10 people ride bikes.
6 people stop.
How many now?

Activity 2

Which Expression?

1. 2 rocks in Lin's jar
   Lin put in 4 more.
   How many rocks now?

   $3 + 3$ $6 - 2$ $2 + 4$

2. 8 kids play.
   3 leave.
   How many now?

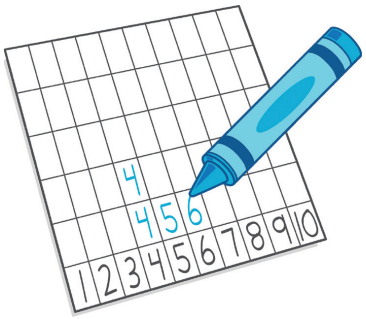
   $8 + 3$ $3 - 3$ $8 - 3$

Activity 3

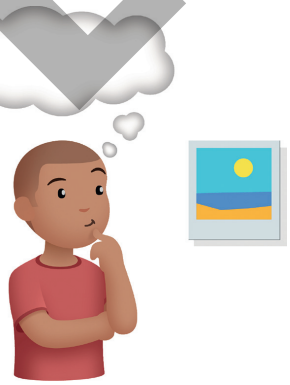
Centers: Choice Time

Choose a center.

Number Race



Math Stories



Unit 4, Lesson 15

Addressing CA CCSSM K.CC.3 and K.OA.1-2; practicing MP7

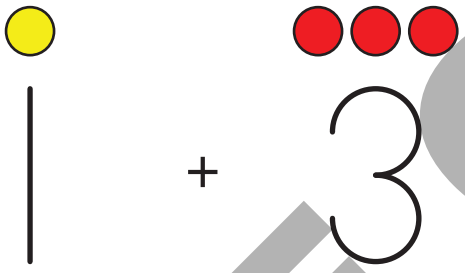
Expressions and Drawings

Let's match expressions to drawings.

Warm-up

Notice and Wonder: Shapes and Numbers

What do you notice?
What do you wonder?



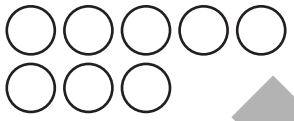
Activity 1

Match Drawings to Expressions

9 – 2

6 – 3

4 + 2



6 + 3

5 + 3

7 + 10

Activity 2

Create Expressions and Drawings

Fill in what's missing.

$4 + 3$

$4 - 0$

_____

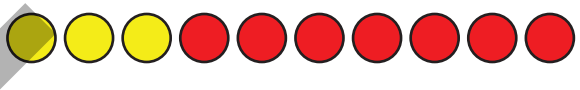
_____ – _____

$5 + 3$

_____

Fill in what's missing.

8 – 2 _____



_____+_____

1 + 6 _____

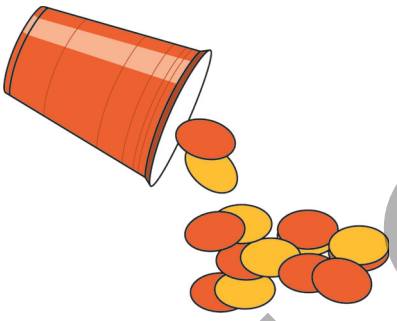
_____–_____

Activity 3

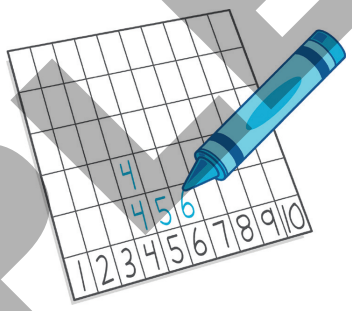
Introduce Shake and Spill—Represent

Choose a center.

Shake and Spill



Number Race



Math Stories

Unit 4, Lesson 16

Addressing CA CCSSM K.OA.1-2; practicing MP2

Find the Value of Expressions

Let's find the value of expressions.

Warm-up

What Do You Know about 3 + 2?

What do you know about 3 + 2?

Activity 2

Find the Value of Expressions

3 + 1

6 – 3

5 – 4

$7 + 2$

$5 + 0$

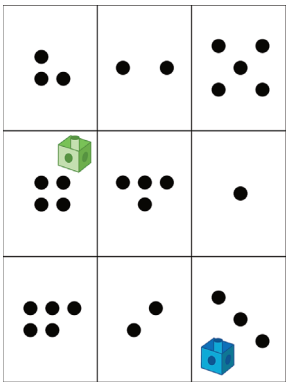
$9 - 4$

Activity 3

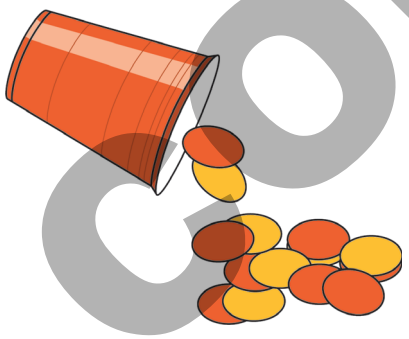
Centers: Choice Time

Choose a center.

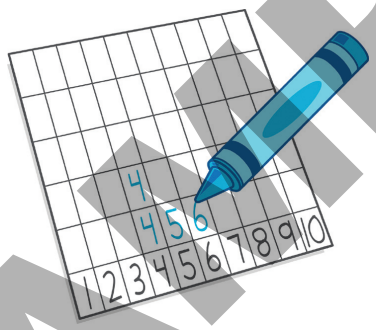
Roll and Add



Shake and Spill



Number Race



Math Stories

Addressing CA CCSSM K.CC.3, K.CC.4c, and K.OA.1-2; building towards K.OA.5; practicing MP7 and MP8

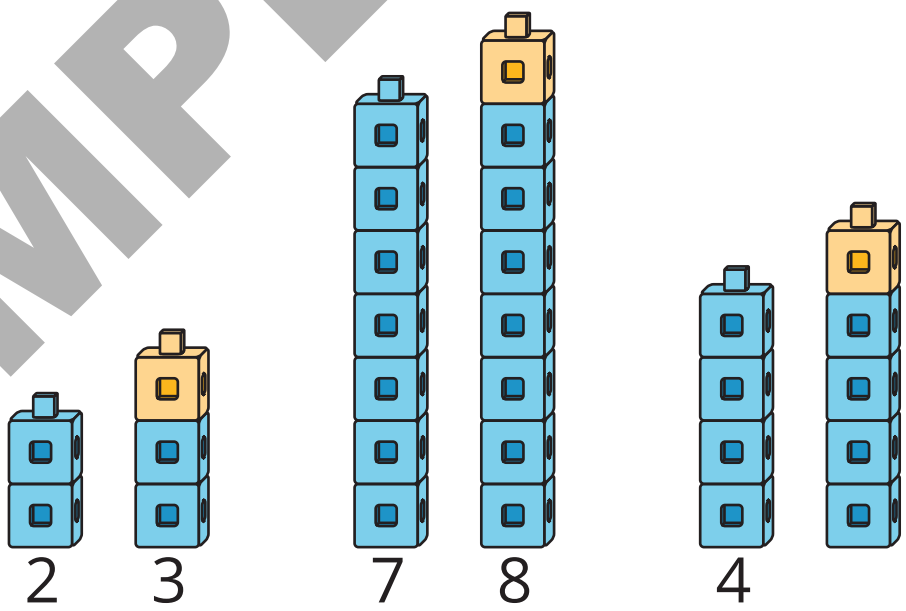
Add 0 and 1

Let's see what happens when we add 0 or 1.

Warm-up

Notice and Wonder: Add 1 More

What do you notice?
What do you wonder?



Activity 1

Add 0 and 1

Sec C

4 + ____

2 + ____

8 + ____

3 + ____

9 + ____

1 + ____

Activity 2

Notice + 0 and + 1 Patterns

4 + 0	4	
2 + 0	2	
8 + 0	8	
3 + 1	4	
9 + 1	10	
1 + 1	2	

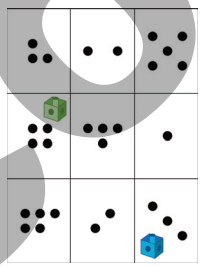
Activity 3

Introduce Find the Value of Expressions—Color the Total or Difference

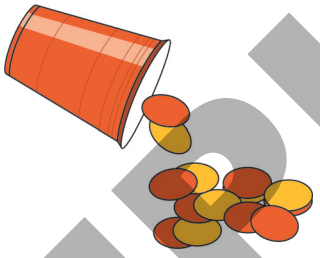
Choose a center.

Find the Value of Expressions

Roll and Add



Shake and Spill



Math Stories

Number Race

Section C Summary

We can use numbers and symbols to add and subtract.

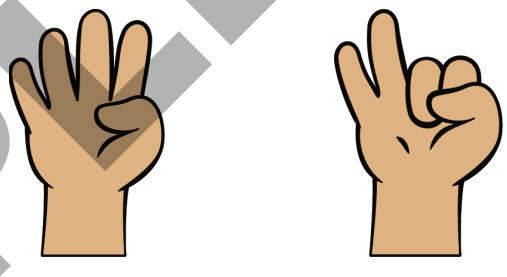
We can match expressions with story problems and drawings.

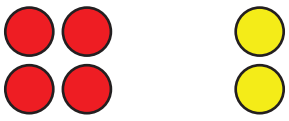
8 – 6

2 + 1

We used our fingers, objects, and drawings to find values.

4 + 2





Addressing CA CCSSM K.CC.1-2 and K.OA.1-2; practicing MP4

Tell Story Problems for Expressions

Let's create our own story problems.

Activity 1

What Do We Need to Know?

Diego and Mai are at the park.
They see 3 butterflies.
They find some rocks to paint.
Some rocks are big and some are tiny.
Mai finds 3 rocks.
Diego finds 6 rocks.
How many rocks did Diego and Mai find?

Activity 2

Tell a Story Problem to Match an Expression

Write an addition or subtraction expression.

Practice Problems

6 Problems

1 from Unit 4, Lesson 14

There are 5 red apples.
There are 3 green apples.
How many apples?

_____

_____

Circle the expression that matches.

5 + 3　　5 – 3　　8 – 5

2 from Unit 4, Lesson 15

Draw a line from each expression to each drawing.

A. $5 + 2$

B. $6 - 3$

C. $6 + 2$

D. $5 - 2$

1.

2.

3.

4.

3 from Unit 4, Lesson 16

Find the value of each expression.
Show your thinking using objects, drawings, numbers, or words.

3 + 5

7 – 1

4 from Unit 4, Lesson 17

Find the value of each expression.
Show your thinking using objects, drawings, numbers, or words.

5 + 0

5 + 1

6 + 0

6 + 1

5 Exploration

Circle the expression that shows 8.

1 + 6 5 + 3 6 + 3

What others show 8?

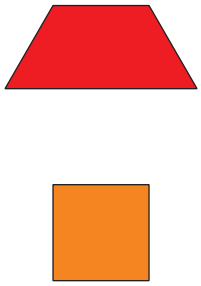
6 Exploration

Tell a story about the picture.

Glossary

- above

above the square

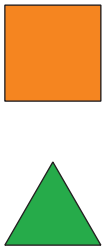


- add

$4 + 3$

four plus three

- below



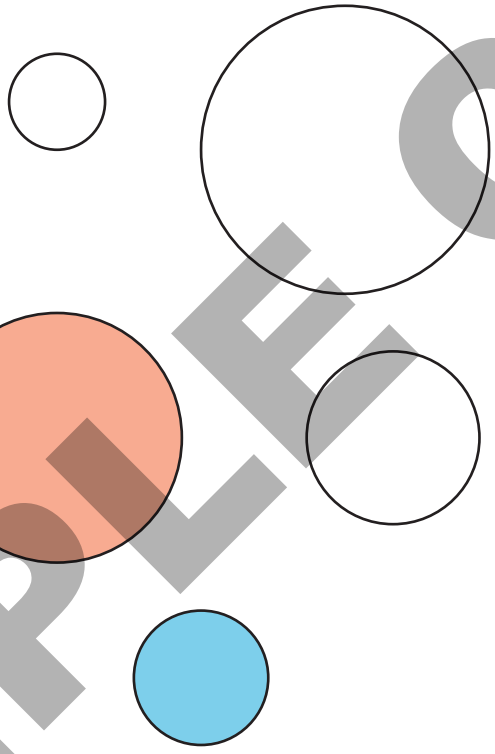
below the square

- beside

beside the square

beside the square

- circle



- expression

$6 + 4$

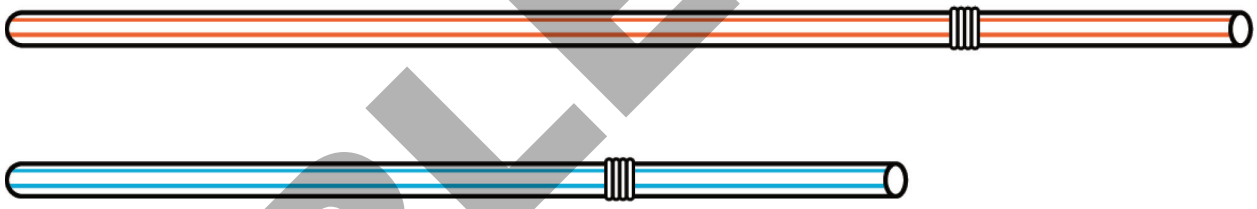
$3 - 3$

- fewer

- less

  3 is less than 9

- longer

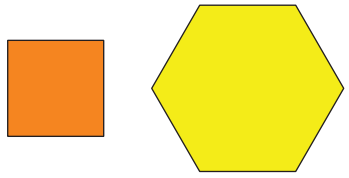


  The straw on top is longer.

- more

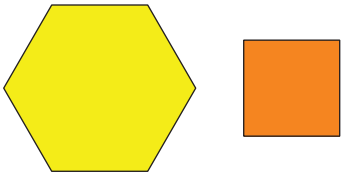
  9 is more than 3.

- next to

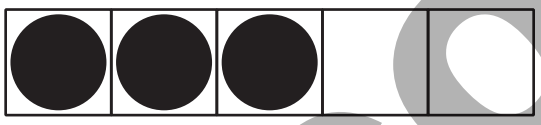
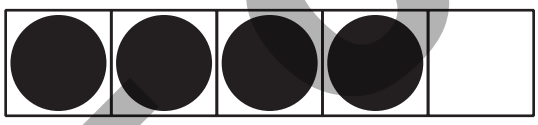
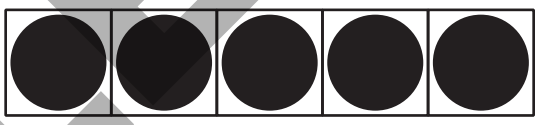


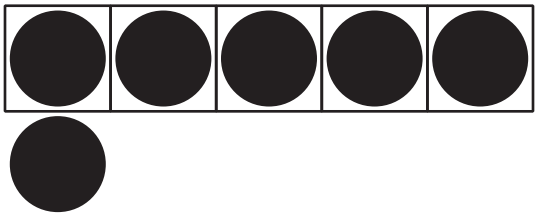
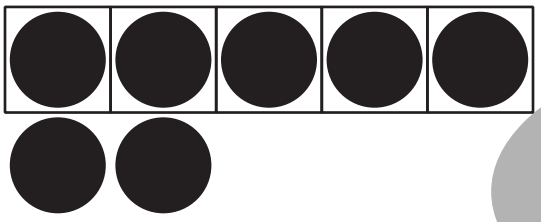
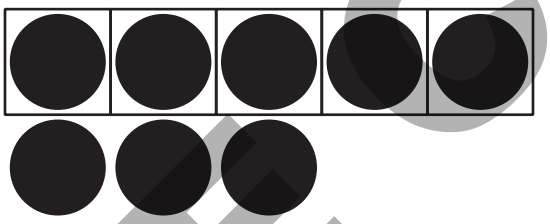
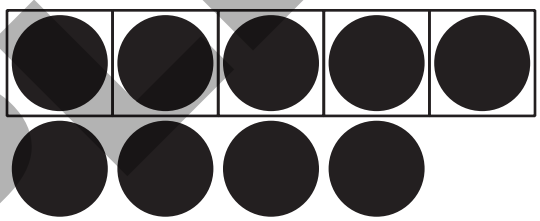
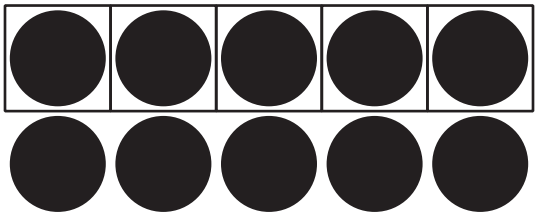
next to the square

next to the square

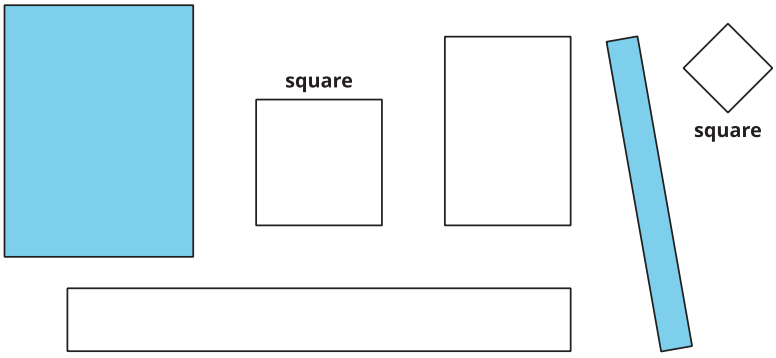


- number writing reference

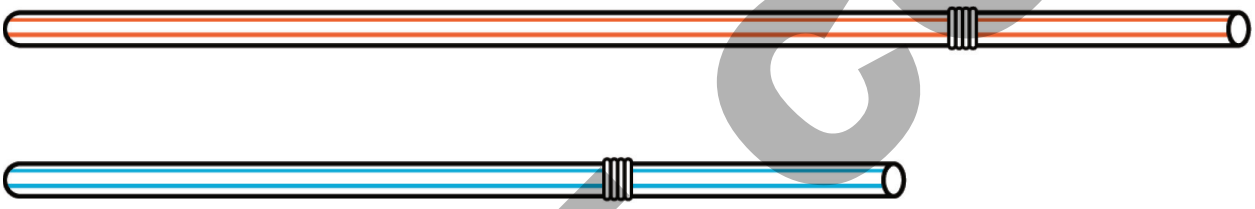
1 one	
2 two	
3 three	
4 four	
5 five	

6 six	
7 seven	
8 eight	
9 nine	
10 ten	

- rectangle



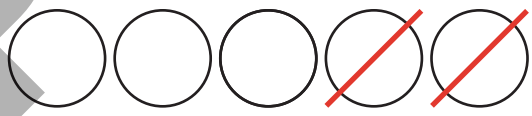
- shorter
  The straw on the bottom is shorter.



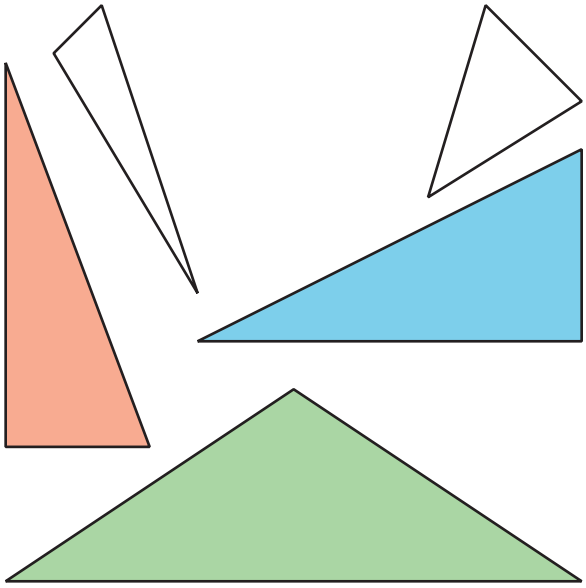
- subtract

$$5 - 2$$

five minus two



- triangle



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Notes

Notes

California Common Core State Standards for Mathematics (CA CCSSM) Reference

K.CC: Kindergarten-Counting and Cardinality

Know number names and the count sequence.

K.CC.1

Count to 100 by ones and by tens.

K.CC.2

Count forward beginning from a given number within the known sequence (instead of having to begin at 1).

K.CC.3

Write numbers from 0 to 20. Represent a number of objects with a written numeral 0–20 (with 0 representing a count of no objects).

Count to tell the number of objects.

K.CC.4

Understand the relationship between numbers and quantities; connect counting to cardinality.

K.CC.4a

When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object.

K.CC.4b

Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.

K.CC.4c

Understand that each successive number name refers to a quantity that is one larger.

K.CC.5

Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.

Compare numbers.

K.CC.6

Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects

in another group, e.g., by using matching and counting strategies. Include groups with up to ten objects.

K.CC.7

Compare two numbers between 1 and 10 presented as written numerals.

K.G Kindergarten-Geometry

Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).

K.G.1

Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.

K.G.2

Correctly name shapes regardless of their orientations or overall size.

K.G.3

Identify shapes as two-dimensional (lying in a plane, "flat") or three-dimensional ("solid").

Analyze, compare, create, and compose shapes.

K.G.4

Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/"corners") and other attributes (e.g., having sides of equal length).

K.G.5

Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes.

K.G.6

Compose simple shapes to form larger shapes. For example, "Can you join these two triangles with full sides touching to make a rectangle?"

K.MD Kindergarten—Measurement and Data

Describe and compare measurable attributes.

K.MD.1

Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.

K.MD.2

Directly compare two objects with a measurable attribute in common, to see which object has “more of”/”less of” the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.

Classify objects and count the number of objects in each category.

K.MD.3

Classify objects into given categories; count the numbers of objects in each category and sort the categories by count. Limit category counts to be less than or equal to 10.

K.NBT Kindergarten—Number and Operations in Base Ten

Work with numbers 11-19 to gain foundations for place value.

K.NBT.1

Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., 1810+8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.

K.OA Kindergarten—Operations and Alegbraic Thinking

Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

K.OA.1

Represent addition and subtraction with objects, fingers, mental images, drawings. Drawings need not show details, but should show the mathematics in the problem. (This applies wherever drawings are mentioned in the Standards), sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

K.OA.2

Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

K.OA.3

Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

K.OA.4

For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects of drawings, and record the answer with a drawing or equation.

K.OA.5

Fluently add and subtract within 5.

California Common Core State Standards for Mathematics Standards for Mathematical Practice

These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

MP1. Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous

problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

MP2. Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own,

without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

MP3. Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments

using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen to or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

- Students build proofs by induction and proofs by contradiction. CA 3.1 (for higher mathematics only).

MP4. Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify

important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

MP5. Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and

compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

MP6. Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

MP7. Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same

amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

MP8. Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle

school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Connecting the Mathematical Practices to the Standards for Mathematical Content

The Standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years. Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to mathematical content in mathematics instruction.