IMKH California

GRADE 1

Student Edition

UNITS

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Illustrative Mathematics® LEARN MATH FOR LIFE | Kendall Hunt

Book 4
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GRADE 1

UNIT

Geometry and Time

Content Connections

In this unit you will reason with shapes, partition shapes into equal pieces, and tell time to the hour and half hour. You will make connections by:

- **Reasoning with Data** while representing, organizing and answering questions about two or more categories of information.
- **Exploring Changing Quantities** while reading and expressing time on digital and analog clocks by the hour and half hour.

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- **Taking Wholes Apart, Putting Parts Together** while partitioning shapes into halves, fourths, and quarters.
- **Discovering Shape and Space** while learning about 2D and 3D shapes by partitioning shapes into equal shares.

Addressing the Standards

As you work your way through **Unit 7 Geometry and Time,** 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.	
MP2 Reason abstractly and quantitatively.	Lesson 13, 16
MP3 Construct viable arguments and critique the reasoning of others.	Lesson 11
MP4 Model with mathematics.	Lesson 18
MP5 Use appropriate tools strategically.	Lesson 2
MP6 Attend to precision.	Lesson 1, 2, 3, 4, 5, 6, 9, 10, 12, 17
MP7 Look for and make use of structure.	Lesson 7, 8, 10, 13, 14, 15, 16
MP8 Look for and express regularity in repeated reasoning.	Lesson 9, 11, 16

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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
• Equal Parts inside Shapes	**1.G.1** Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.	Lesson 1, 2, 3, 4, 5, 6, 7, 9, 11, 12, and 17
• Equal Parts inside Shapes	**1.G.2** Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.	Lesson 1, 2, 3, 4, 6, 7, 8, 9, 11, and 17

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Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Clocks and time • Equal Parts inside Shapes	**1.G.3** Partition circles and rectangles into two and four equal shares, describe the shares using the words *halves, fourths,* and *quarters,* and use the phrases *half of, fourth of,* and *quarter of.* Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.	Lesson 1, 2, 3, 4, 6, 7, 9, 10, 11, 17, and 18
• Equal Expressions • Reasoning about Equality	**1.OA.6** Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., $8 + 6 = 8 + 2 + 4 = 10 + 4 = 14$); decomposing a number leading to a ten (e.g., $13 – 4 = 13 – 3 – 1 = 10 – 1 = 9$); using the relationship between addition and subtraction	Lesson 8 and 12

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Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
	(e.g., knowing that 8 + 4 = 12, one knows 12 – 8 = 4); and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13).	
• Equal Expressions • Reasoning about Equality	**1.OA.7** Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. *For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.*	Lesson 15
• Make Sense of Data • Tens and Ones	**1.NBT.1** Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.	Lesson 15

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Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Equal Expressions • Reasoning about Equality • Tens and Ones	**1.NBT.4** Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relation-ship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.	Lesson 6, 14, and 16
• Tens and Ones	**1.NBT.5** Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.	Lesson 11

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Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Make Sense of Data • Clocks and Time • Equal Parts inside Shapes	**1.MD.3** Tell and write time in hours and half-hours using analog and digital clocks.	Lesson 13, 14, 15, 16, and 17

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Addressing CA CCSSM 1.G.1-3; practicing MP6

Shapes That Are Solid

Let's sort and describe solid shapes.

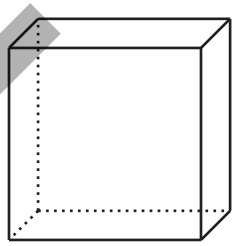
Warm-up

Which Three Go Together: Shapes

Which 3 go together?

A

B



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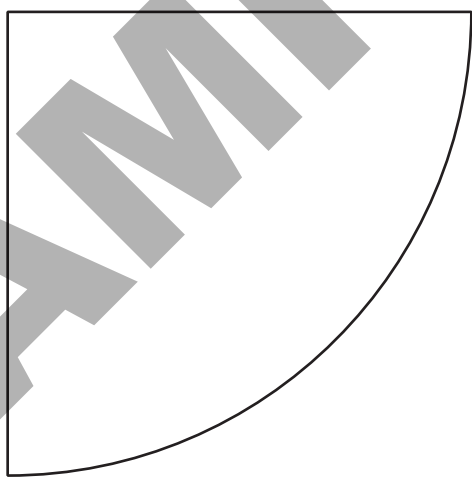

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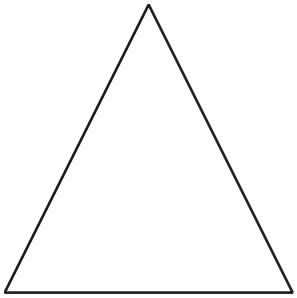

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Activity 1

Sort Solid Shapes

1. Sort some of the shapes into categories in a way that makes sense to you.
   Explain to your partner how you sorted the shapes.

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2. Sort some of your shapes into categories in a different way. Explain to your partner how you sorted the shapes.

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Activity 2

Describe and Find Shapes

- Pick a bag.
- Do not look at the shape in the bag. Take turns feeling the shape. Think about which shape it is.
- Tell your partner which shape it is and why.
- Look in the bag to check.
- Pick a different bag.

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Addressing CA CCSSM 1.G.1-3; practicing MP5 and MP6

Build Shapes from Other Shapes

Let's use solid shapes to build new shapes.

Warm-up

Notice and Wonder: A Shape Bridge

What do you notice?
What do you wonder?

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Unit 7, Lesson 3

Addressing CA CCSSM 1.G.1-3; practicing MP6

Shapes That Are Flat

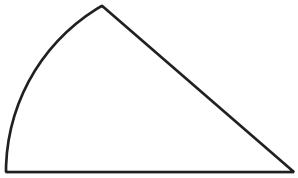
Let's sort flat shapes and explain how we sorted them.

Warm-up

Which Three Go Together: All the Shapes

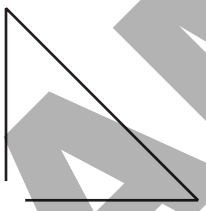
Which 3 go together?

A



B

C



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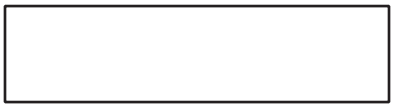

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Addressing CA CCSSM 1.G.1-3; practicing MP6

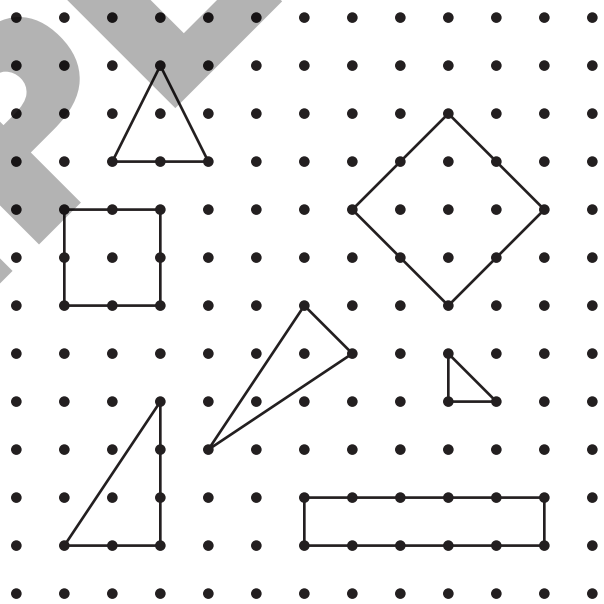
Draw Flat Shapes

Let's describe and draw shapes.

Warm-up

Notice and Wonder: Dot Paper

What do you notice?
What do you wonder?



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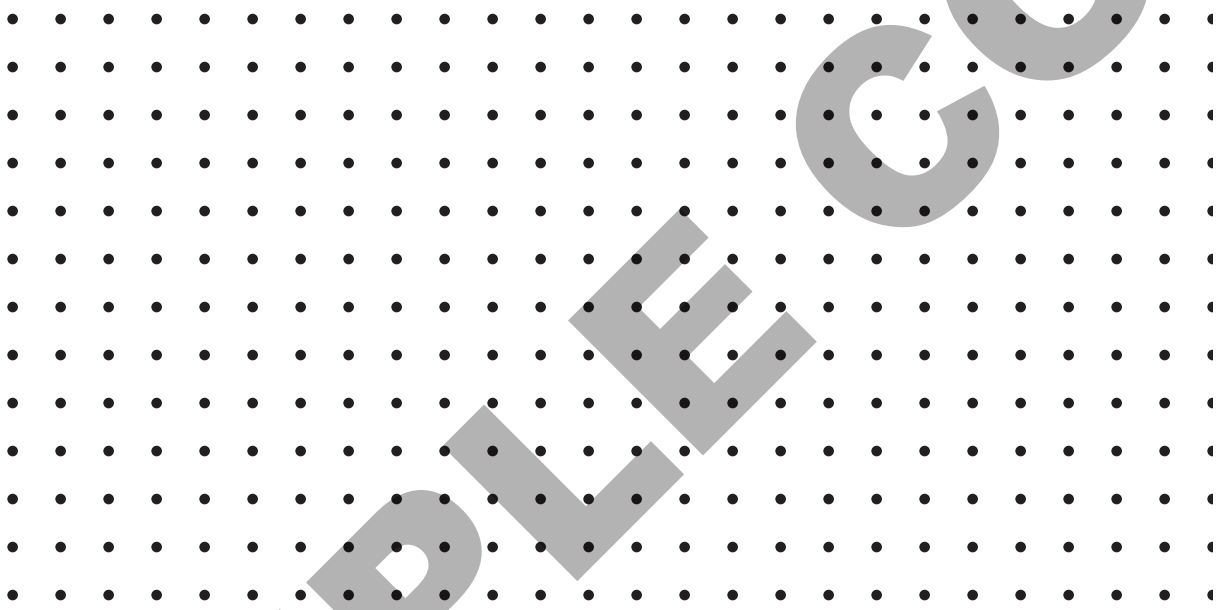
Activity 1

Draw Shapes on Dot Paper

- Pick a shape card.
- Draw the shape on the dot grid.
- Take turns describing the shape that you have drawn.



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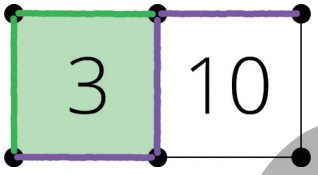
Activity 3

Centers: Choice Time

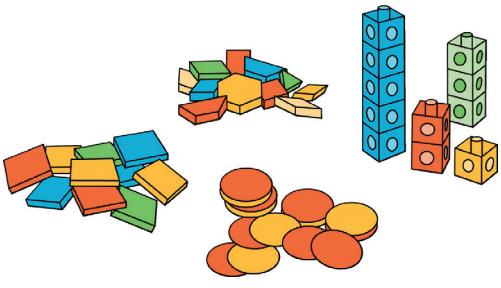
Choose a center.

Capture Squares



Compare

Counting Collections



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Addressing CA CCSSM 1.G.1; practicing MP6

Some Triangles, All Triangles

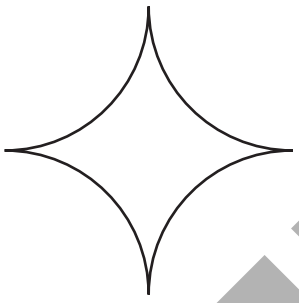
Let's explore what makes a shape a triangle.

Warm-up

Which Three Go Together: More Shapes

Which 3 go together?

A



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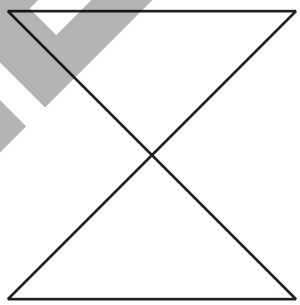

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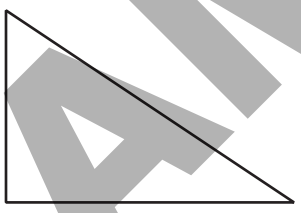
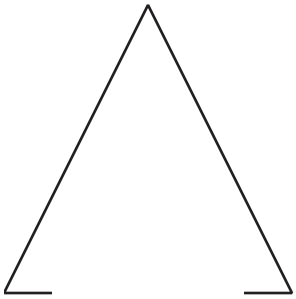


D



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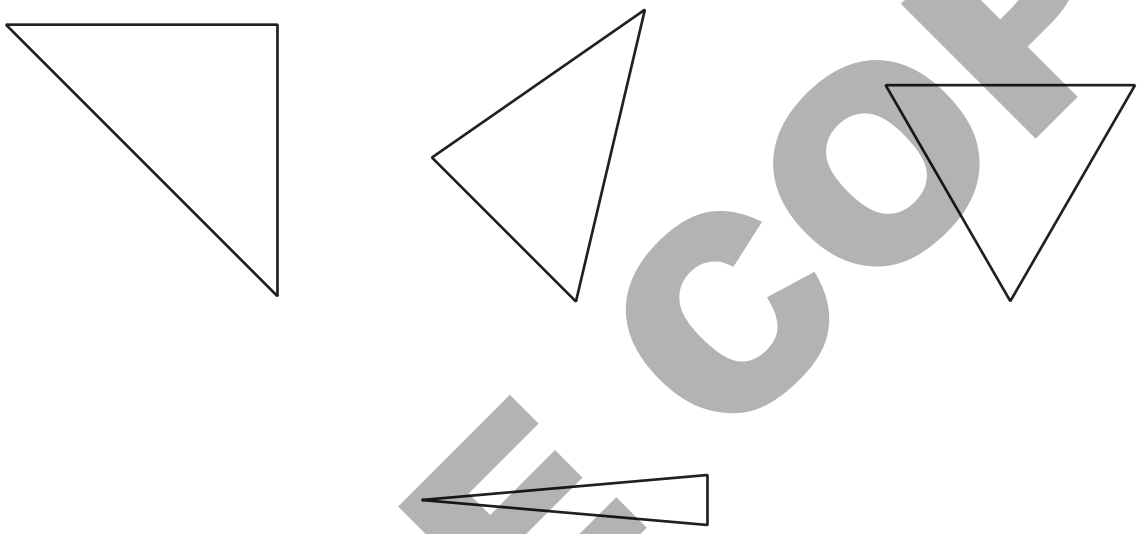
Activity 1

Triangles and Not Triangles

1. These are triangles.



What is the same about all these triangles?

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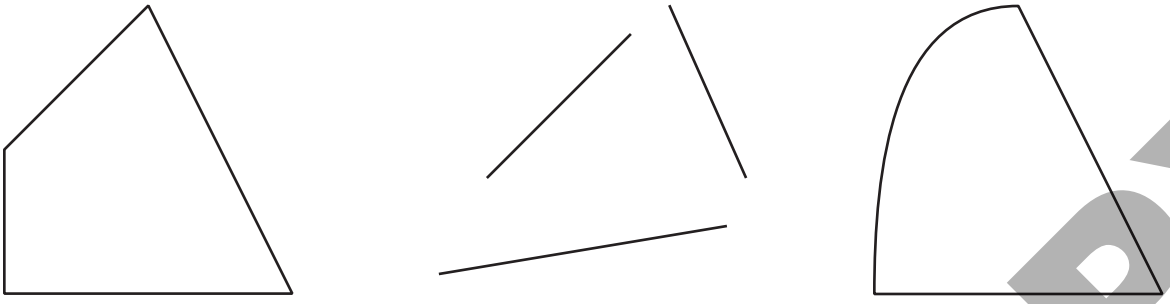
2. These are *not* triangles.



What makes these shapes different from the triangles?

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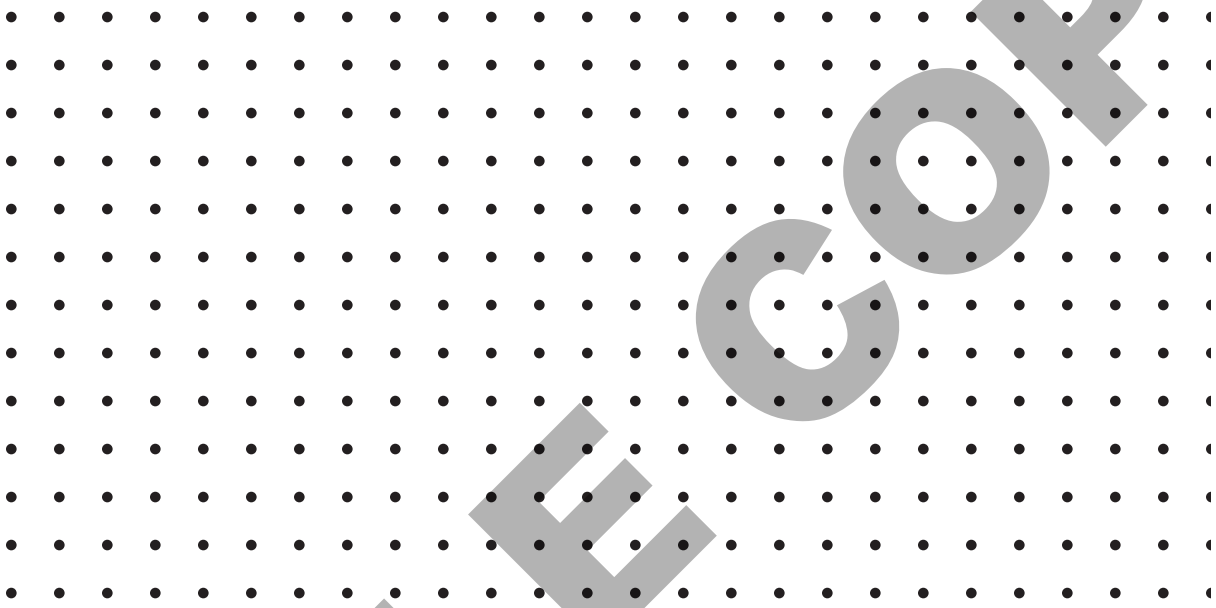
Activity 2

Draw Triangles

1. Choose 3 dots. Connect the dots.



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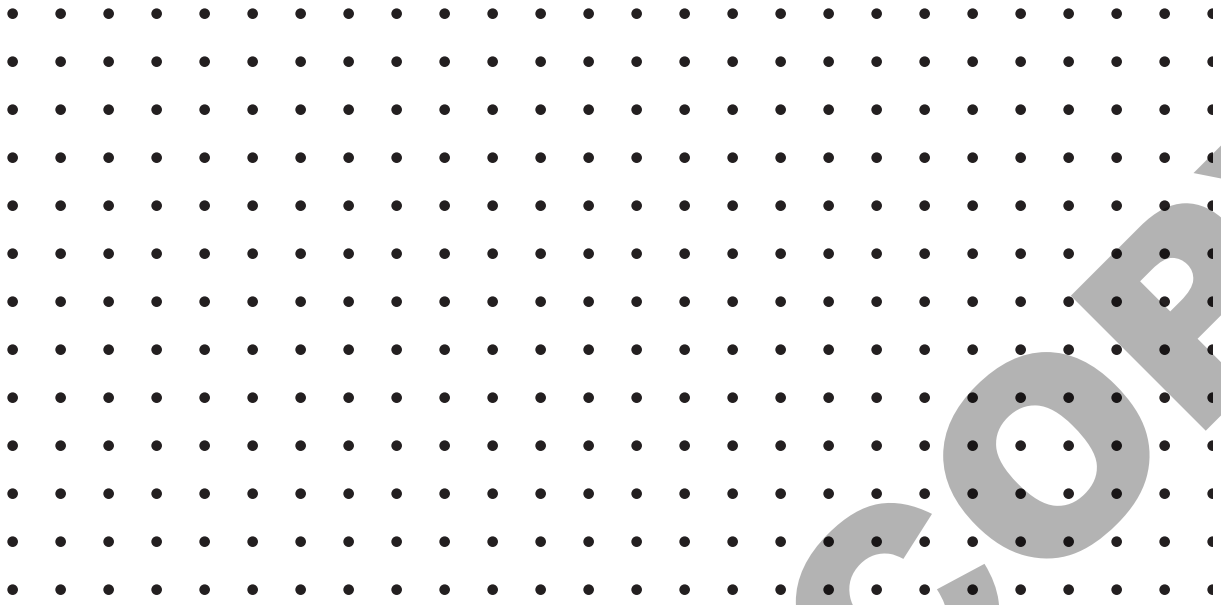
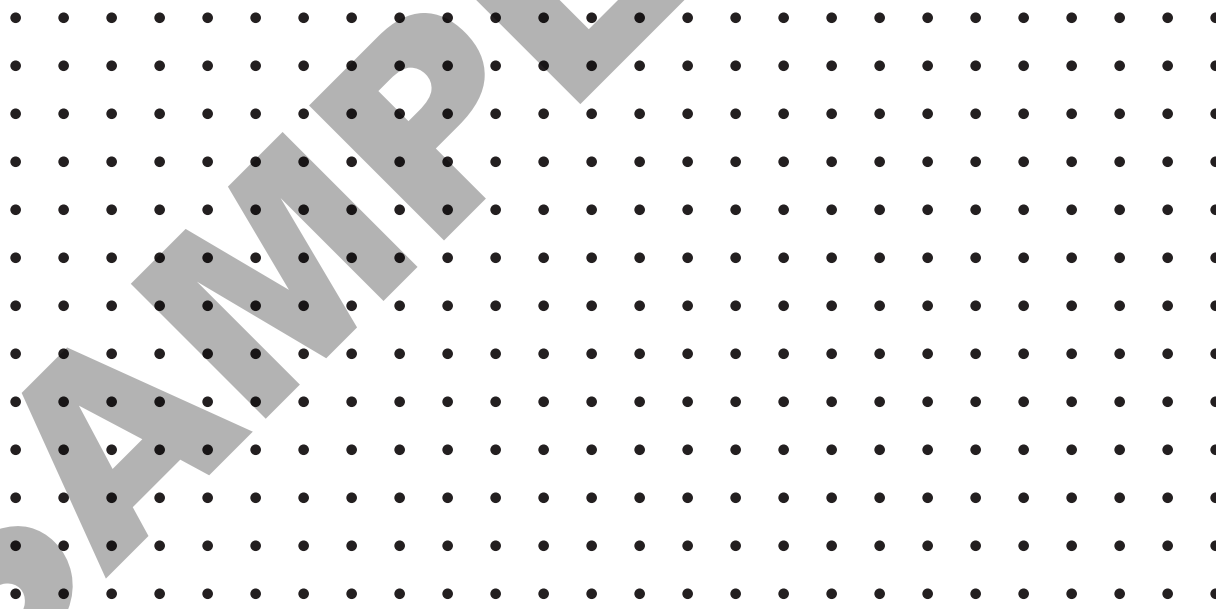
2. Draw 3 different triangles.



3. Draw 3 different shapes that are *not* triangles.



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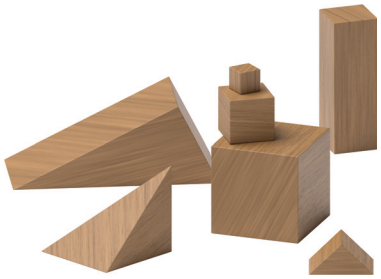
Activity 3

Centers: Choice Time

Choose a center.

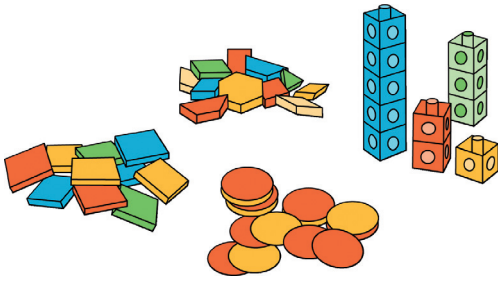
Geoblocks



How Are They the Same?

Compare

Counting Collections



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Addressing CA CCSSM 1.G.1-3 and 1.NBT.4; practicing MP6

Rectangles and Squares

Let's explore what makes a shape a rectangle or a square.

Warm-up

Number Talk: Some Sums

Find the value of each expression mentally.

- 57 + 10
- 57 + 11
- 57 + 21
- 57 + 42

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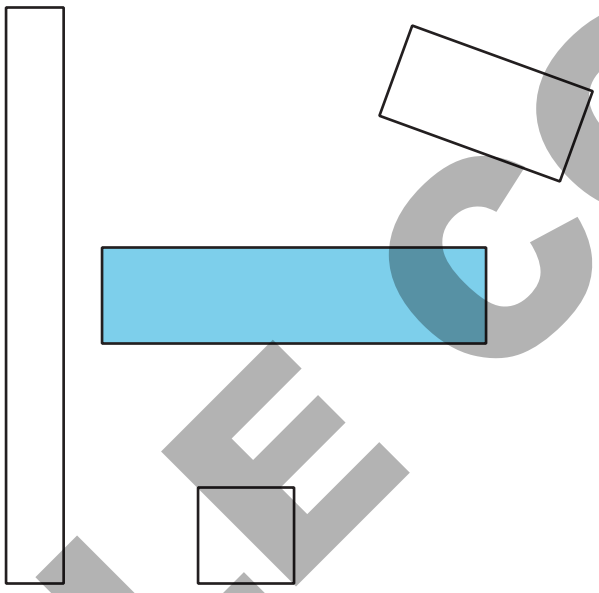
Activity 1

Rectangles and Squares

1. These are rectangles.



What is the same about all these rectangles?

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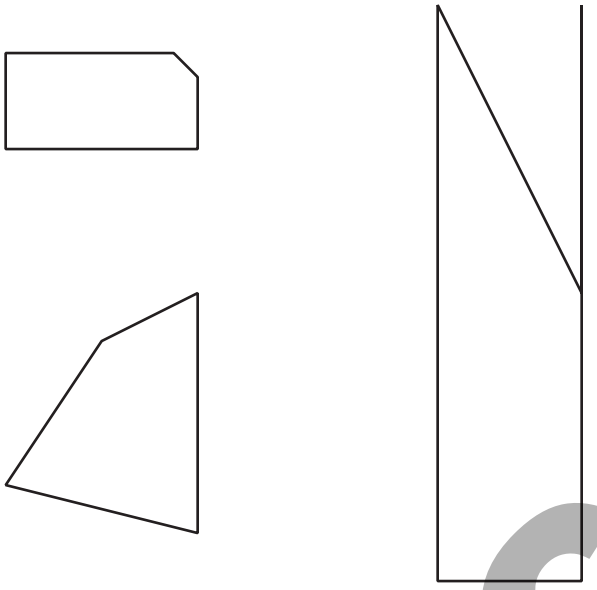
2. These are *not* rectangles.



What makes these shapes different from the rectangles?

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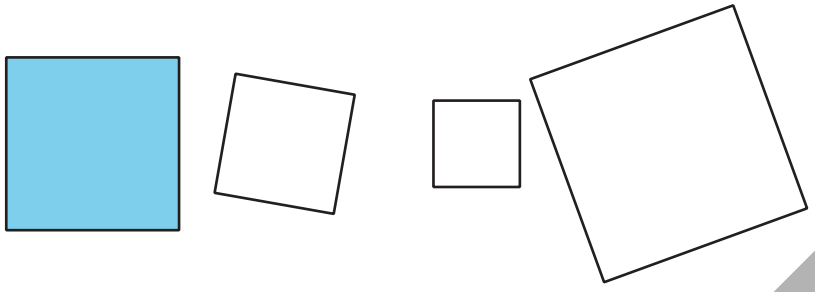
3. These are squares.



What is the same about all these squares?

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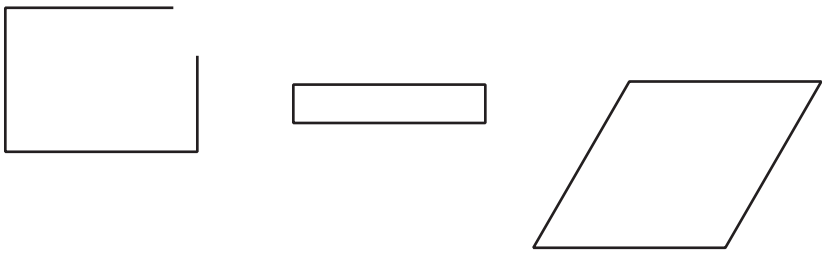
4. These are *not* squares.



What makes these shapes different from the squares?

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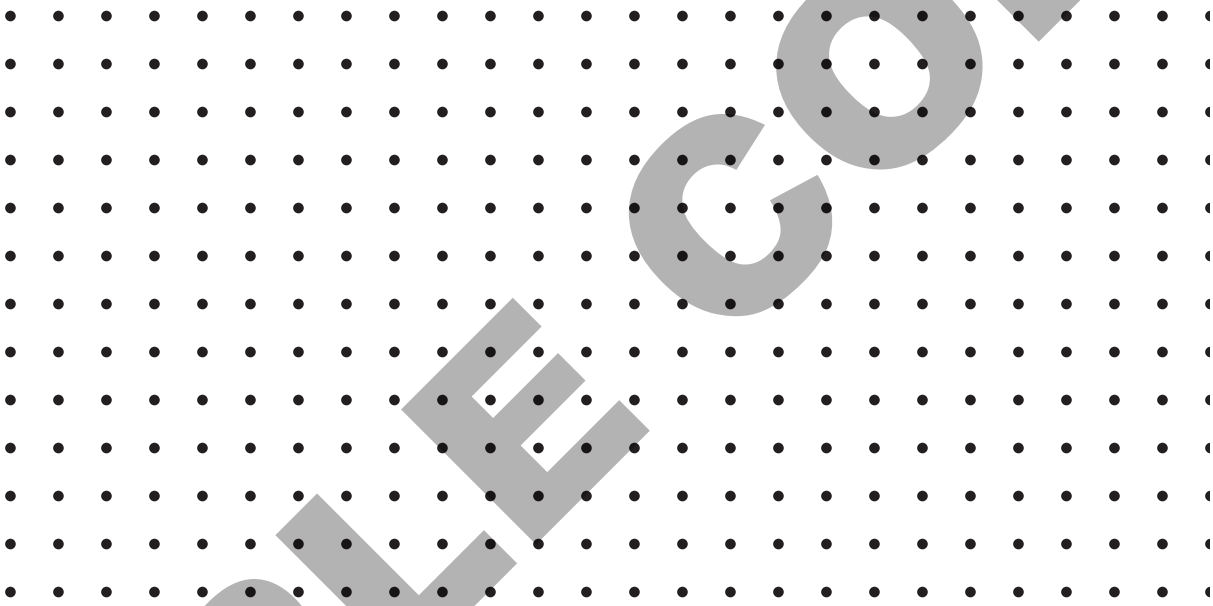
Activity 2

Draw Rectangles and Squares

1. Draw 5 rectangles.



How do you know these are rectangles?

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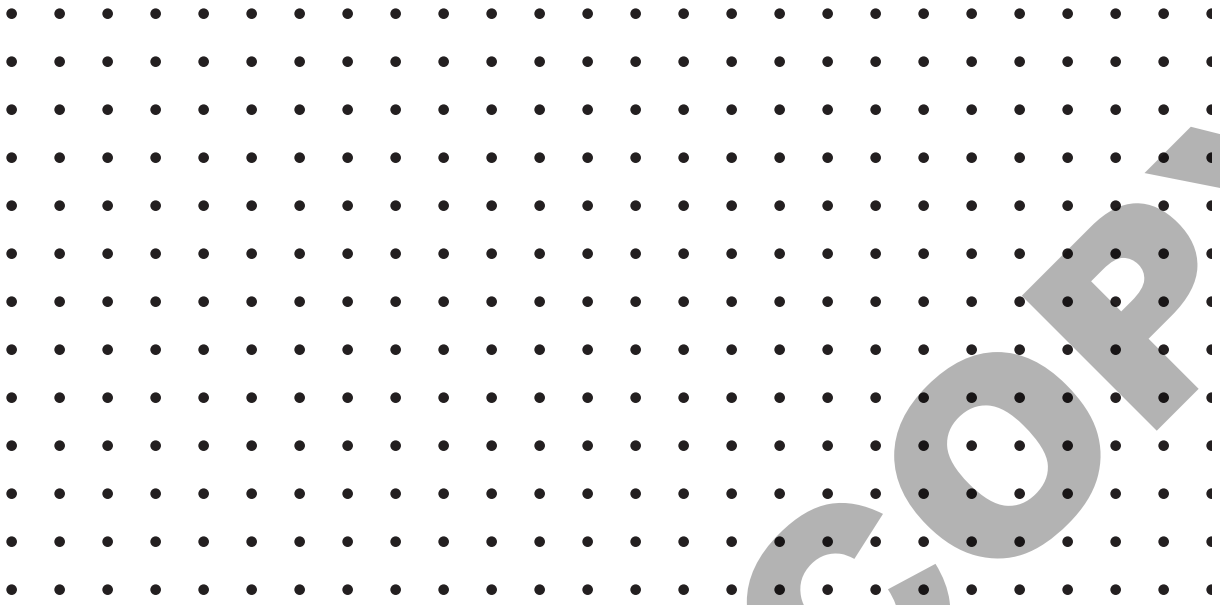
2. Draw 3 shapes that are *not* rectangles.



How do you know these are *not* rectangles?

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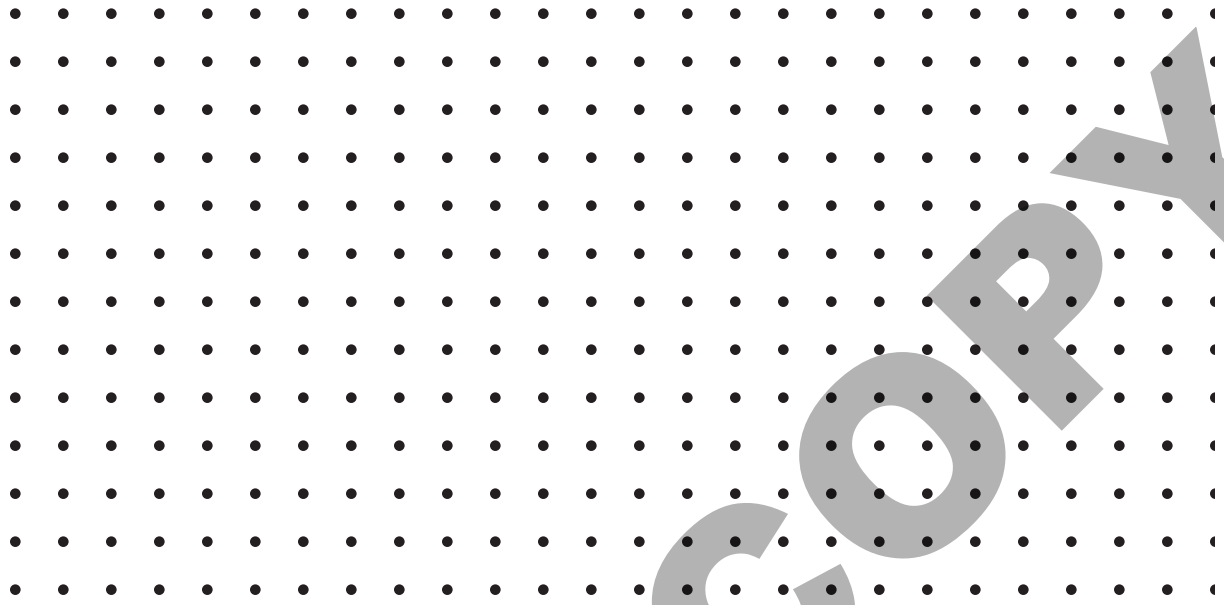
3. Draw 5 squares.

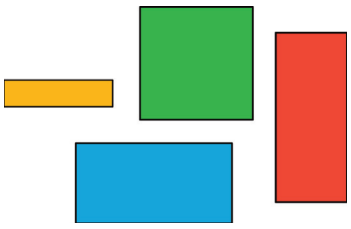


How do you know these are squares?

SAMPLE COPY

4. Draw 3 shapes that are *not* squares.

How do you know these are *not* squares?



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Addressing CA CCSSM 1.G.1-3; building on 1.G.2; practicing MP7

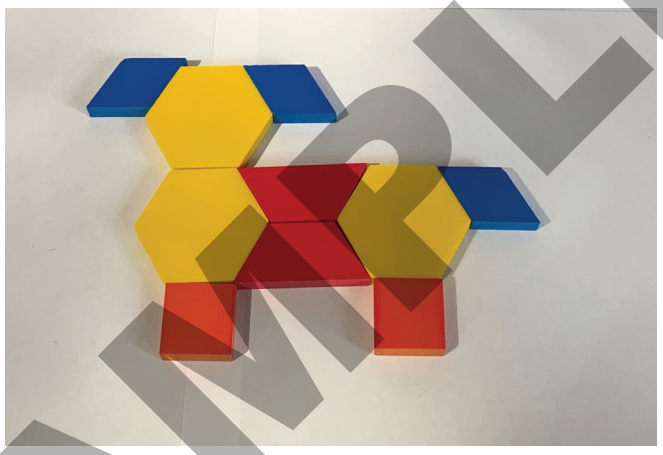
Put Together Flat Shapes

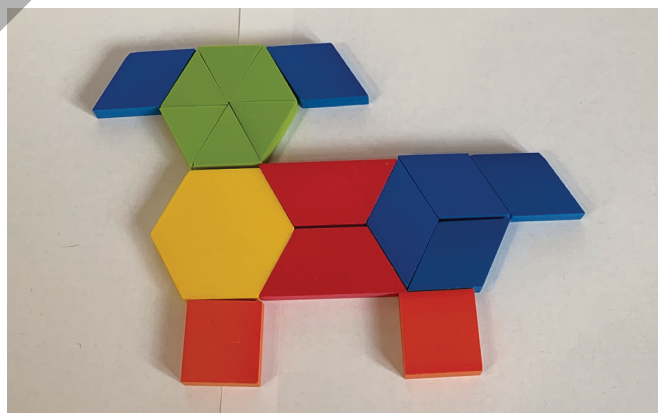
Let's build a new shape from smaller shapes.

Warm-up

Notice and Wonder: Dogs

What do you notice?
What do you wonder?





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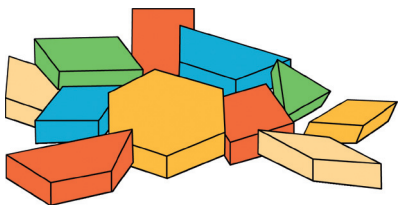
Activity 2

Shape Pictures

1. Build something using the pattern blocks.
   Trace what you made. Record how many pattern blocks you used.



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2. Make the same object you just made. Use different pattern blocks.

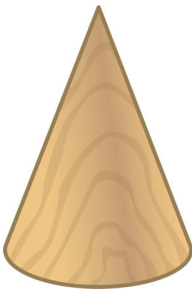
   Record how many pattern blocks you used.

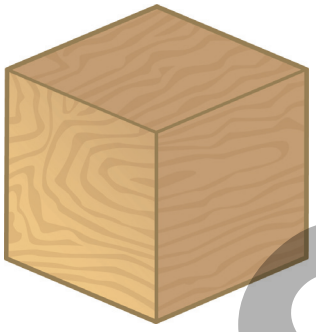
SAMPLE COPY

If you have time: Build the same object again.
Use the most pattern blocks you can.
Record how many pattern blocks you used.

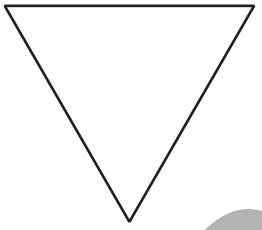
Section A Summary

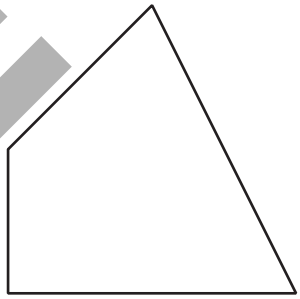
We learned about solid shapes.





We learned about flat shapes.





We described and named shapes.
This shape has 3 straight sides and 3 corners.
So, it is a **triangle**.

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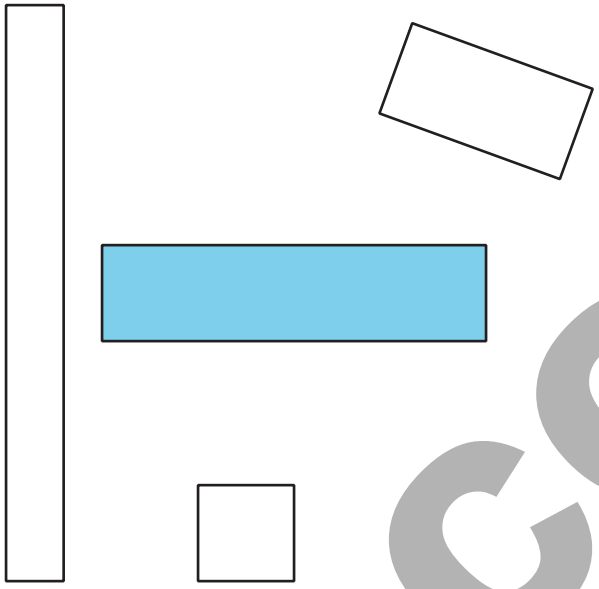
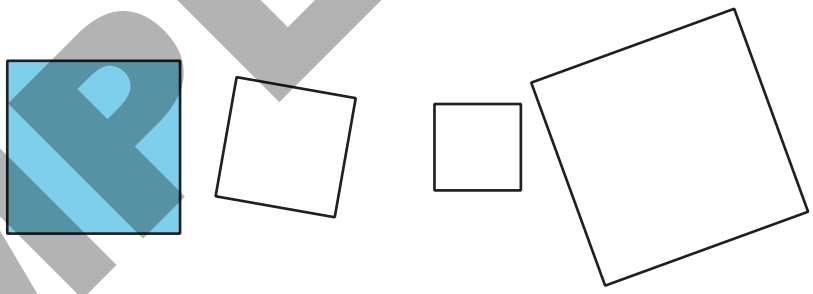
These shapes have 4 straight sides and 4 square corners.
So, they are all **rectangles**.



These shapes all have 4 straight sides that are the same length and 4 square corners.
So, they are all **squares**.



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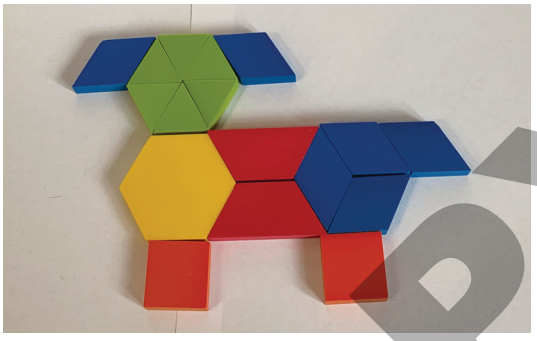
We built larger shapes from smaller shapes.



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Addressing CA CCSSM 1.G.2 and 1.OA.6; practicing MP7

Center Day 1

Let's work with shapes and add or subtract numbers.

Warm-up

Number Talk: Add 3 Numbers

Find the value of each expression mentally.

- 6 + 4 + 8
- 6 + 8 + 4
- 6 + 8 + 5
- 6 + 5 + 9

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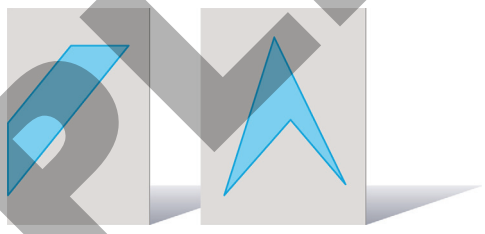
Activity 2

Centers: Choice Time

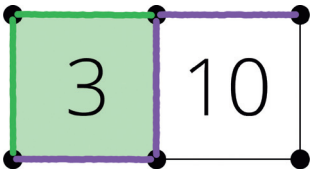
Choose a center.

Picture Books

How Are They the Same?



Capture Squares



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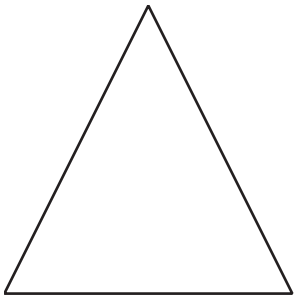
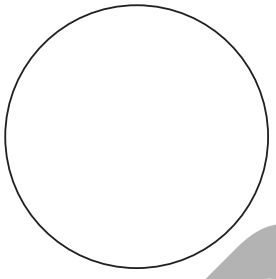
Practice Problems

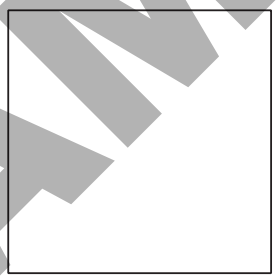
12 Problems

1 Pre-unit

Name each shape.





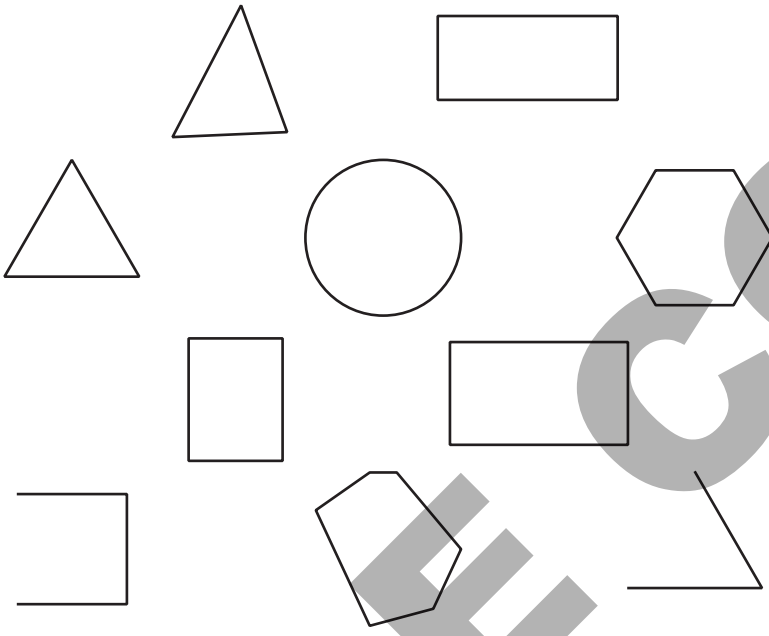


SAMPLE COPY

2 Pre-unit

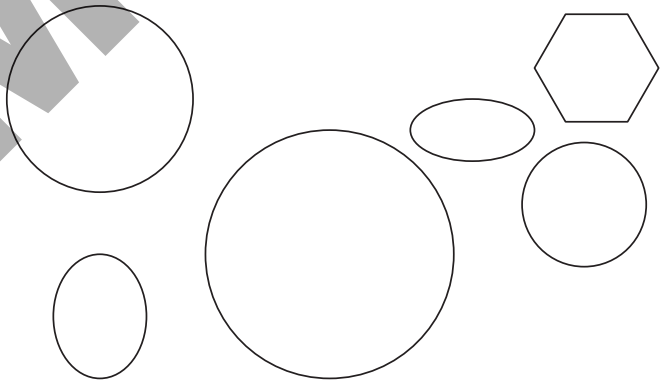
Color **all** of the triangles.

Cross out **all** of the rectangles.



3 Pre-unit

Cross out **all** of the circles.



SAMPLE COPY

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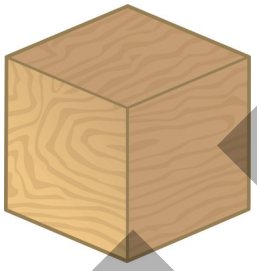
4 from Unit 7, Lesson 1

Jada feels a shape in a bag.
She feels a point and a curve.
Circle the shape that could be in the bag.

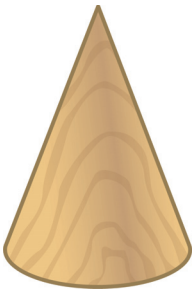
A.

B.



C.

D.



SAMPLE COPY

5 from Unit 7, Lesson 2

This is the tallest building in the world.

Use the blocks to build a shape that looks like the building.

SAMPLE COPY

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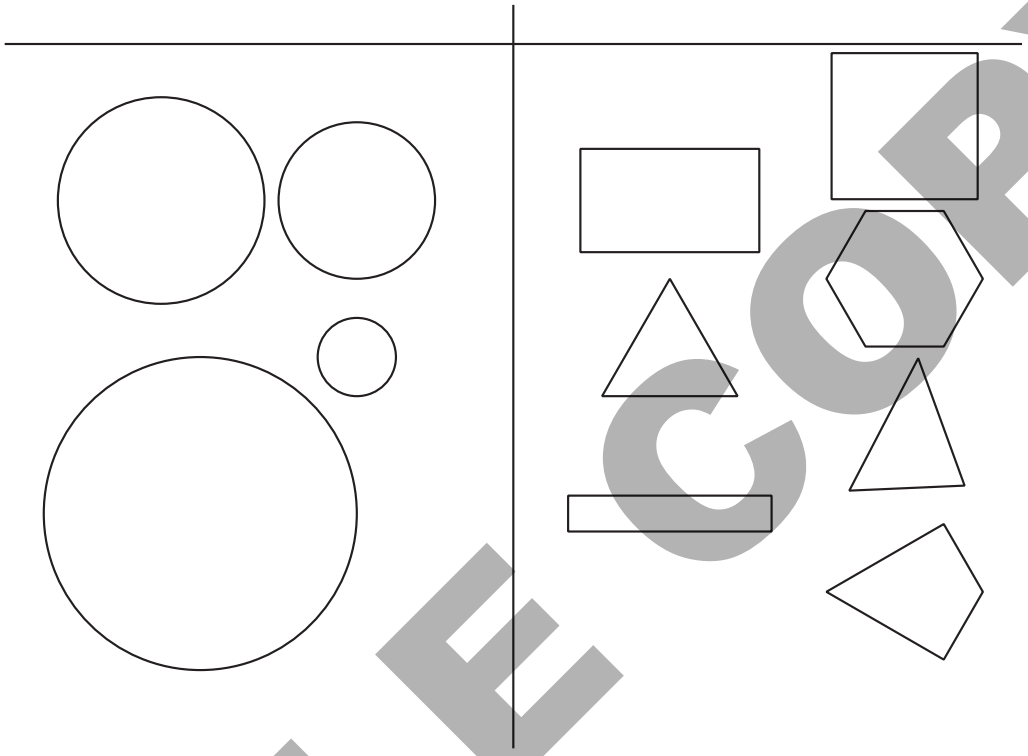
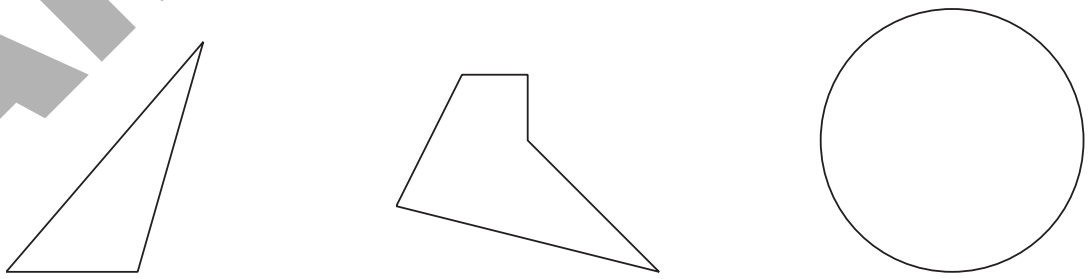
6 from Unit 7, Lesson 3

Here is how Diego sorted some shapes.



Draw each shape where it belongs on Diego's chart.

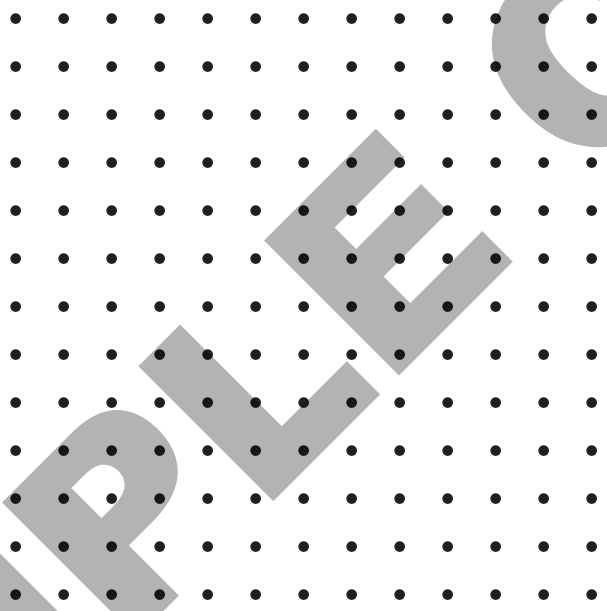


SAMPLE COPY

7 from Unit 7, Lesson 4

Here is a shape.

a. Draw the shape on dot paper.



b. Describe the shape.

SAMPLE COPY

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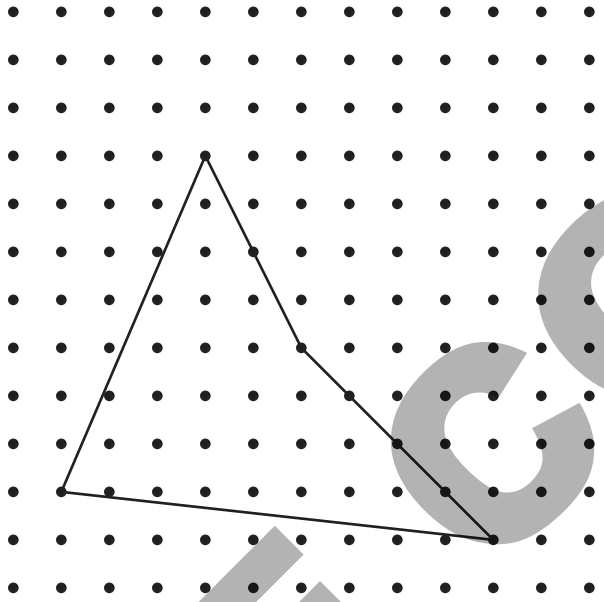
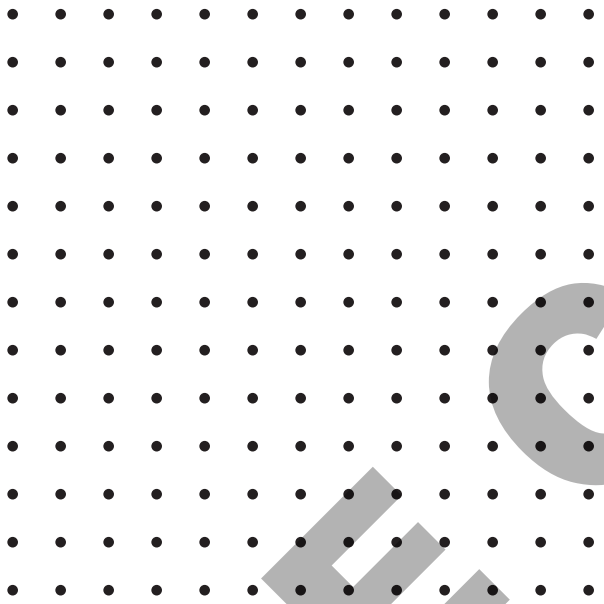
8 from Unit 7, Lesson 5

Is this shape a triangle? Explain your reasoning.



SAMPLE COPY

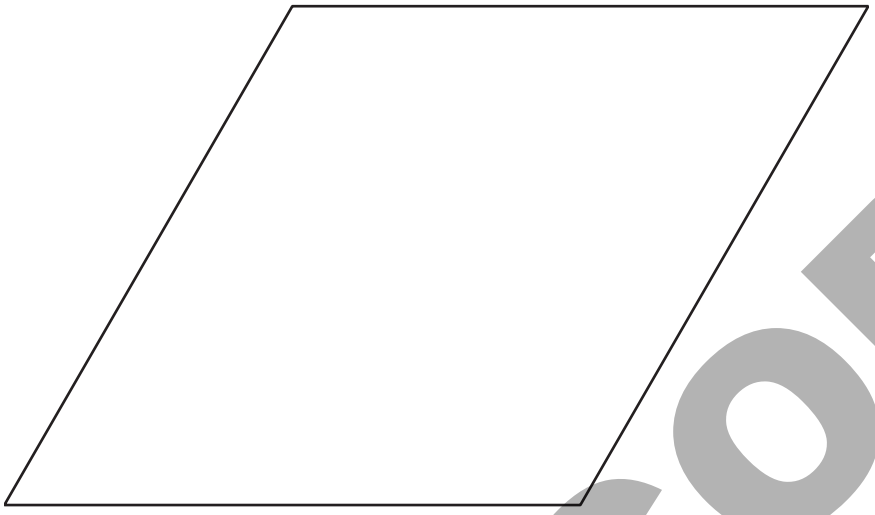
a. Draw 2 different rectangles and 2 different squares.



b. How are the shapes alike? How are they different?

SAMPLE COPY

10 from Unit 7, Lesson 7



a. Use pattern blocks to fill in the outline in 2 different ways.

b. Write the number of pattern blocks you used for each way.

11 Exploration

a. Choose an object in the classroom or outside. Use geoblocks to build a solid shape that looks like the object.

b. Share your solid shape with a partner. Try to guess what object your partner built.

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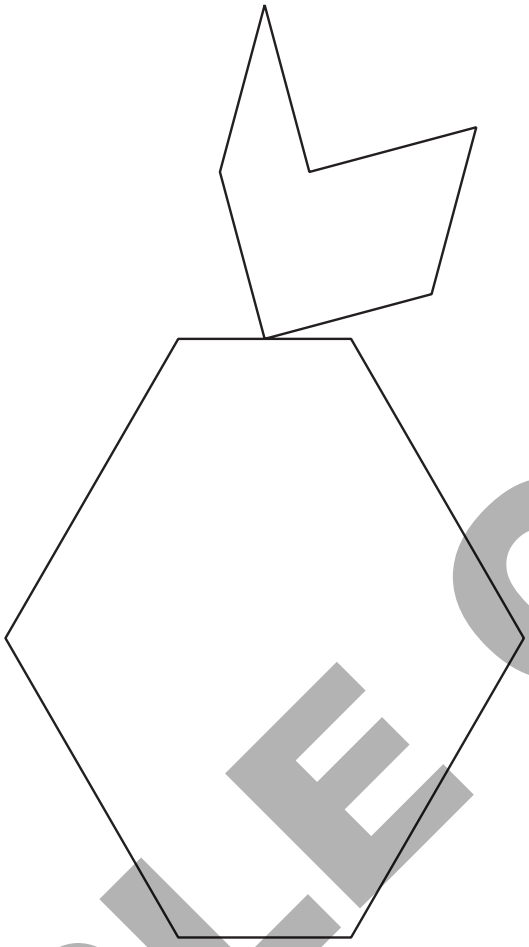


a. What is the least number of pattern blocks you can use to fill in the puzzle?

b. What is the greatest number of pattern blocks you can use to fill in the puzzle?

c. Can you fill in the puzzle, using exactly 12 pattern blocks?

SAMPLE COPY

Addressing CA CCSSM 1.G.1-3; building on 1.G.3; practicing MP6 and MP8

Equal Pieces

Let's split shapes into equal-size pieces.

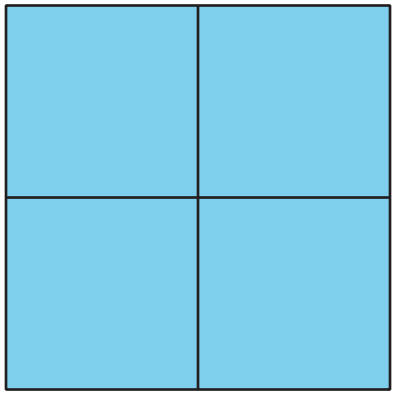
SAMPLE COPY

Warm-up

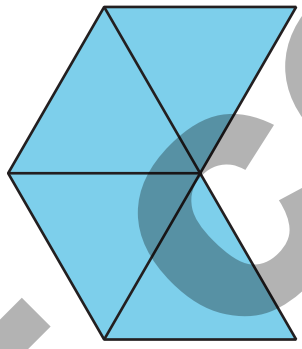
Which Three Go Together: Pieces of Shapes

Which 3 go together?

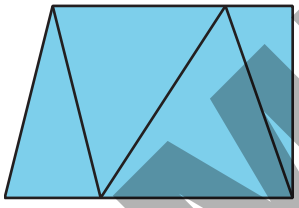
A



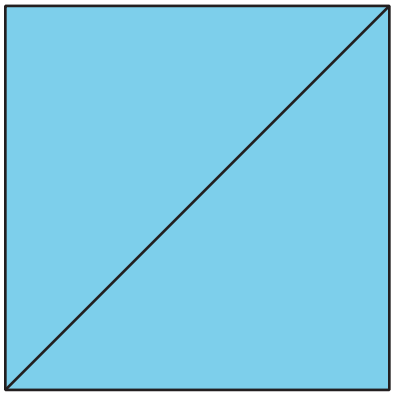
B



C



D



SAMPLE COPY

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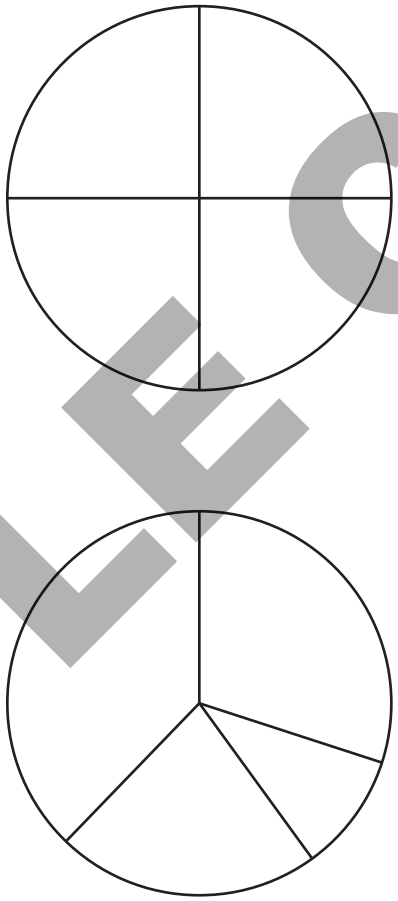
Activity 1

Build a Circle

Synthesis:



SAMPLE COPY

Activity 2

Fold into Equal Pieces

1. Cut out 1 circle and 1 square.
   Fold each shape so that there are 2 equal pieces.
   Be ready to explain how you know your shape has 2 equal pieces.

2. Cut out 1 circle and 1 square.
   Fold each shape so that there are 4 equal pieces.
   Be ready to explain how you know your shape has 4 equal pieces.

SAMPLE COPY

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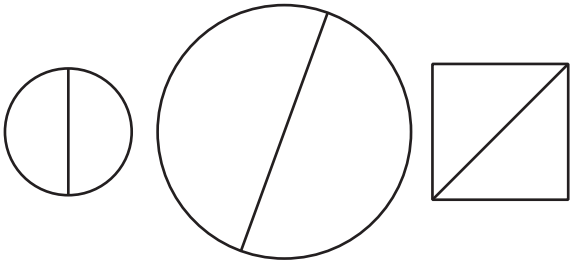
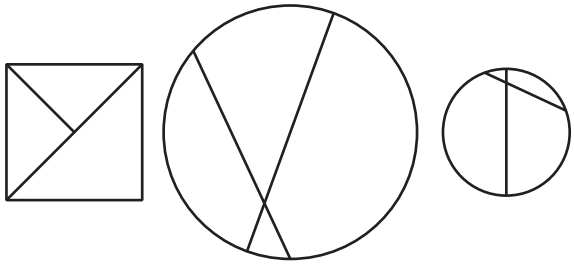
Activity 3

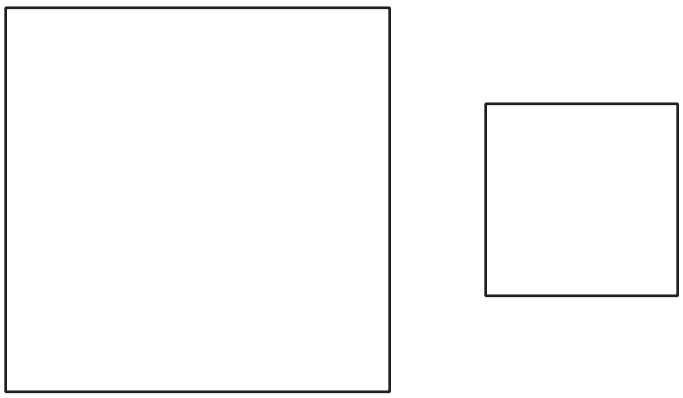
Halves or Fourths

split into halves	not split into halves
	

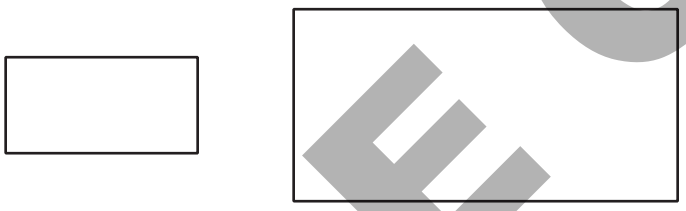
split into fourths	not split into fourths
	

SAMPLE COPY

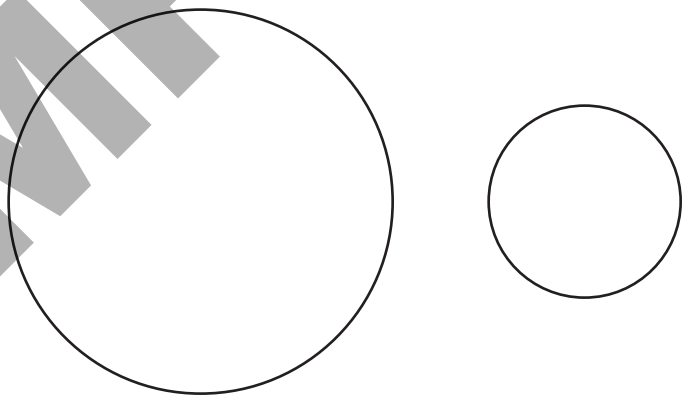
1. Split each shape into halves.



2. Split each shape into fourths.



3. Split each shape into fourths.



SAMPLE COPY

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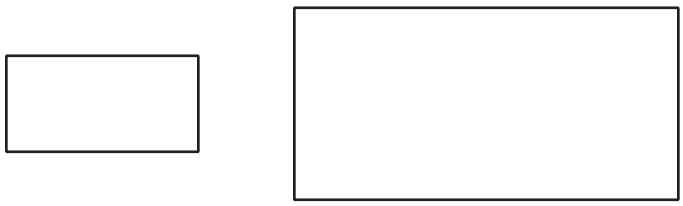
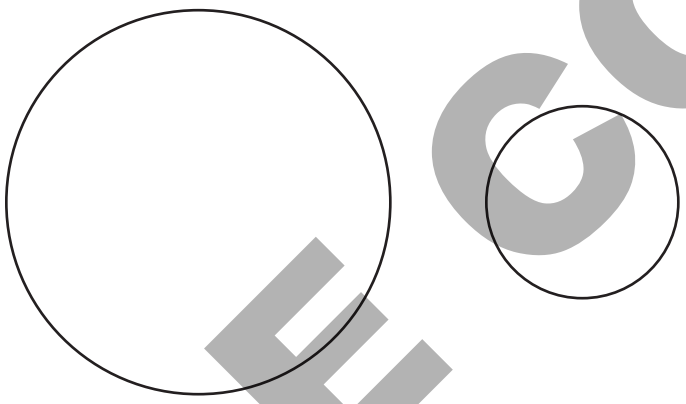
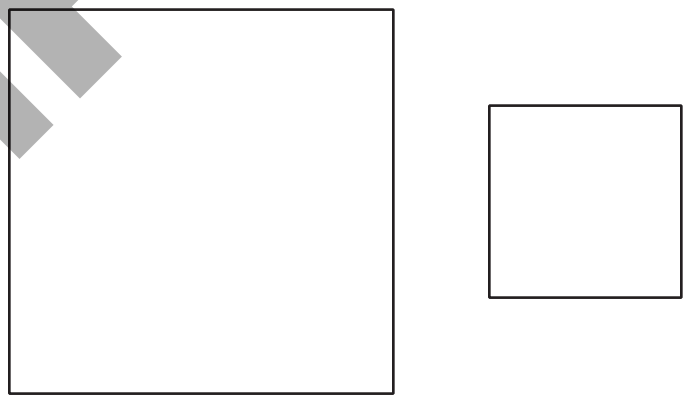
4. Split each shape into halves.



5. Split each shape into halves.



6. Split each shape into fourths.



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Unit 7, Lesson 10

Addressing CA CCSSM 1.G.3; practicing MP6 and MP7

One of the Pieces, All of the Pieces

Let's describe equal pieces of shapes.

SAMPLE COPY

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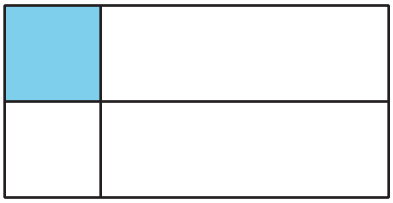
Warm-up

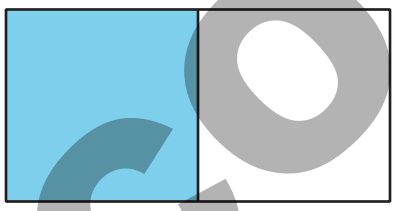
Which Three Go Together: Split Shapes

Which 3 go together?

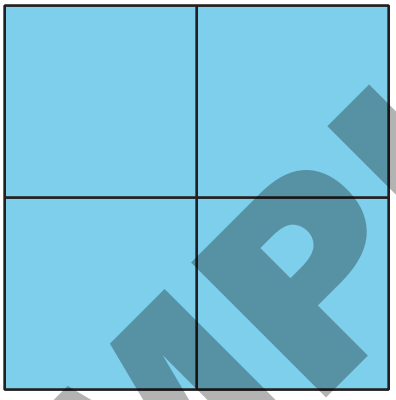
A



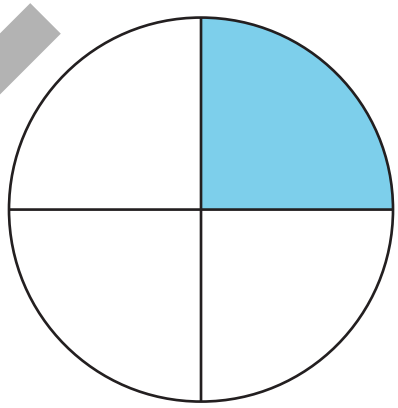
B



C



D



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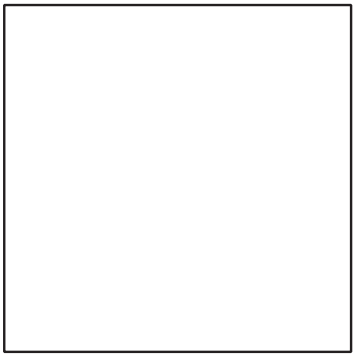
Activity 1

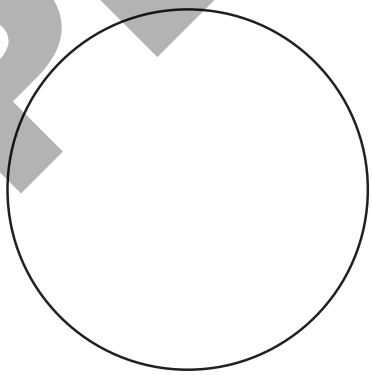
Color a Piece

1. Split the square into halves.



Color in 1 of the halves.
How much of the square is colored in?

2. Split the circle into fourths.



Color in 1 of the fourths.
How much of the circle is colored in?

SAMPLE COPY

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Activity 2

Card Sort: Shaded Pieces

Sort your cards into these categories.

A fourth or a quarter is shaded.	A half is shaded.

SAMPLE COPY

The whole shape is shaded.

The pieces are *not* equal.

SAMPLE COPY

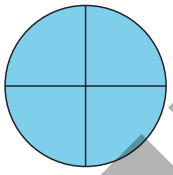
Activity 3

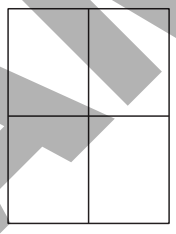
Describe Equal Pieces

Pick 1 or more of these phrases to describe each shape.

- Split into fourths
- Split into halves
- Split into quarters
- Half shaded
- A quarter shaded
- A fourth shaded
- 2 halves shaded
- 4 fourths shaded

1.

2. 

3. 

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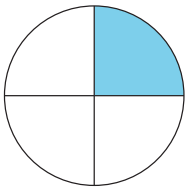
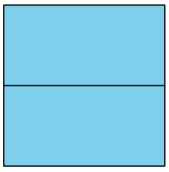
4.



5.



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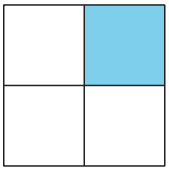

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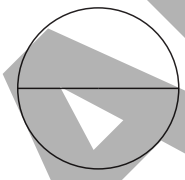

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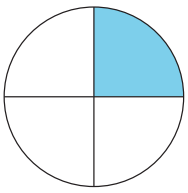
Addressing CA CCSSM 1.G.1-3 and 1.NBT.5; practicing MP3 and MP8

A Bigger Piece

Let's compare the size of halves and fourths.

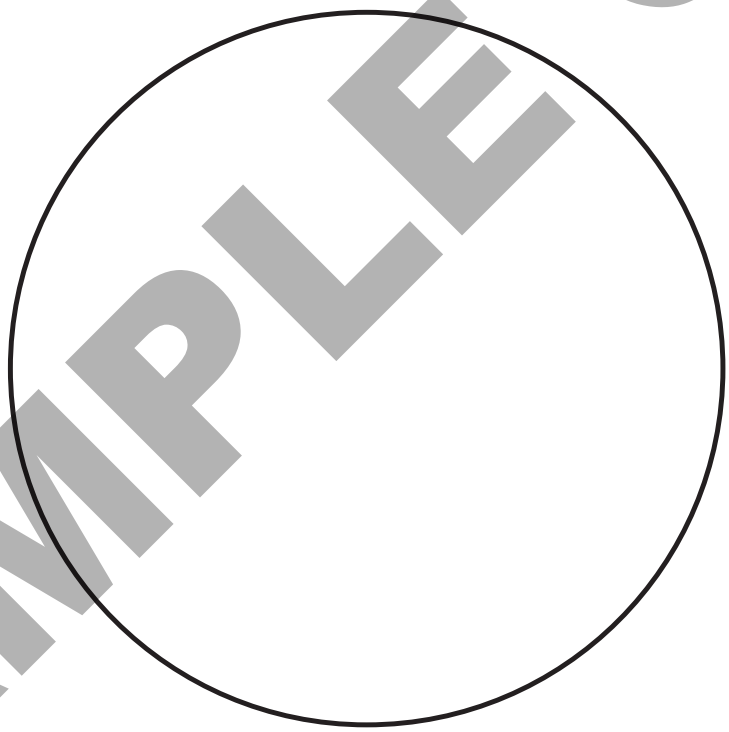
SAMPLE COPY



Activity 1

Which Is Bigger?

1. Work with a partner.
   - Cut out the circles
   - Decide who will cut halves and who will cut fourths.
   - Fold your circle into halves or fourths, and then cut it.
   - Compare your pieces with your partner.
   - What do you notice?
   - Be ready to explain your thinking.



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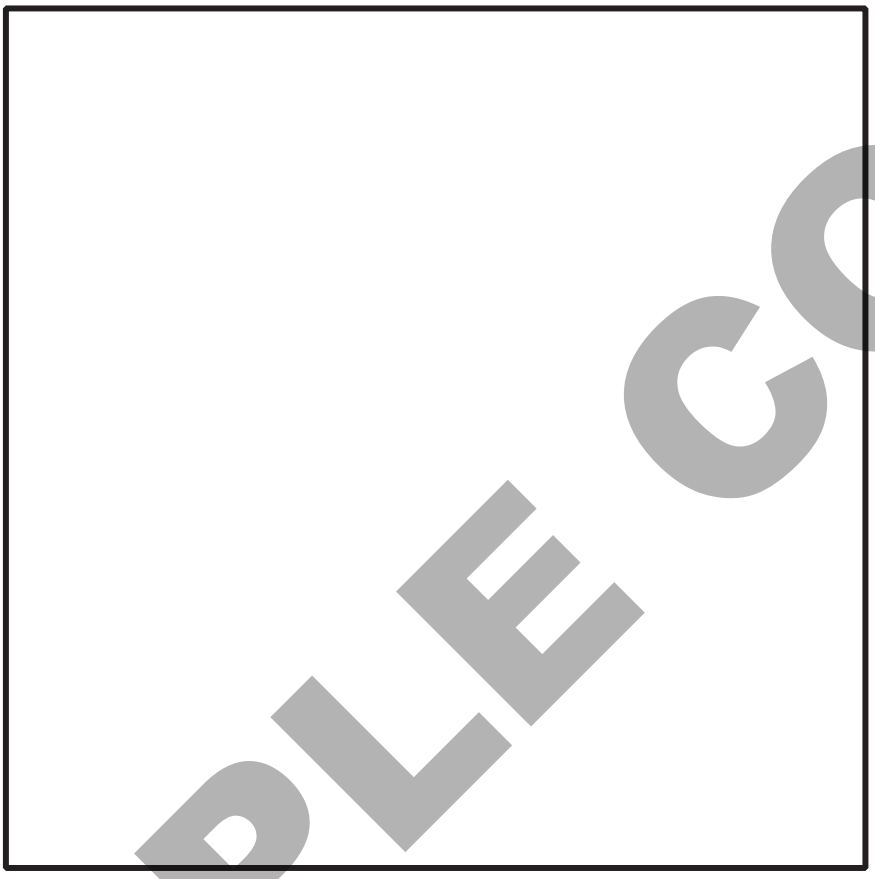
2. ○ Repeat with the squares.
   ○ Compare your pieces with your partner.
   ○ What do you notice?
   ○ Be ready to explain your thinking.



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8. Write 2 things you notice about your pieces.

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Activity 2

Priya and Han Share a Roti

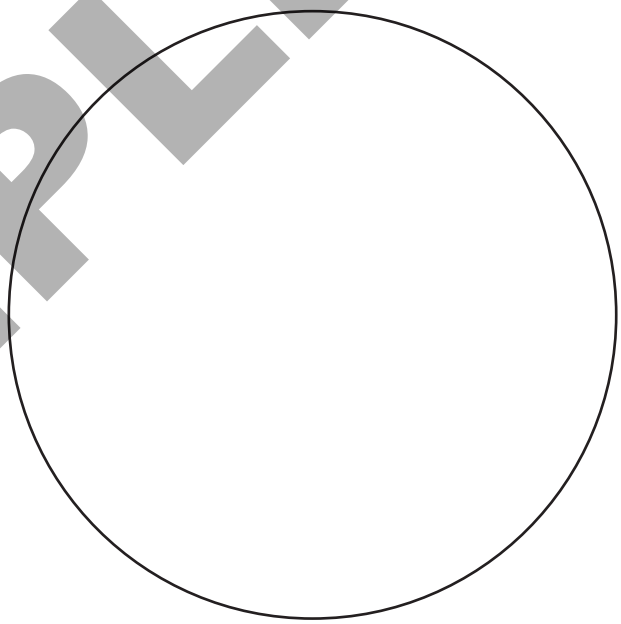
Priya and Han share a roti.

- Priya says, "I want half of the roti because halves are bigger than fourths."
- Han says, "I want a fourth of the roti because fourths are bigger than halves. I know because 4 is bigger than 2."

Who do you agree with?

Show your thinking, using drawings, numbers or words.

Use the circle if it helps you.



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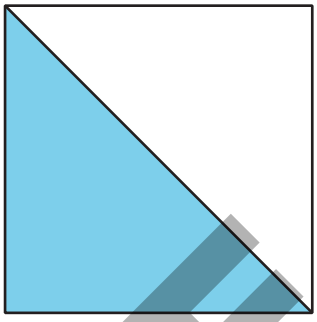
Section B Summary

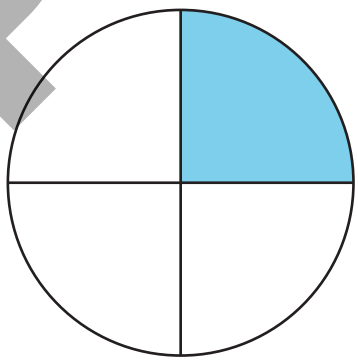
We learned that circles and rectangles can be split into equal pieces.

- 2 equal pieces are called **halves**.
- 4 equal pieces are called **fourths**, or quarters.

A half of the square is shaded.



A fourth, or a quarter, of the circle is shaded.



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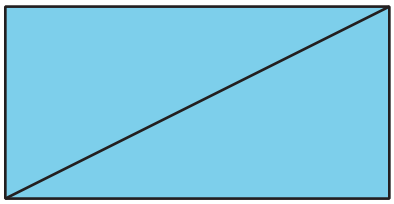
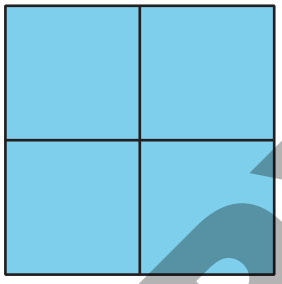
2 halves are shaded.



4 fourths are shaded.



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Addressing CA CCSSM 1.G.1 and 1.OA.6; practicing MP6

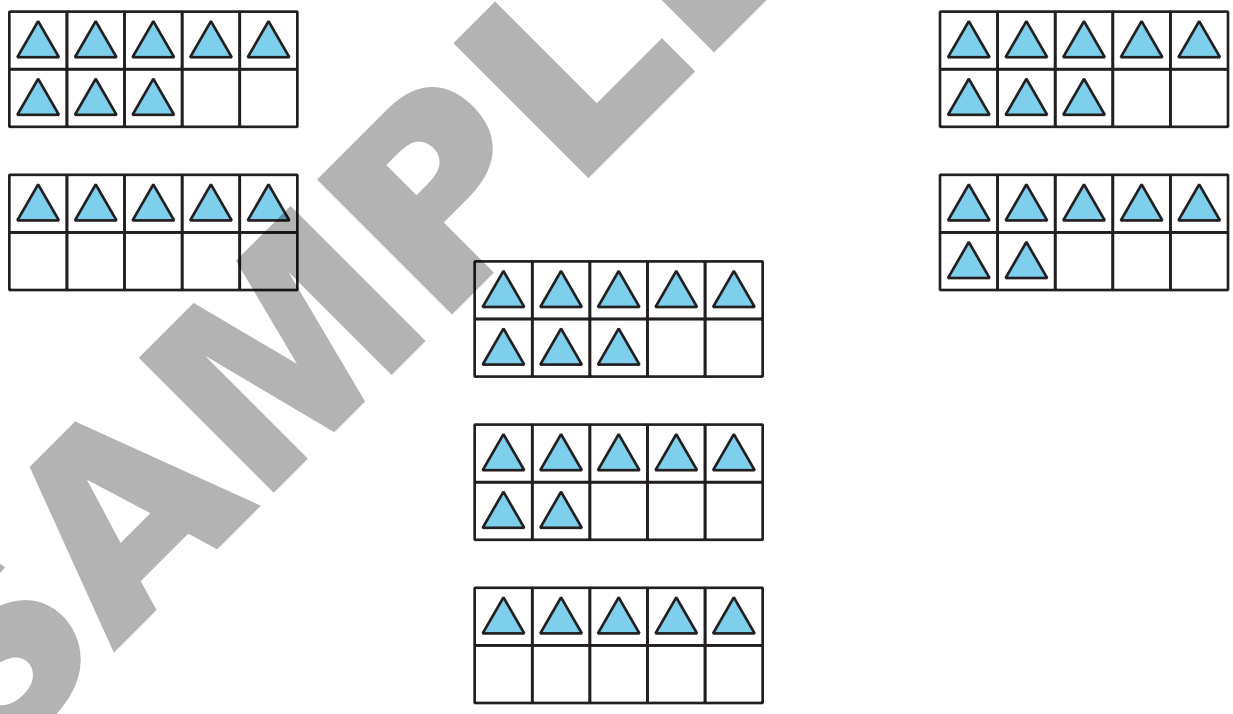
Center Day 2

Let's work with shapes and numbers.

Warm-up

How Many Do You See: 2 or 3 Parts

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



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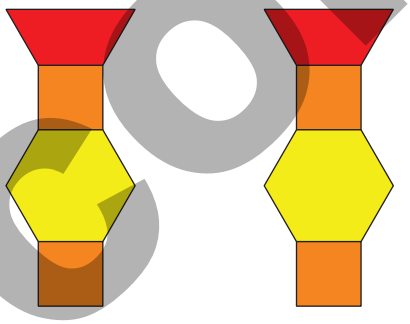
Activity 2

Centers: Choice Time

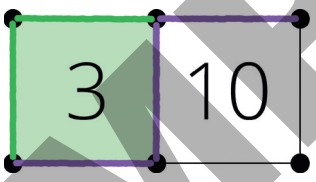
Choose a center.

Picture Books

Match Mine



Capture Squares



Target Numbers

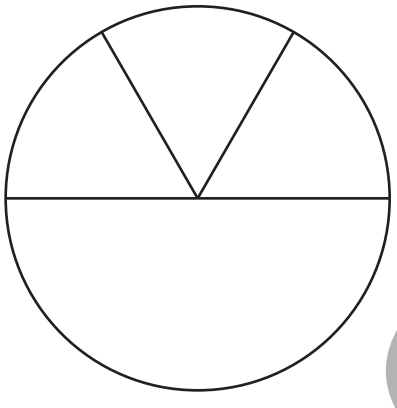
SAMPLE COPY

Practice Problems

5 Problems

1 from Unit 7, Lesson 9

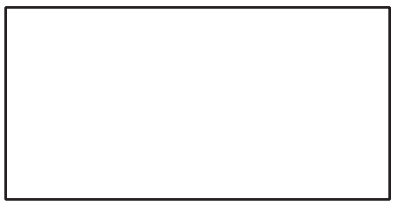
a. Han says this circle is split into fourths.



Do you agree?

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

b. Split the rectangle into fourths.



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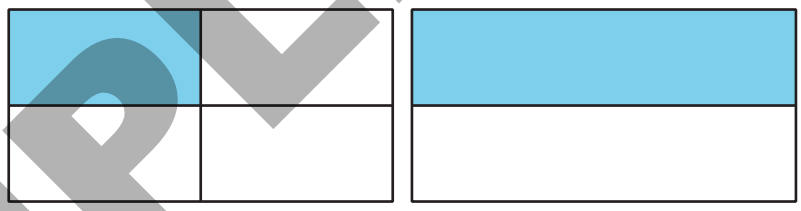
2 from Unit 7, Lesson 10

a. Split the circle into fourths.

b. Color 4 fourths.

3 from Unit 7, Lesson 10

a. How much of each rectangle is shaded?



_____ _____

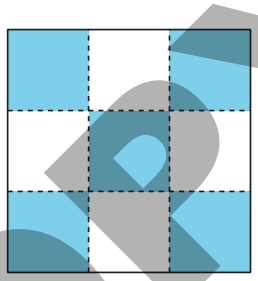
b. Circle the rectangle that has a bigger shaded piece.

SAMPLE COPY

a. Kiran says half of the large square is shaded.

Do you agree?

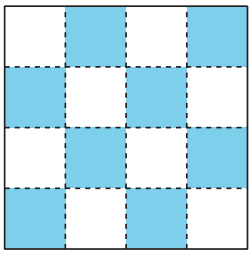
Show your thinking, using drawings, numbers, or words.



b. Priya says half of the large square is shaded.

Do you agree?

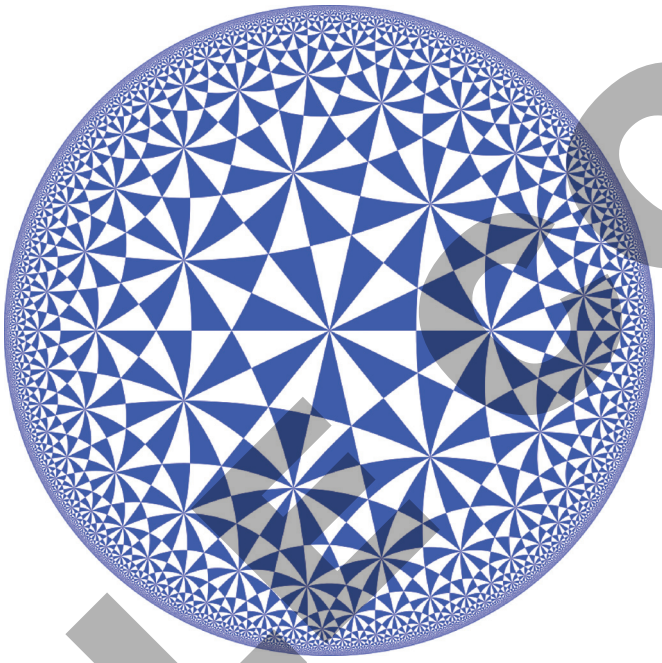
Show your thinking, using drawings, numbers, or words.



SAMPLE COPY

5 Exploration

Han wonders if half of the circle is shaded.
What do you think?



SAMPLE COPY

Unit 7, Lesson 13

Addressing CA CCSSM 1.MD.3; practicing MP2 and MP7

It's Time to Learn about Clocks

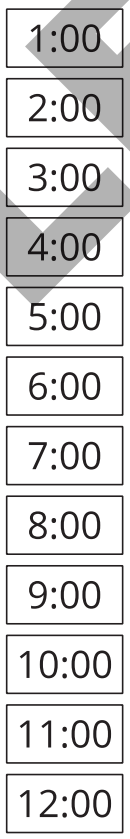
Let's tell and write times from a clock.

Warm-up

Sec C

Notice and Wonder: Clocks

What do you notice?
What do you wonder?

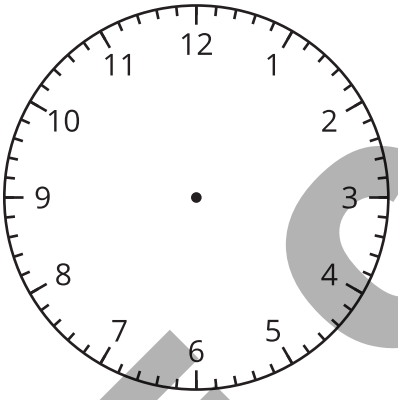


SAMPLE COPY

Activity 1

Organize Clocks

What do you notice about this clock?
What do you wonder?

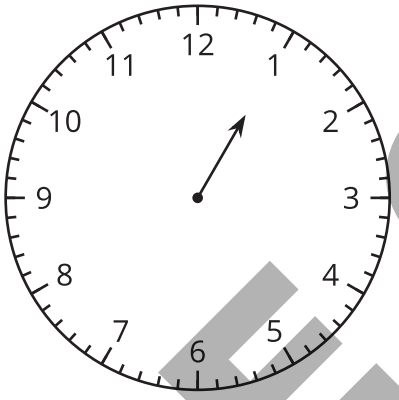


SAMPLE COPY

Activity 2

Connect Clocks to Written Times

Both clocks show the same time.
What time do they show?
How do you know?



1:00

SAMPLE COPY

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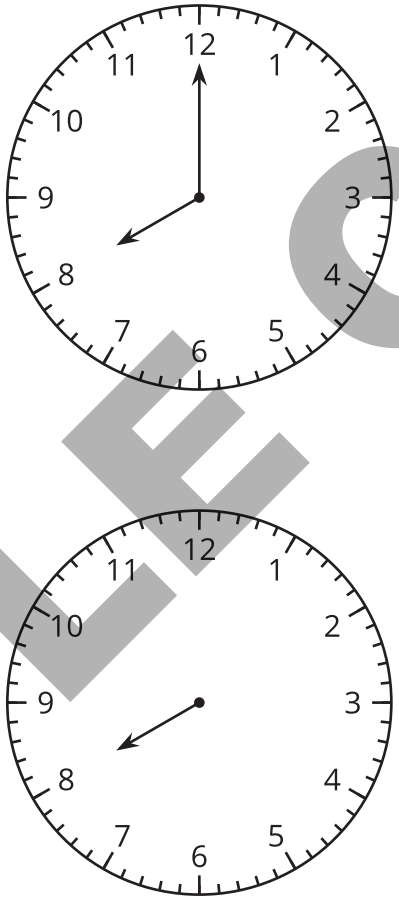
Activity 3

Our School Day

These 2 clocks show the same time.
What do you notice?



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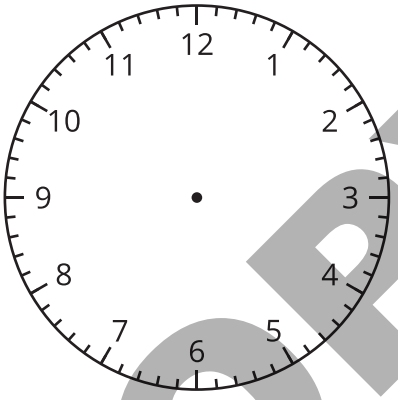
Fill in the clocks to show what time each activity starts.

8:00

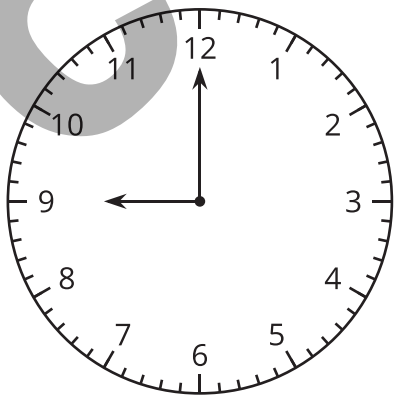
Arrival



Sec C

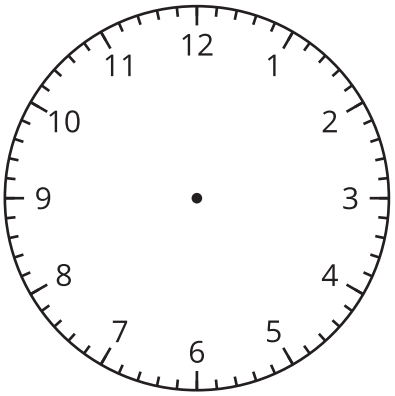
:

Reading



10:00

Snack



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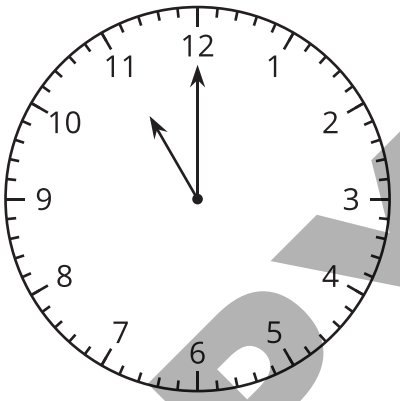
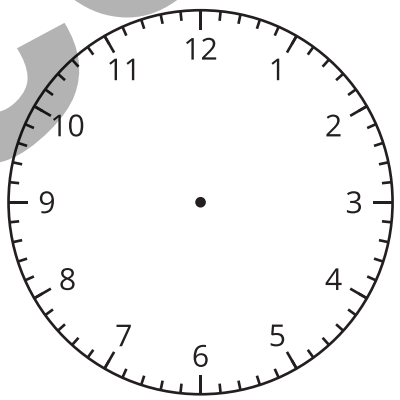
:

Math



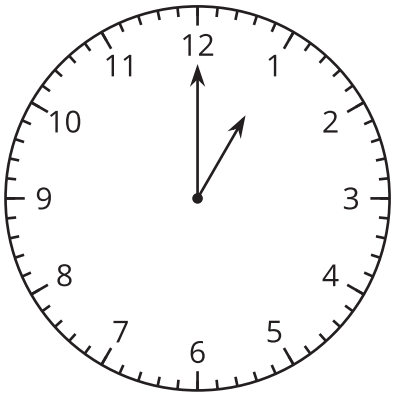
12:00

Lunch



:

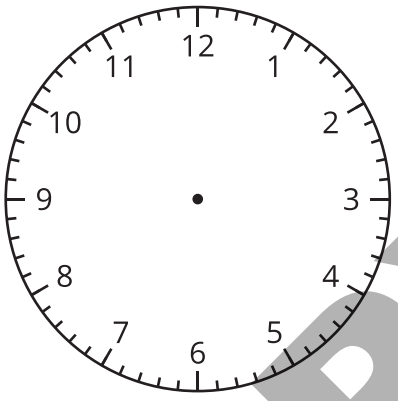
Recess



SAMPLE COPY

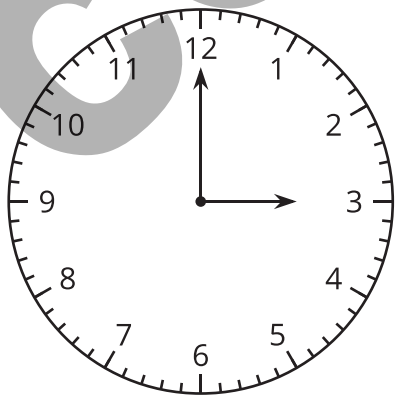
2:00

Art



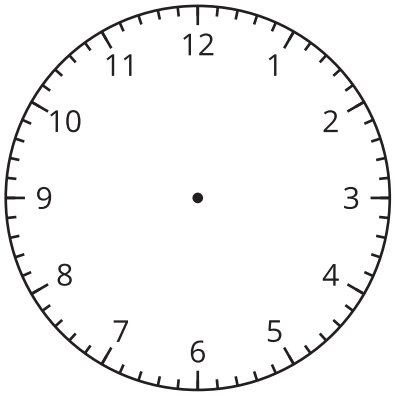
:

Dismissal



4:00

Homework



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Addressing CA CCSSM 1.MD.3 and 1.NBT.4; practicing MP7

Half of the Clock

Let's learn more about time to the half hour.

Warm-up

Number Talk: Work with 30

Find the value of each expression mentally.

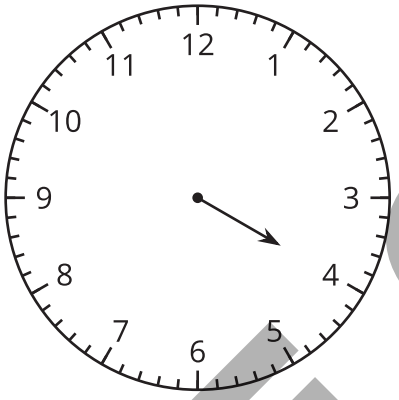
- 30 + 10
- 30 + 15
- 30 + 30
- 30 + 35

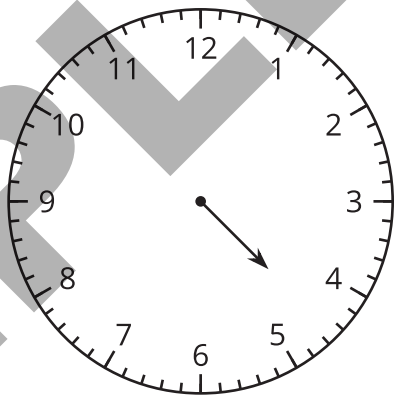
SAMPLE COPY

Activity 1

Put Times in Order

What do you notice?
What do you wonder?





SAMPLE COPY

Activity 2

Half Past What?

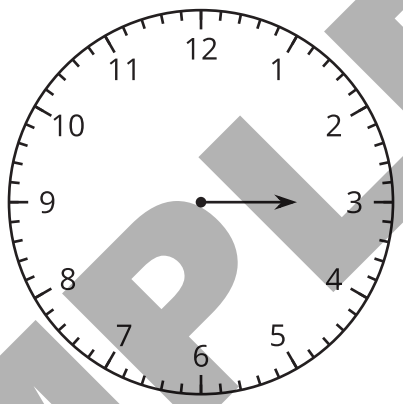
What time is shown on each clock?

- If the time is **half past**, color the clock red.
- If the time is **o'clock**, color the clock blue.

For the first 2 clocks, circle the time.

For the rest of the clocks, write the time. Use "o'clock" or "half past."

1.



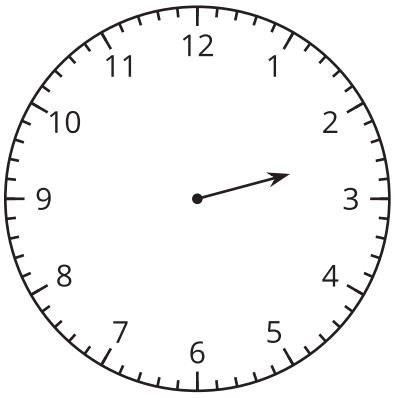
half past 2

3 o'clock

half past 3

SAMPLE COPY

2.

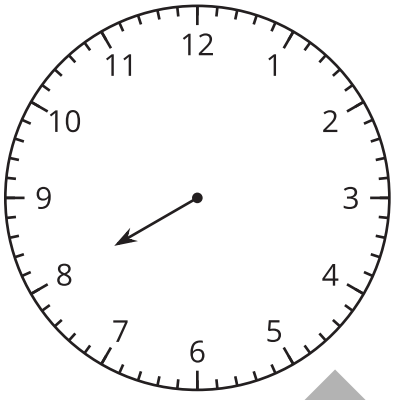


half past 2

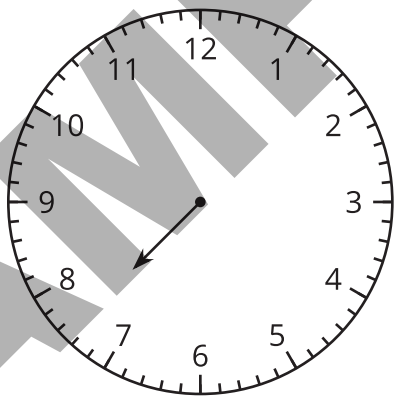
3 o’clock

half past 3

3.



4.



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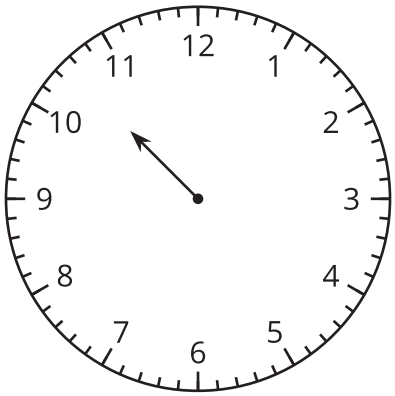
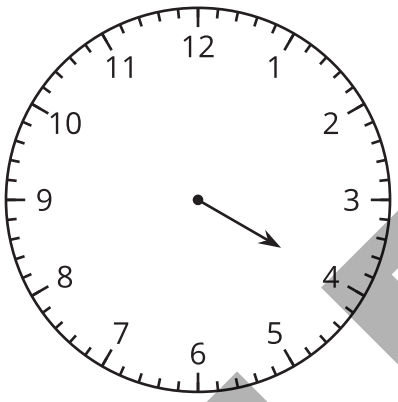
5.



6.



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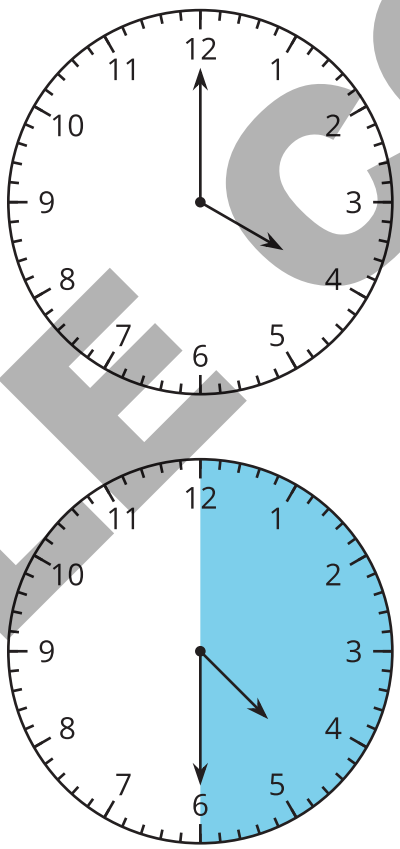
Activity 3

Notice and Wonder: The Hands on the Clock Go Round and Round

What do you notice?

What do you wonder?



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Addressing CA CCSSM 1.MD.3, 1.NBT.1, and 1.OA.7; practicing MP7

Write Times

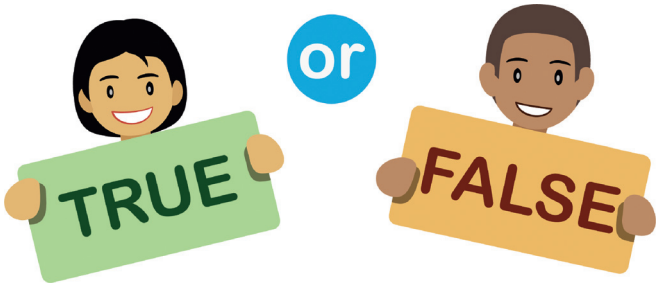
Let's write times in hours and half hours.

Warm-up

True or False: Close to 30

Decide if each statement is true or false.
Be prepared to explain your reasoning.

- $30 = 30$
- $10 + 15 = 15 + 10$
- $10 + 10 + 10 = 3$

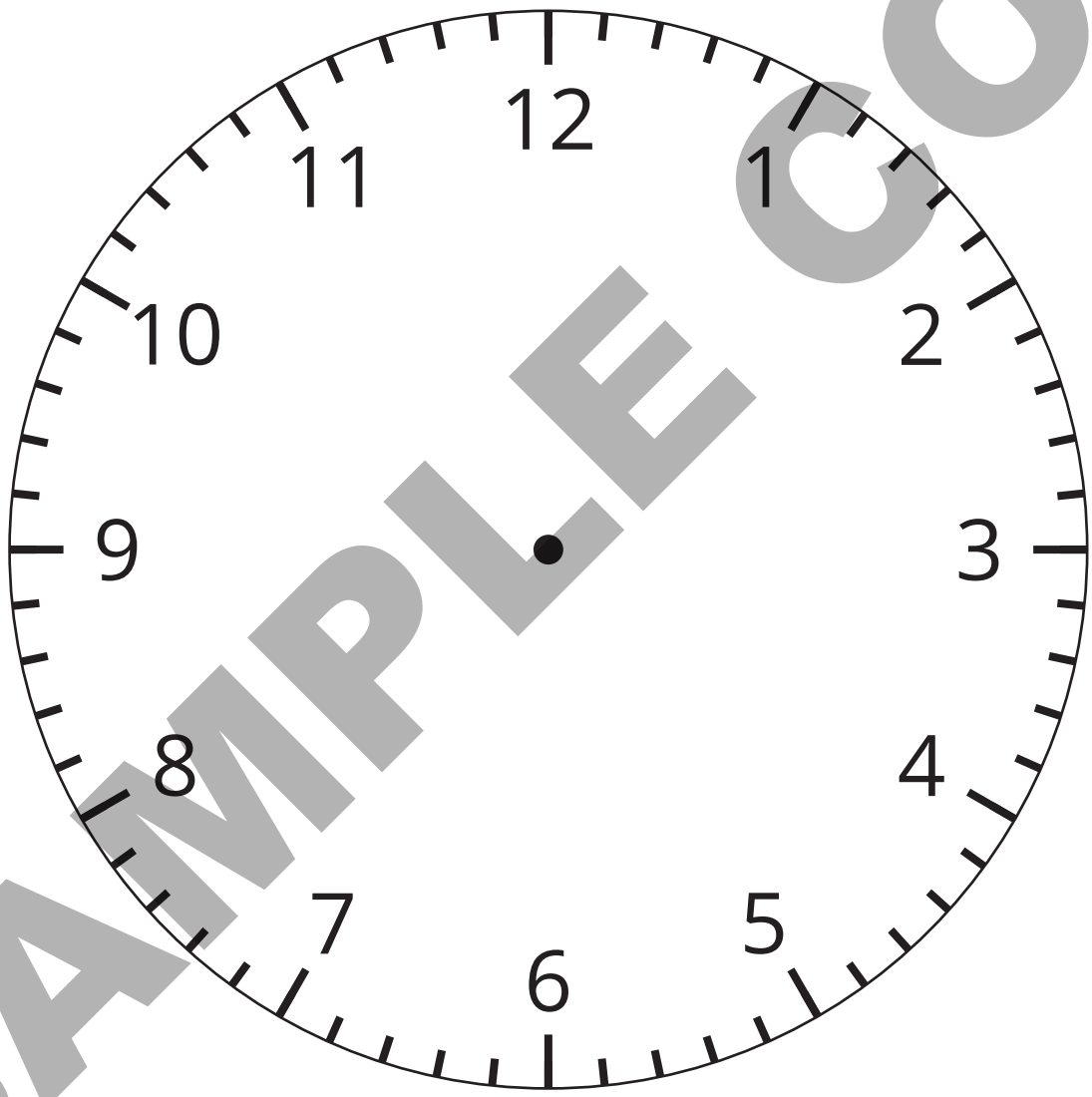


SAMPLE COPY

Activity 1

Count the Minutes

Start at 12.
Count the minutes until you get halfway around the clock.
Circle where you stop.



SAMPLE COPY

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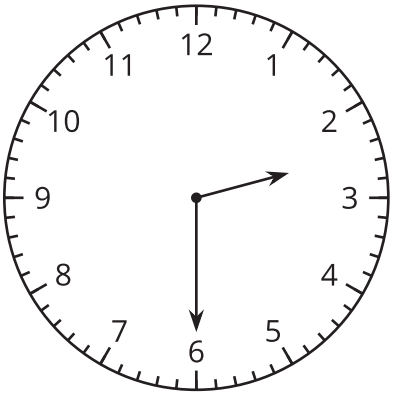
Your teacher will tell you what to do with these clocks.



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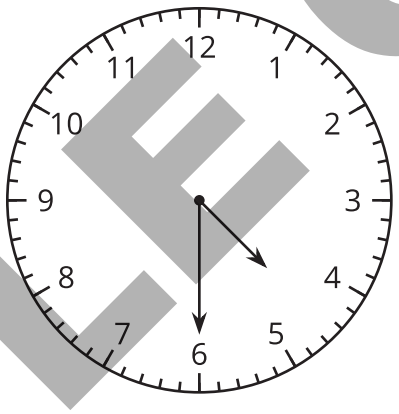

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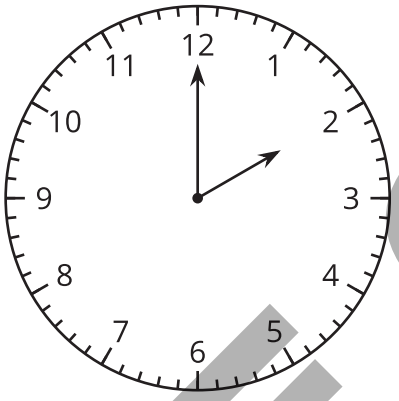
SAMPLE COPY

Activity 2

All the Time in the World

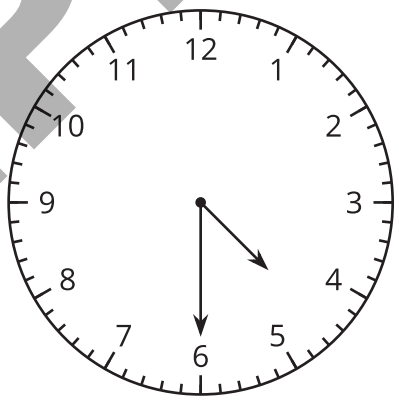
1. Write the time shown on each clock.

   a.



   :

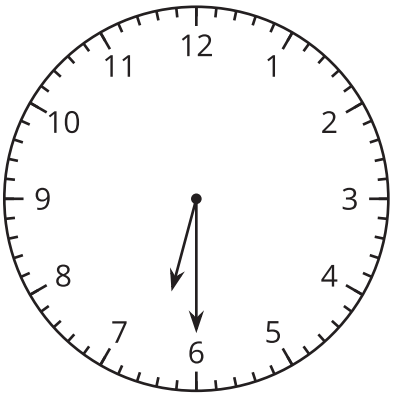
   b.



   :

SAMPLE COPY

c.



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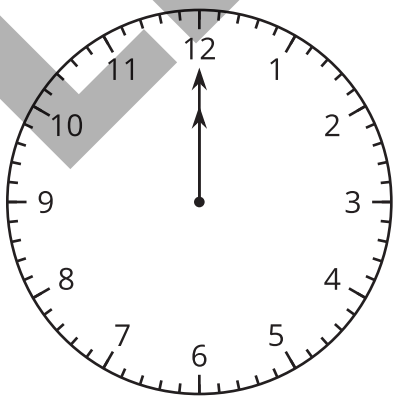
d.



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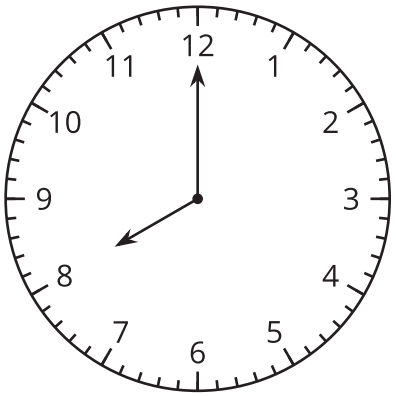
SAMPLE COPY

e.



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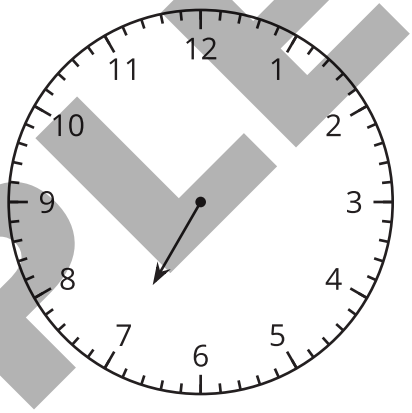
Sec C

2. For each clock, draw the minute hand and write the time.

a.



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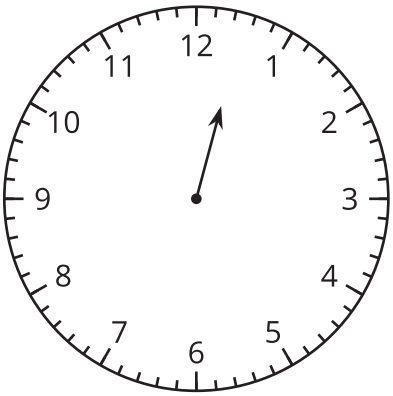
SAMPLE COPY

b.



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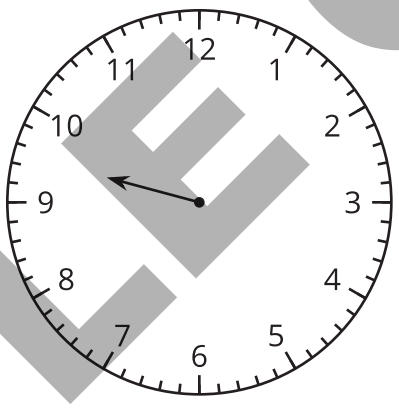
c.



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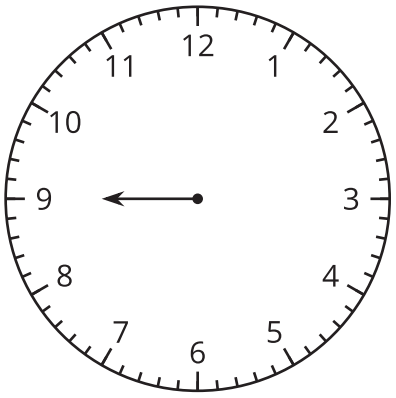
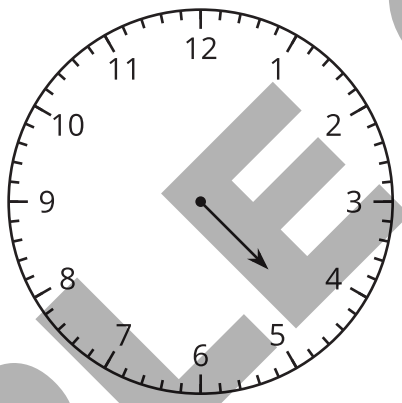
SAMPLE COPY

d.



e.



SAMPLE COPY

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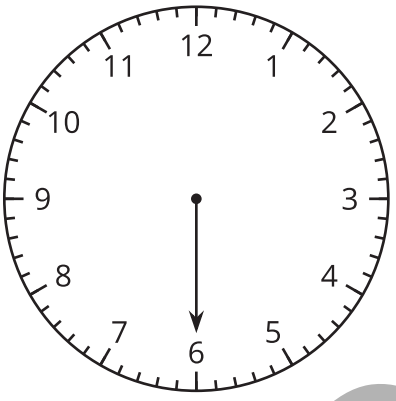
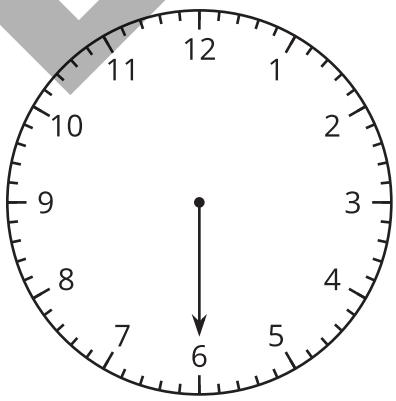
3. For each clock, draw the hour hand and write the time.

a. What time could it be?



:

b. What other time could it be?



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SAMPLE COPY

Addressing CA CCSSM 1.MD.3 and 1.NBT.4; practicing MP2, MP7, and MP8

Hard Times

Let's show time in hours and half hours.

Warm-up

Number Talk: Tens and Ones

Find the value of each expression mentally.

- 8 + 32
- 8 + 33
- 8 + 38
- 8 + 48

SAMPLE COPY

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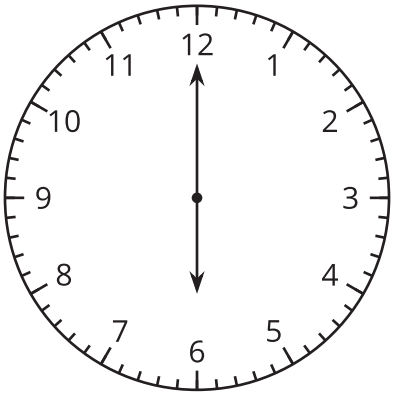
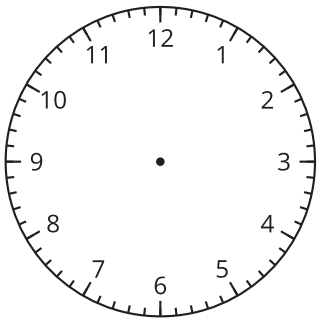
Activity 2

What's the Time, Again?



- Diego says this clock shows 6:00.
- Priya says the clock shows 12:30.
- Who do you agree with? Explain your reasoning.

Your teacher will tell you what to do with this clock.

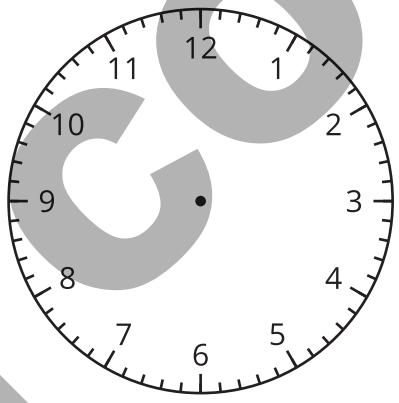
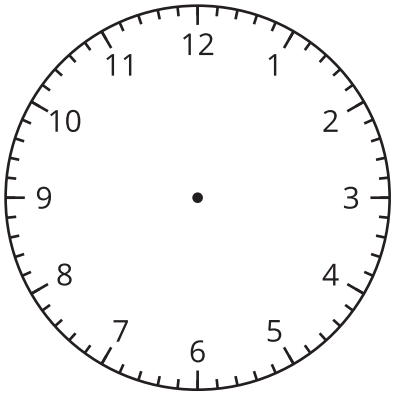


SAMPLE COPY

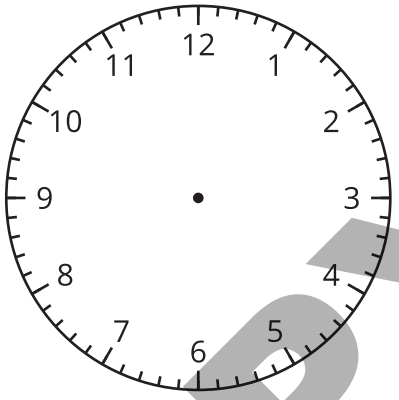
Activity 3

Sunday Schedule

Fill in the blanks to show your best Sunday schedule.

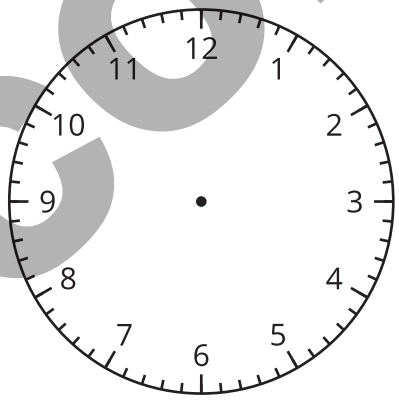
Time	Activity	Clock
:	_____	
:	_____	

SAMPLE COPY


12
1
2
3
4
5
6
7
8
9
10
11

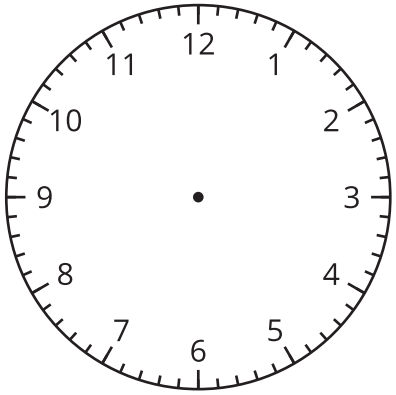
:

_____


12
1
2
3
4
5
6
7
8
9
10
11

:

_____


12
1
2
3
4
5
6
7
8
9
10
11

:

_____

SAMPLE COPY

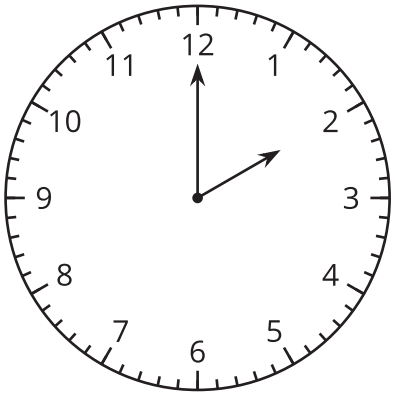
SUNDAY
FUNDAY

Section C Summary

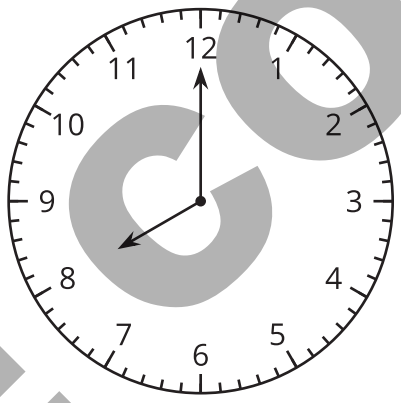
We learned how to tell time to the hour and the half hour.

We say " ___ o'clock" when:

- The minute hand points to the 12.
- The hour hand points to a number.



It is 2 o'clock.



It is 8 o'clock.

SAMPLE COPY

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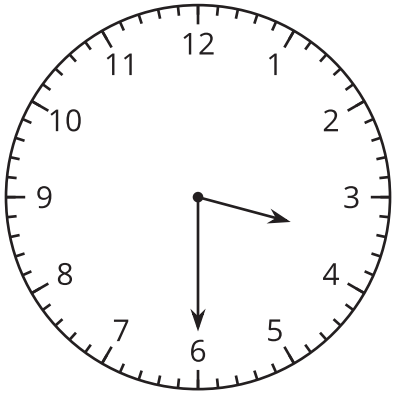
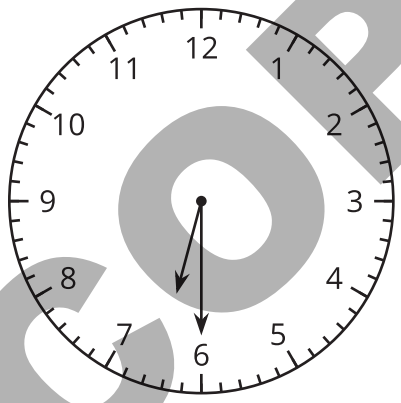
We say “half past ___” when:

- The minute hand has gone halfway around the clock and points to the 6.
- The hour hand points halfway between two numbers.



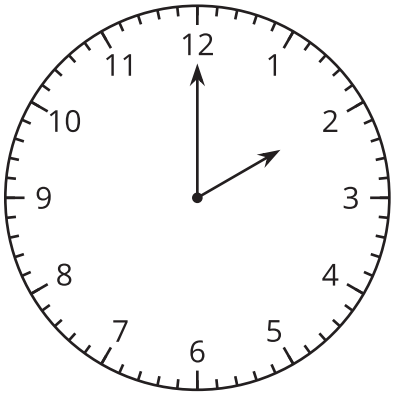
It is half past 3.



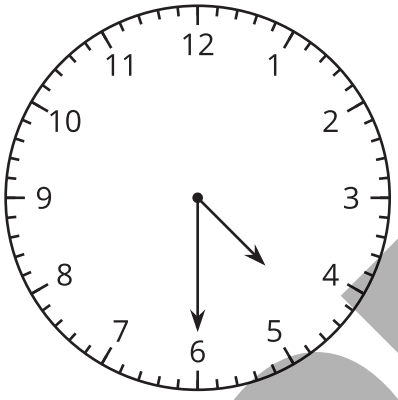
It is half past 6.

SAMPLE COPY

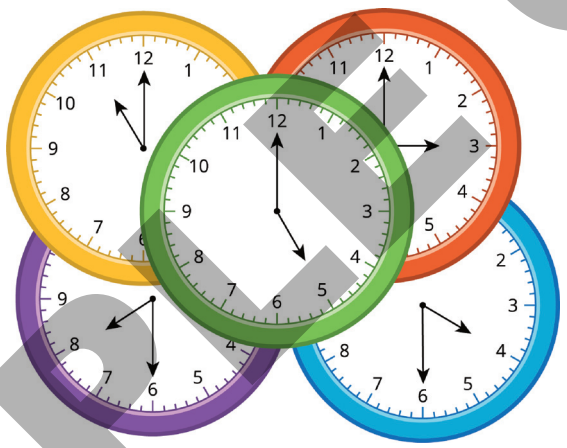
We learned how to write time.



It is 2:00.



It is 4:30.



SAMPLE COPY

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Addressing CA CCSSM 1.G.1-3 and 1.MD.3; practicing MP6

Center Day 3

Let's work with shapes and numbers.

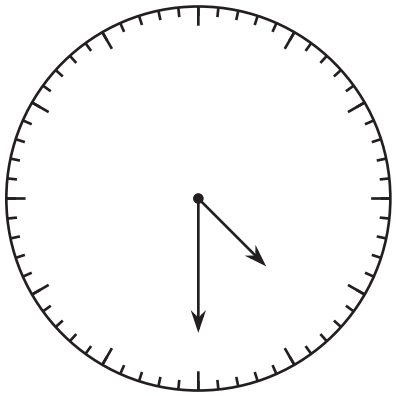
SAMPLE COPY

Warm-up

Which Three Go Together: Clocks

Which 3 go together?

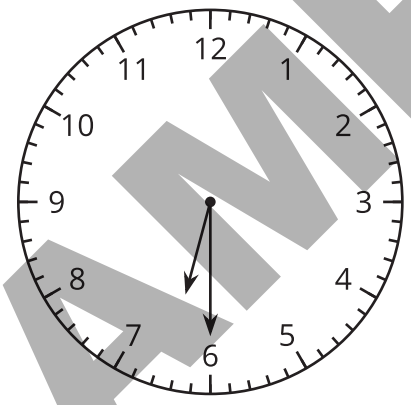
A



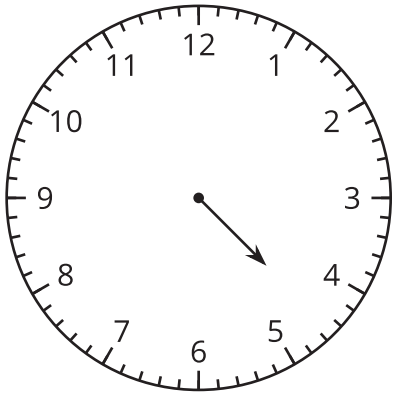
B

4:30

C



D



SAMPLE COPY

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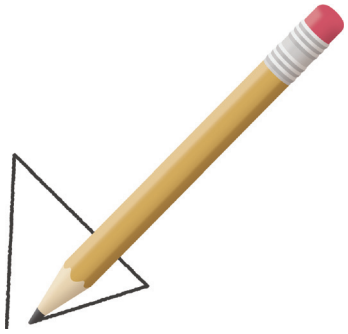
Activity 2

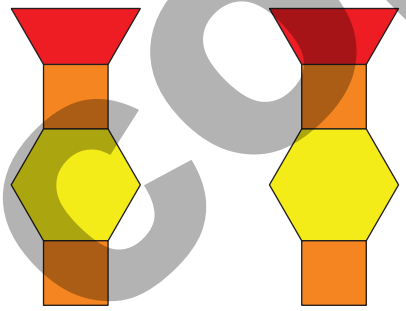
Centers: Choice Time

Choose a center.

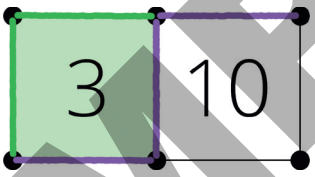
Can You Draw It?



Match Mine



Capture Squares



Target Numbers

SAMPLE COPY

Unit 7, Lesson 18

Addressing CA CCSSM 1.G.3; building on 1.G.3; building towards 1.G.3; practicing MP4

Halves and Fourths in Our World

Let's draw objects that are split into halves and fourths.

Sec C

Warm-up

Notice and Wonder: The Court

What do you notice?
What do you wonder?

SAMPLE COPY

Activity 1

Designing a Park

Designers plan a park. It will be split into 4 equal sections. Here is what will be in each section:

1. A pool in the shape of a rectangle.
   The pool will have 4 lanes for swimming laps.
   Each lane is the same size.

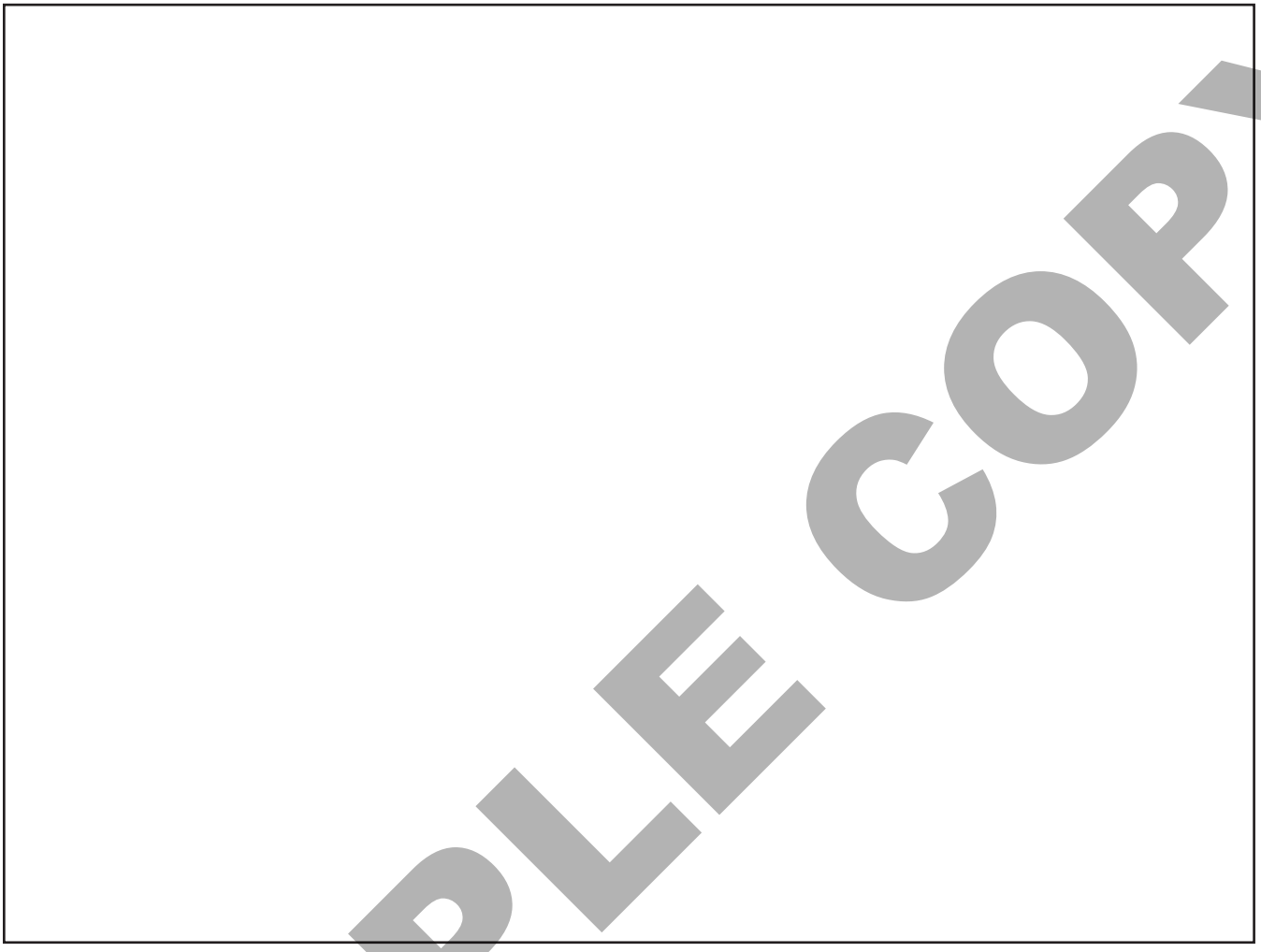
2. A tennis court in the shape of a rectangle.
   A net splits the court into 2 equal pieces.

3. A pond in the shape of a circle.
   Half of the pond will be for fishing and half for feeding the ducks.

4. A playground. A fourth of the playground is for swings, a fourth is for slides, a fourth is for a sandbox, and a fourth is for monkey bars.

SAMPLE COPY

Use the outline of the park below to make a drawing that shows each section of the park.



SAMPLE COPY

Activity 2

Halves and Fourths Hunt

Look for objects made up of circles or rectangles split into halves or fourths.

Draw the objects.

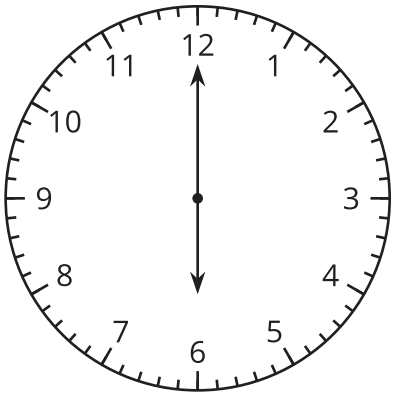
SAMPLE COPY

Practice Problems

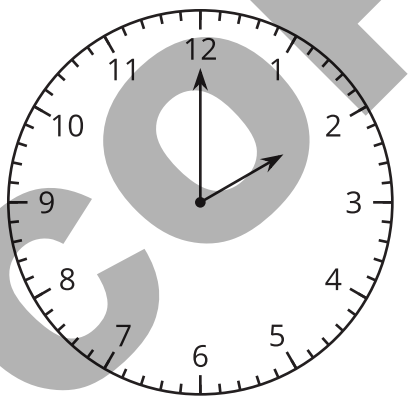
4 Problems

1 from Unit 7, Lesson 13

a. What time does each clock show? Write the time.



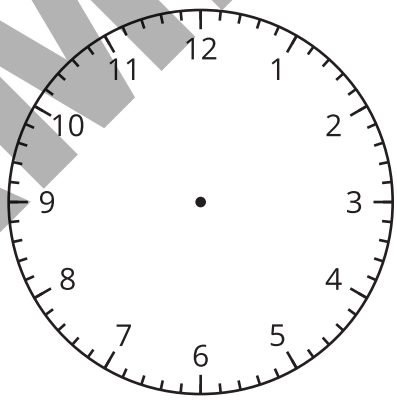
:



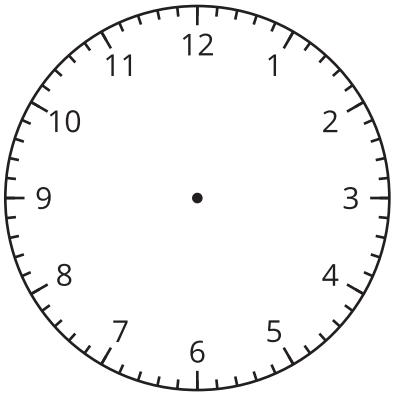
:

b. Show each time.

3:00



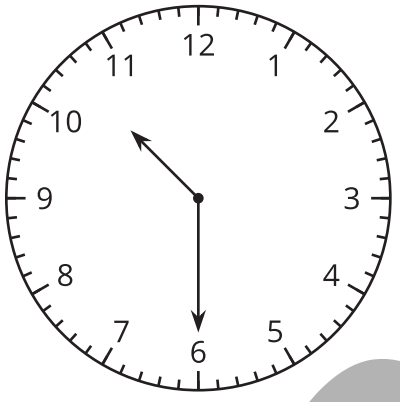
7:00



SAMPLE COPY

2 from Unit 7, Lesson 14

Han says the clock shows half past 11.



Do you agree?

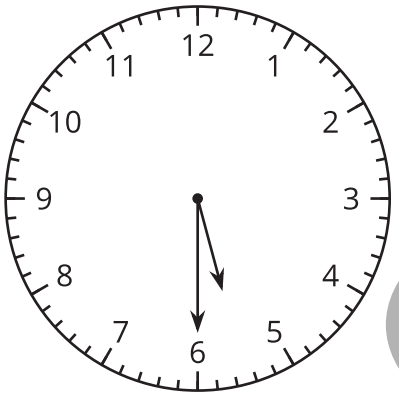
Show your thinking, using drawings, numbers, or words.

SAMPLE COPY

3 from Unit 7, Lesson 15

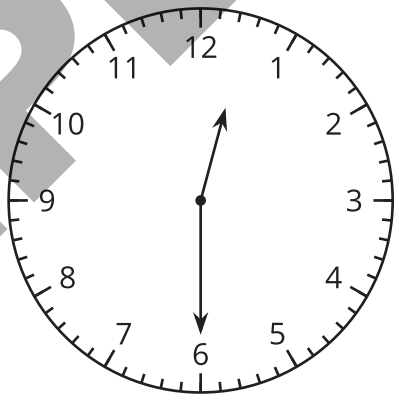
What time does each clock show?
Write the time.

a.



____ : ____

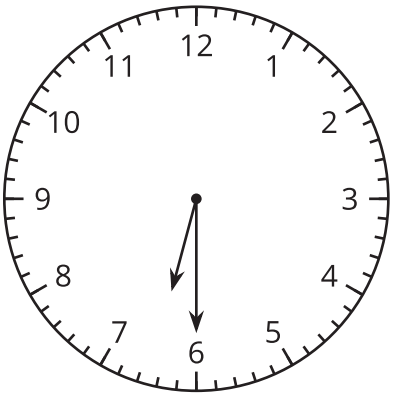
b.

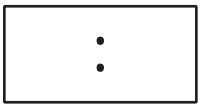


____ : ____

SAMPLE COPY

C.



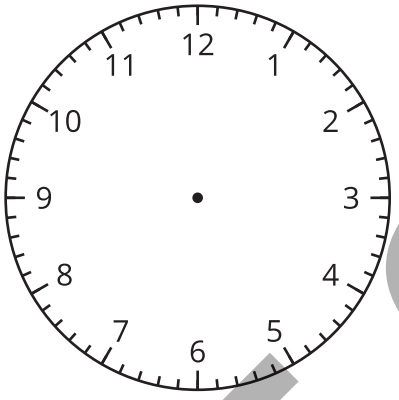


SAMPLE COPY

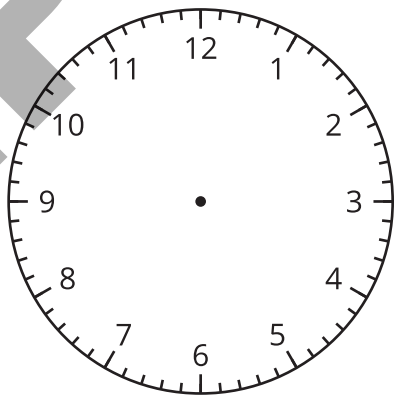
4 Exploration

Show the time when you might do each of these activities.

a. Wake up in the morning.

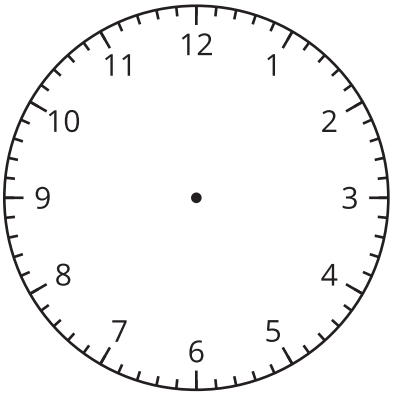


b. Go to school.

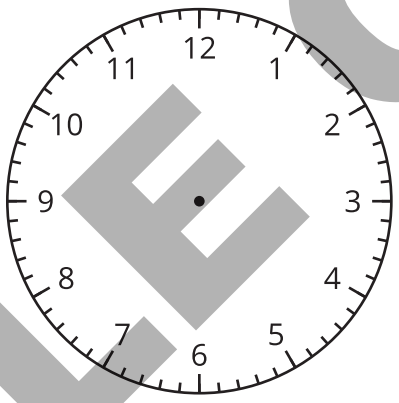


SAMPLE COPY

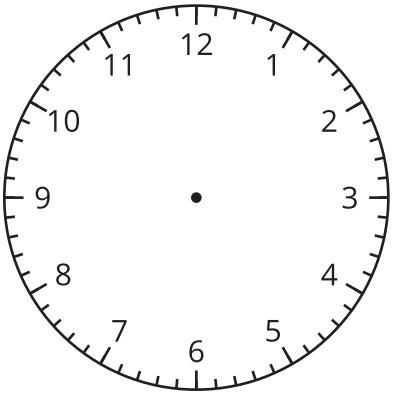
c. Have a snack.



d. Go for recess.



e. Have lunch.



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GRADE 1

UNIT

8

Putting it All Together

Content Connections

In this unit you will review what you have learned throughout the year including adding and subtracting within 20, solving story problems, exploring shapes, and telling time. You will make connections by:

- **Reasoning with Data** while collecting, representing, organizing and answering questions about two or more categories of information.
- **Exploring Changing Quantities** while solving addition and subtraction problems with the use of manipulatives and expressions and measuring objects using small units.

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- **Taking Wholes Apart, Putting Parts Together** while making sense of adding as it relates to composing a ten when adding ones and ones and learning about 2D and 3D shapes by partitioning shapes into equal shares.

Addressing the Standards

As you work your way through **Unit 8 Putting it All Together,** 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 5
MP2 Reason abstractly and quantitatively.	Lesson 4, 5, 6
MP3 Construct viable arguments and critique the reasoning of others.	Lesson 5, 8, 9
MP4 Model with mathematics.	Lesson 6
MP5 Use appropriate tools strategically.	
MP6 Attend to precision.	Lesson 6, 7
MP7 Look for and make use of structure.	Lesson 2, 3, 4, 5, 7, 9, 10
MP8 Look for and express regularity in repeated reasoning.	Lesson 1

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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
• Make Sense of Data • Equal Expressions	**1.OA.1** Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.	Lesson 4, 5, and 6

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Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Make Sense of Data • Equal Expressions	**1.OA.2** Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.	Lesson 6
• Equal Expressions • Reasoning about Equality	**1.OA.6** Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., $8 + 6 = 8 + 2 + 4 = 10 + 4 = 14$); decomposing a number leading to a ten (e.g., $13 – 4 = 13 – 3 – 1 = 10 – 1 = 9$); using the relationship between addition and subtraction (e.g., knowing that $8 + 4 = 12$, one knows $12 – 8 = 4$); and creating equivalent but easier or known sums (e.g., adding $6 + 7$ by creating the known equivalent $6 + 6 + 1 = 12 + 1 = 13$).	Lesson 1, 2, 3, 4, 5, 6

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Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Equal Expressions • Reasoning about Equality	**1.OA.7** Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. *For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.*	Lesson 5
• Equal Expressions	**1.OA.8** Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 + ? = 11, 5 = □ – 3, 6 + 6 = □.*	Lesson 2 and 3

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Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Make Sense of Data • Tens and Ones	**1.NBT.1** Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.	Lesson 7
• Clocks and Time • Reasoning about Equality • Tens and Ones	**1.NBT.2** Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: a. 10 can be thought of as a bundle of ten ones—called a "ten." b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).	Lesson 7, 8, 9, and 10

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Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Reasoning about Equality • Tens and Ones	**1.NBT.3** Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.	Lesson 7, 8, 9, and 10
• Equal Expressions • Reasoning about Equality	**1.NBT.4** Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relation-ship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.	Lesson 5, 9, and 10

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Big Ideas You Are Studying	California Content Standards	Lessons Where You Learn This
• Tens and Ones	**1.NBT.5** Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.	Lesson 9 and 10
• Tens and Ones	**1.NBT.6** Subtract multiples of 10 in the range 10–90 from multiples of 10 in the range 10–90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.	Lesson 9 and 10

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Addressing CA CCSSM 1.OA.6; practicing MP8

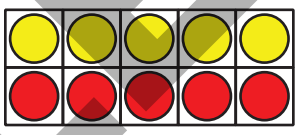
Addition Fluency within 10

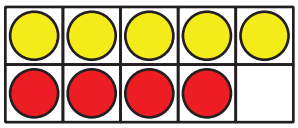
Let's add within 10.

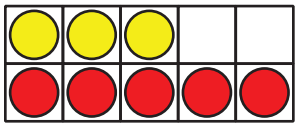
Warm-up

How Many Do You See: Within 10

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







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Activity 1

Sums I Know

Color the sums you know.

0+0	0+1	0+2	0+3	0+4	0+5	0+6	0+7	0+8	0+9	0+10
1+0	1+1	1+2	1+3	1+4	1+5	1+6	1+7	1+8	1+9	
2+0	2+1	2+2	2+3	2+4	2+5	2+6	2+7	2+8		
3+0	3+1	3+2	3+3	3+4	3+5	3+6	3+7			
4+0	4+1	4+2	4+3	4+4	4+5	4+6				
5+0	5+1	5+2	5+3	5+4	5+5					
6+0	6+1	6+2	6+3	6+4						
7+0	7+1	7+2	7+3							
8+0	8+1	8+2								
9+0	9+1									
10+0										

Write each sum that isn't colored on an index card.
Use the cards to practice these sums.

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Activity 2

Centers: Choice Time

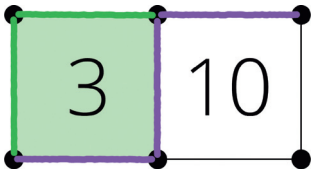
Choose a center.

Check It Off

Number Puzzles

$14 = 8 + \square$

Capture Squares



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Addressing CA CCSSM 1.OA.6 and 1.OA.8; practicing MP7

Relate Addition and Subtraction

Let's look at the relationship between addition and subtraction.

Warm-up

Number Talk: Connect Addition and Subtraction

Find the value of each expression mentally.

- 5 + 4
- 4 + 5
- 9 – 4
- 9 – 5

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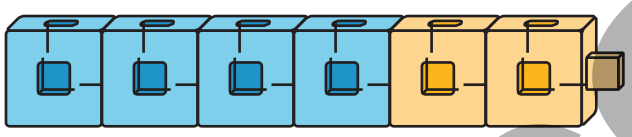
Activity 1

Cube Tower Addition and Subtraction

Write an addition and a subtraction equation to match the connecting cubes.

1.



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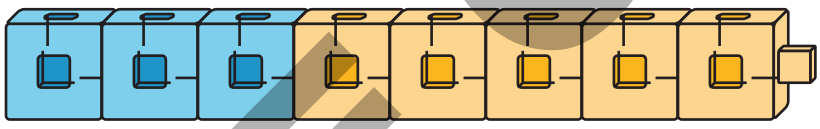

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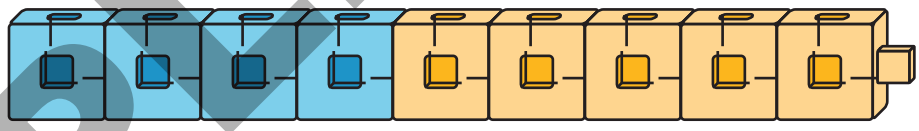

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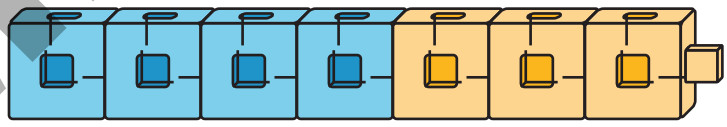

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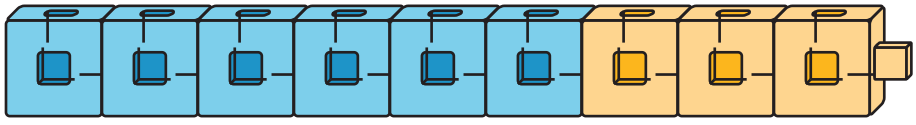

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Activity 2

Find the Unknown Number

Find the number that makes each equation true.
Explain to your partner how you found it.

1. $4 + \square = 9$

2. $9 - 5 = \square$

3. $\square + 5 = 8$

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4. $8 - 3 = \square$

5. $7 - 4 = \square$

6. $8 = 2 + \square$

7. $8 - \square = 4$

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Activity 3

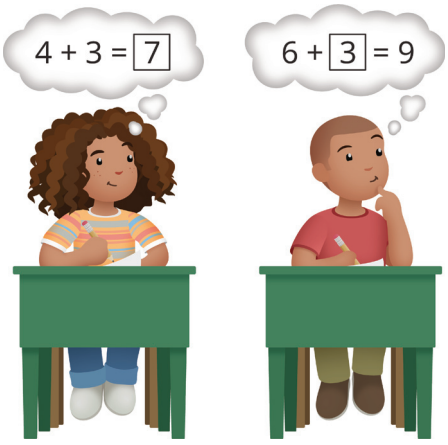
Differences I Know

Color the differences you know.

10-0	10-1	10-2	10-3	10-4	10-5	10-6	10-7	10-8	10-9	10-10
9-0	9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8	9-9	
8-0	8-1	8-2	8-3	8-4	8-5	8-6	8-7	8-8		
7-0	7-1	7-2	7-3	7-4	7-5	7-6	7-7			
6-0	6-1	6-2	6-3	6-4	6-5	6-6				
5-0	5-1	5-2	5-3	5-4	5-5					
4-0	4-1	4-2	4-3	4-4						
3-0	3-1	3-2	3-3							
2-0	2-1	2-2								
1-0	1-1									

Write each difference that isn't colored on an index card.

Write an addition equation on the card that can help you find the value of the difference.



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Addressing CA CCSSM 1.OA.6 and 1.OA.8; practicing MP7

Add and Subtract within 20

Let's add and subtract within 20.

Warm-up

Number Talk: Use Known Sums

Find the value of each expression mentally.

- 6 + 7
- 13 – 7
- 7 + 8
- 15 – 7

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Activity 1

Many Ways to Add and Subtract

Circle 1 addition expression and 1 subtraction expression.

$5 + 9$	$14 - 8$
$4 + 7$	$15 - 9$
$6 + 4 + 4$	$13 - 6$

Find the value of the expressions in as many different ways as you can.

Show your thinking using drawings, numbers, or words.

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Activity 2

Heads Up

Write an equation for each round you play.

Round 1: _____

Round 2: _____

Round 3: _____

Round 4: _____

Round 5: _____

Round 6: _____

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Unit 8, Lesson 4

Addressing CA CCSSM 1.OA.1 and 1.OA.6; practicing MP2 and MP7

Change Unknown Story Problems

Let's solve story problems.

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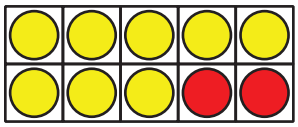
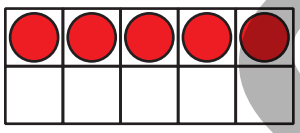
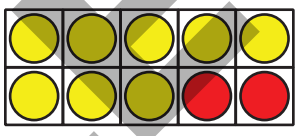
Warm-up

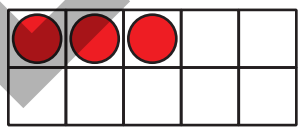
How Many Do You See: Numbers to 20

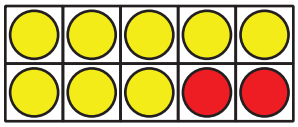
How many do you see?
How do you see them?

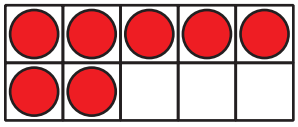












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Activity 1

Field Trip to the Aquarium

Solve each problem.

Show your thinking using drawings, numbers, or words.

1. Clare sees 8 sea turtles swimming.
   Some more turtles join them.
   Now there are 15 turtles.
   How many turtles join the group?

2. 17 penguins sit on the rocks.
   Some of the penguins jump into the water.
   Now 5 penguins sit on the rocks.
   How many penguins jump into the water?

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3. The trainer brings out a bucket of 20 fish.
   The seals eat some of the fish.
   Now there are 3 fish left in the bucket.
   How many fish do the seals eat?

4. In the touch pools, Tyler touches 6 stingrays.
   Then he touches some sea stars.
   Tyler touches 14 animals all together.
   How many sea stars does Tyler touch?

SAMPLE COPY

Activity 2

Find the Unknown Number

Clare watches 16 bullfrogs at the aquarium.
Then some of them swim away.
Now Clare can only see 9 bullfrogs.
How many bullfrogs swim away?

Andre wrote 16 – ☐ = 9, but he doesn't know how to find the unknown number.

Show Andre how you would find the unknown number.
Show your thinking using drawings, numbers, or words.

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Addressing CA CCSSM 1.NBT.4, 1.OA.1, 1.OA.6, and 1.OA.7; practicing MP1, MP2, MP3, and MP7

Put Together and Take Apart Story Problems

Let's solve more story problems.

Warm-up

True or False: More or Less

Decide if each statement is true or false.
Be prepared to explain your reasoning.

- 57 + 20 = 59
- 66 – 4 = 62
- 17 + 76 = 59

SAMPLE COPY

Activity 1

At the Planetarium

Solve each problem.

Show your thinking using drawings, numbers, or words.

1. There are 7 first graders and some second graders at the planetarium.
   There are 18 students at the planetarium.
   How many second graders are at the planetarium?

2. There are 18 stars in the sky.
   13 stars are bright.
   Some of the stars are dim.
   How many stars are dim?

SAMPLE COPY

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3. Diego and Tyler see 15 shooting stars during the show.
   Diego sees 6 shooting stars. Tyler sees the rest.
   How many shooting stars does Tyler see?

4. Elena buys 12 star stickers.
   She also buys some planet stickers.
   Elena buys 20 stickers.
   How many planet stickers does she buy?

SAMPLE COPY

Activity 2

Which Equations Match?

Circle **2** equations that can be used to solve each problem.

1. Noah paints 9 white stars.
   He also paints some yellow stars.
   Noah paints 17 stars all together.
   How many yellow stars does Noah paint?

   A. $17 - 9 = \square$

   B. $9 + 17 = \square$

   C. $9 + \square = 17$

2. Kiran sees 16 objects in the sky.
   11 of the objects are stars.
   The rest of the objects are planets.
   How many of the objects are planets?

   A. $16 + 11 = \square$

   B. $11 + \square = 16$

   C. $16 - 11 = \square$

If you have time: Solve each problem using both equations.

SAMPLE COPY

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Unit 8, Lesson 6

Addressing CA CCSSM 1.OA.1-2 and 1.OA.6; practicing MP2, MP4, and MP6

Compare Story Problems

Let's solve Compare story problems.

Warm-up

Which Three Go Together: Equations with 25

Which 3 go together?

A. $25 = \square + 10$

B. $20 + 5 = 25$

C. $35 - 10 = 25$

D. $25 + 10 = 35$

SAMPLE COPY

Activity 1

The School Carnival

Solve each problem.
Show your thinking using drawings, numbers, or words.

1. Lin has 7 tickets for rides.
   Mai has 12 tickets.
   How many more tickets does Mai have than Lin?

2. The cotton candy booth sells 17 bags of blue cotton candy.
   They sell 7 bags of pink cotton candy.
   How many more bags of blue candy do they sell than pink candy?

SAMPLE COPY

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3. Tyler picks a prize.
   There are 13 toys and 9 stuffed animals.
   How many fewer stuffed animals are there than toys?

4. The ferris wheel holds 20 people.
   The swings hold 14 people.
   How many fewer people do the swings hold than the ferris wheel?

SAMPLE COPY

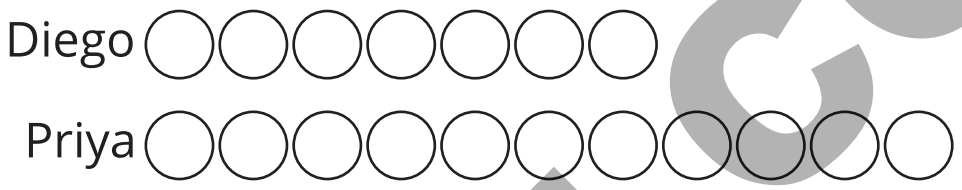
Activity 2

How Many Rides?

Write and answer 2 questions using the information.
Use the picture for the first one if it is helpful.

Sec B

1. Diego goes on 7 rides.
   Priya goes on 11 rides.



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2. Jada goes on 3 rides.
   Kiran goes on 6 rides.
   Noah goes on 9 rides.

SAMPLE COPY

Unit 8, Lesson 7

Addressing CA CCSSM 1.NBT.1 and 1.NBT.2-3; building towards 1.NBT.1; practicing MP6 and MP7

Count Large Collections

Let's organize, count, and represent large collections.

Warm-up

Sec C

What Do You Know about 103?

What do you know about 103?

SAMPLE COPY

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Activity 2

Count and Represent

How many objects are in your collection?

Represent how many in as many ways as you can.

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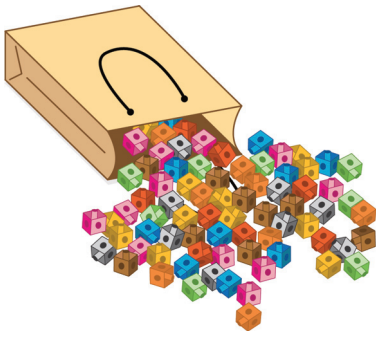
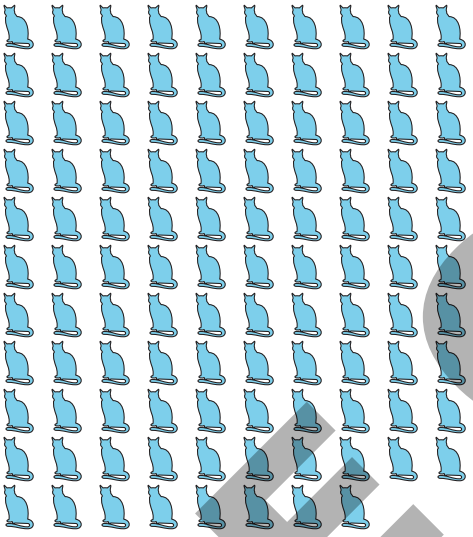


Activity 3

How Many Cats?

How many cats are there?



There are _____ cats.

Show your thinking using drawings, numbers, or words.

SAMPLE COPY

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Addressing CA CCSSM 1.NBT.2-3; building towards 1.NBT.1; practicing MP3

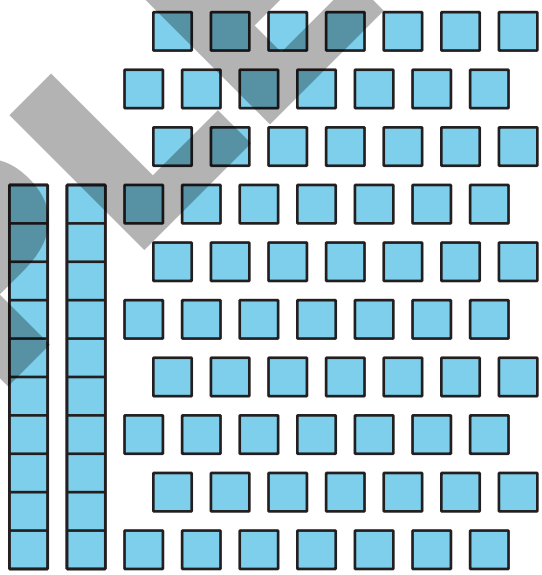
Show Me All the Ways

Let's represent 2-digit numbers in different ways.

Warm-up

Estimation Exploration: Tens and Ones

1.



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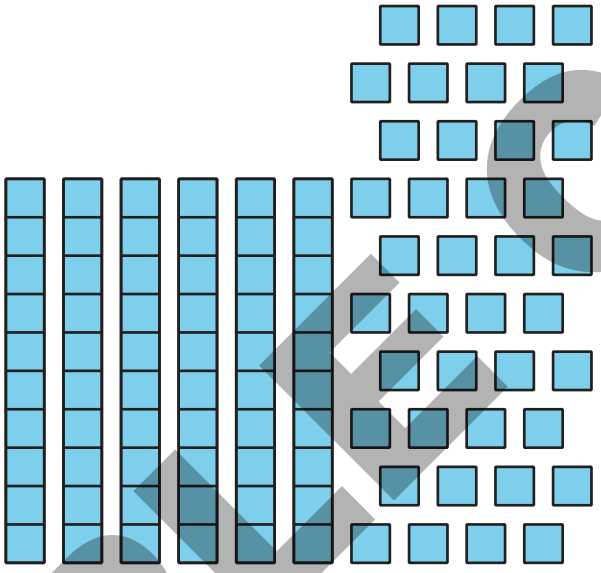
Record an estimate that is:

too low	about right	too high

2.



Record an estimate that is:

too low	about right	too high

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Activity 3

Centers: Choice Time

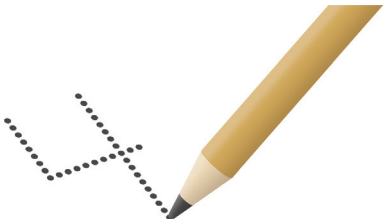
Choose a center.

Compare

How Close?

☐ ☐ + ☐ ☐ = _____

Write Numbers



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Unit 8, Lesson 9

Addressing CA CCSSM 1.NBT.2-3 and 1.NBT.4-6; practicing MP3 and MP7

Solve Number Riddles

Let's solve number riddles.

Warm-up

Sec C

True or False: Comparison Statements

Decide if each statement is true or false.
Be prepared to explain your reasoning.

- $65 > 35$
- $65 = 75 - 10$
- $65 > 35 + 30$

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Activity 1

A Number Riddle

My number is less than 60.

My number has 4 ones.

My number is more than 30.

What numbers fit these clues?

Secret number: _____

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Activity 2

More Number Riddles

Secret Numbers

A: _____

B: _____

C: _____

D: _____

E: _____

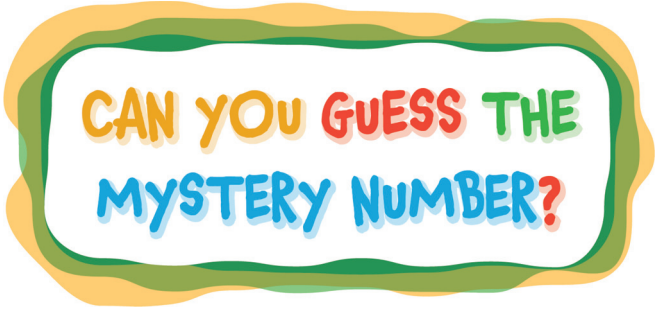
F: _____

G: _____

H: _____

I: _____

J: _____



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Addressing CA CCSSM 1.NBT.2-3 and 1.NBT.4-6; practicing MP7

Write Number Riddles

Let's write and solve number riddles.

Warm-up

True or False: Add within 100

Decide if each statement is true or false.

Be prepared to explain your reasoning.

- $60 = 25 + 45$

- $70 = 24 + 46$

- $80 = 32 + 37$

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Activity 1

Write Number Riddles

Our secret number: _____

Our **4** clues:

- Write each clue on an index card.
- Make sure the last clue is an addition expression.
- Fold that clue in half.

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Activity 2

Solve Our Number Riddles

Record your ideas as you solve each number riddle.

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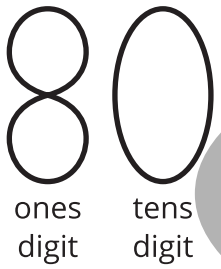
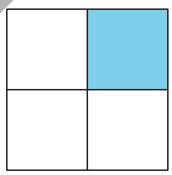
Glossary

- 2-digit number
  A number with 1 digit to show tens and 1 digit to show ones.

  Example:



- a fourth
  One of the pieces created when a shape is split into 4 equal parts.



  A fourth, or a quarter, of the square is shaded.

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- a half
  One of the pieces created when a shape is split into 2 equal parts.

  A half of the rectangle is shaded.

- category
  A label that tells how objects in a group are alike.

- data
  A collection of facts, such as numbers, measurements, or observations.

  Examples:
  the color of each pencil in a box
  the number of pencils sold each day
  the length of each pencil in a box

- difference
  The result when a number is subtracted from another.

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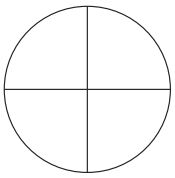
Example:
4 – 1=3
The difference is 3.

- equal to
  Having the same value.

  Example:
  35 is equal to 35.
  35 = 35

- estimate
  To find a value that is close to the actual value.

- fourths
  The pieces created when a shape is split into 4 pieces that are the same size.



  The circle is split into fourths, or quarters.

- greater than
  Having a larger value.

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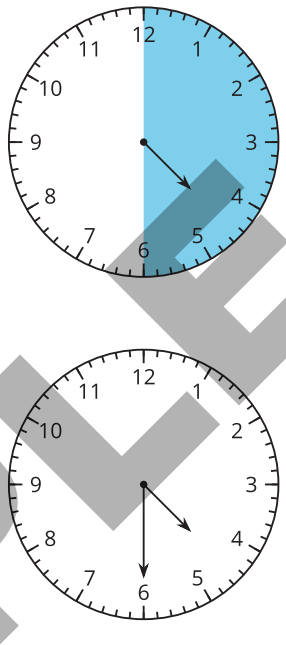
Example:
63 is greater than 32.
$63 > 32$

- half past
  When the time is halfway through one hour.
  When the minute hand is pointing at the 6.

  Example:



  This clock shows half past 4 o'clock or 4:30.

- halves
  The pieces created when a shape is split into 2 pieces that are the same size.

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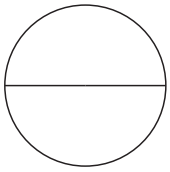

The circle is split into halves.

- length
  The measure of how long an object is in same-size units with no gaps or overlaps.

  Example:
  This sneaker is 15 cubes long.
  Its length is 15 cubes.

- less than
  Having a smaller value.

  Example:
  32 is less than 63.
  $32 < 63$

- o'clock
  When the time is at the start of an hour.
  The minute hand on a clock points to 12.

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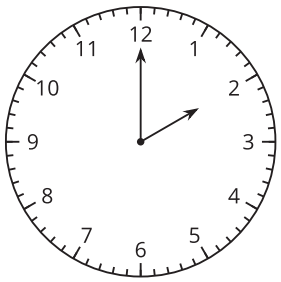
Example:



- rectangle
  A shape with 4 straight sides and 4 square corners.

- square
  A shape with 4 straight sides that are the same length and 4 square corners.

- sum
  The total when 2 or more numbers are added.

  Example:
  $3 + 1 = 4$
  The sum is 4.

- survey
  A way to collect data by asking people the same questions.

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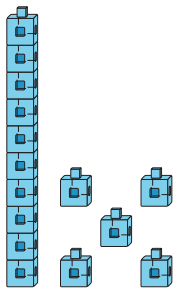
- teen number
  A number with 1 ten and between 1 and 9 ones.

  Example:
  15 is 1 ten and 5 ones.
  15 is a teen number.



- ten
  A group of 10 ones.

- triangle
  A shape with 3 straight sides and 3 corners.

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Notes

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

1.G: Grade 1 - Geometry

Reason with shapes and their attributes.

1.G.1

Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.

1.G.2

Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape. Students do not need to learn formal names such as “right rectangular prism.”

1.G.3

Partition circles and rectangles into two and four equal shares, describe the shares using the words *halves,*

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fourths, and *quarters*, and use the phrases *half of, fourth of*, and *quarter of*. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.

1.MD: Grade 1 - Measurement and Data

Measure lengths indirectly and by iterating length units.

1.MD.1

Order three objects by length; compare the lengths of two objects indirectly by using a third object.

1.MD.2

Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.

Tell and write time.

1.MD.3

Tell and write time in hours and half-hours using analog and digital clocks.

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Represent and interpret data.

1.MD.4

Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

1.NBT: Grade 1 - Number and Operations in Base Ten

Extend the counting sequence.

1.NBT.1

Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.

Understand place value.

1.NBT.2

Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:

1.NBT.2a

10 can be thought of as a bundle of ten ones--called a "ten."

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1.NBT.2b

The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.

1.NBT.2c

The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).

1.NBT.3

Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.

Use place value understanding and properties of operations to add and subtract.

1.NBT.4

Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.

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1.NBT.5

Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.

1.NBT.6

Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

1.OA: Grade 1 - Operations and Algebraic Thinking

Represent and solve problems involving addition and subtraction.

1.OA.1

Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. See Glossary, Table 1.

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1.OA.2

Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.

Understand and apply properties of operations and the relationship between addition and subtraction.

1.OA.3

Apply properties of operations as strategies to add and subtract. Students need not use formal terms for these properties. Examples: If $8 + 3 = 11$ is known, then $3 + 8 = 11$ is also known. (Commutative property of addition.) To add $2 + 6 + 4$, the second two numbers can be added to make a ten, so $2 + 6 + 4 = 2 + 10 + 12$. (Associative property of addition.)

1.OA.4

Understand subtraction as an unknown-addend problem. For example, subtract $10 – 8$ by finding the number that makes 10 when added to 8.

Add and subtract within 20.

1.OA.5

Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).

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1.OA.6

Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., $8 + 6 = 8 + 2 + 4 = 10 + 4 = 14$); decomposing a number leading to a ten (e.g., $13 – 4 = 13 – 3 – 1 = 10 – 1 = 9$); using the relationship between addition and subtraction (e.g., knowing that $8 + 4 = 12$ one knows $12 – 8 = 4$); and creating equivalent but easier or known sums (e.g., adding $6 + 7$ by creating the known equivalent $6 + 6 + 1 = 12 + 1 = 13$).

Work with addition and subtraction equations.

1.OA.7

Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? $6 = 6$, $7 = 8 – 1$, $5 + 2 = 2 + 5$, $4 + 1 = 5 + 2$.

1.OA.8

Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. For example, determine the unknown number that makes the equation true in each of the equations $8 + ? = 11$, $5 = \square – 3$, $6 + 6 = \square$.

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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

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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

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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

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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

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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

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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

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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

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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.

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