Mathematics | Grade 1

In Grade 1, instructional time should focus on four critical areas: (1) developing understanding of addition, subtraction, and strategies for addition and subtraction within 20; (2) developing understanding of whole number relationships and place value, including grouping in tens and ones; (3) developing understanding of linear measurement and measuring lengths as iterating length units; and (4) reasoning about attributes of, and composing and decomposing geometric shapes.

(1) Students develop strategies for adding and subtracting whole numbers based on their prior work with small numbers. They use a variety of models, including discrete objects and length-based models (e.g., cubes connected to form lengths), to model add-to, take-from, put-together, take-apart, and compare situations to develop meaning for the operations of addition and subtraction, and to develop strategies to solve arithmetic problems with these operations. Students understand connections between counting and addition and subtraction (e.g., adding two is the same as counting on two). They use properties of addition to add whole numbers and to create and use increasingly sophisticated strategies based on these properties (e.g., "making tens") to solve addition and subtraction problems within 20. By comparing a variety of solution strategies, children build their understanding of the relationship between addition and subtraction.

(2) Students develop, discuss, and use efficient, accurate, and generalizable methods to add within 100 and subtract multiples of 10. They compare whole numbers (at least to 100) to develop understanding of and solve problems involving their relative sizes. They think of whole numbers between 10 and 100 in terms of tens and ones (especially recognizing the numbers 11 to 19 as composed of a ten and some ones). Through activities that build number sense, they understand the order of the counting numbers and their relative magnitudes.

(3) Students develop an understanding of the meaning and processes of measurement, including underlying concepts such as iterating (the mental activity of building up the length of an object with equal-sized units) and the transitivity principle for indirect measurement.[1]

(4) Students compose and decompose plane or solid figures (e.g., put two triangles together to make a quadrilateral) and build understanding of part-whole relationships as well as the properties of the original and composite shapes. As they combine shapes, they recognize them from different perspectives and orientations, describe their geometric attributes, and determine how they are alike and different, to develop the background for measurement and for initial understandings of properties such as congruence and symmetry.

[1] Students should apply the principle of transitivity of measurement to make indirect comparisons, but they need not use this technical term.

Contents

Grade 1 Overview

Operations and Algebraic Thinking

- Represent and solve problems involving addition and subtraction.
- Understand and apply properties of operations and the relationship between addition and subtraction.
- Add and subtract within 20.
- Work with addition and subtraction equations.

Number and Operations in Base Ten

- Extend the counting sequence.
- Understand place value.
- Use place value understanding and properties of operations to add and subtract.

Measurement and Data

- Measure lengths indirectly and by iterating length units.
- Tell and write time.
- Represent and interpret data.

Geometry

- Reason with shapes and their attributes.

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Operations and Algebraic Thinking *1.OA*

Represent and solve problems involving addition and subtraction. (1.OA.A)

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.[2] **(1.OA.A.1) (DOK 2)**
    a. Example: Solution (DOK 1)

    Pia takes some money to the store to buy school supplies. She buys some paper for $3 and a pen for $2. After she buys these supplies, she has $7 left. How much money did Pia bring to the store?

    b. Example: Solution (DOK 1)

    a. There were 7 children at the park. Then 4 more showed up. How many children were at the park all together?

    b. There were 7 children at the park. Some more showed up. Then there were 11 children in all. How many more children came?

    c. There were some children at the park. Four more children showed up. Then there were 11 children at the park. How many children were at the park to start with?

    c. Example: Solution (DOK 1)

    a. 9 boys and 8 girls were in the class. How many children were in the class in all?

    b. 17 children were in the class. 9 were boys and the rest were girls. How many girls were in the class?

    c. 17 children were in the class. There were some boys and 8 girls. How many boys were in the class?

    d. Example: Solution (DOK 1)

[2] See Glossary, Table 1.

a. Ali had 9 marbles. Maria had 5 marbles. How many more marbles did Ali have than Maria?
Ali had 9 marbles. Maria had 5 marbles. How many fewer marbles did Maria have than Ali?

b. Ali had 4 more marbles than Maria. Maria had 5 marbles. How many marbles did Ali have?
Maria had 4 fewer marbles than Ali. Maria had 5 marbles. How many marbles did Ali have?

c. Ali had 4 more marbles than Maria. Ali had 9 marbles. How many marbles did Maria have?
Maria had 4 fewer marbles than Ali. Ali had 9 marbles. How many marbles did Maria have?

e. Example: Solution (DOK 1)

a. Char had 10 markers. She gave 3 to a friend. How many did she have left?

b. Char had 10 markers. She gave some to a friend. Now she has 7 left. How many markers did she give to her friend?

c. Char had some markers. She gave 3 to a friend. Then she had 7 left. How many markers did she have to start with?

f. Example: Solution (DOK 1)

a. There are 8 children and 6 chairs. A child sits in each chair. How many children won't have a chair?

b. There are 8 children and some chairs. A child sits in each chair. 2 children don't have a chair. How many chairs are there?

c. There are some children and 6 chairs. A child sits in each chair. 2 children don't have a chair. How many children are there?

d. There are 8 children and 10 chairs. A child sits in each chair. How many empty chairs are there?

e. There are 8 children and some chairs. A child sits in each chair. Two chairs are empty. How many chairs are there?

f. There are some children and 10 chairs. A child sits in each chair. Two chairs are empty. How many children are there?

g. Example: Solution (DOK 2)

9 children were in the class. How many boys and how many girls could have been in the class?

Solve the problem. Write an equation. Draw a picture and use it to explain your answer.

h. Example: Solution (DOK 1)

a. The class had a pet snake. It was 14 inches long. It grew 3 more inches. How long is it now?

b. The class had a pet snake. It was 14 inches long. It grew a few more inches. Now it is 17 inches long. How many inches did it grow?

c. The class had a pet snake. It grew 3 more inches. Now it is 17 inches long. How long was it to start?

i. Example: Solution (DOK 3)

Have two or more blocks of different lengths on hand and paper clips to use to measure them. The blocks need to measure a whole number of paper clips whose combined length is less than or equal to 20 paper clips.

Have students work in pairs. Give each pair a block to measure using paper clips. After they have measured their block, say,

Find someone who measured the other block. Ask them how many paper clips long it is. How long will the two different blocks be together if they are laid end-to-end? First try to figure this out. Then put the blocks end-to-end and measure it to check your answer.

Ask students to explain how they solved the problem and whether their answer checked out correctly. Even if students added correctly, they may not have lined up the paperclips very carefully and could get different lengths. This is a good opportunity to talk about how important it is to be careful when measuring.

Next, ask the students,

Imagine you put another block end-to-end with the first one you measured. Together, they measure 18 paper clips. How long is the new block? Draw a picture to explain how you know.

Ask students to explain how they solved the problem and whether their answer checked out correctly. Finally, ask the students to write equations to represent their work.

j. Example: Solution (DOK 3)

Materials

- 2 clear plastic cups for each pair of students
- 4 bean seeds for each pair
- soil
- unifix cubes
- a plant or math journal to record data in

Actions

a. Students in pairs grow bean plants from seed. Students should label the first cup with a A and the second cup with a B and write their names on the cups. Then they fill their plastic cups 2/3 full with soil and place two bean seeds in each cup about one inch below the surface of the soil. Water the seeds and place the cups on a window ledge where they will receive sun light. The teacher should grow several cups to be "class plants" and as backups.

b. The beans will sprout within 7-10 days. When the bean seeds start to grow, choose two plants to be the class plants. Every few days, the class should water the plants. As a whole group, they measure the height of the class plants with unifix cubes. The first few times the teacher can do it, then the students can take turns measuring and recording the height in a table.

Date	Plant A	Plant B
March 1	2	1
March 4	4	3
March 8	8	5
March 11	11	7

The measurements should be recorded to the closest whole number.

c. Once students have done the measuring and recording as a whole group, the pairs of students can measure their own bean plants. They should measure the tallest plant in each cup if more than one bean sprouts. Students record each measurement in a table with the date in a math journal (or a plant journal for this project only if the class does not keep math journals).

d. After the students have measured their plants, they answer these two questions:

- Which plant is tallest today?
- How much taller is it?

e. On the last day of the activity, the students can compare the tallest plant in the room with the shortest plant.

k. Example: Solution (DOK 2)

Materials

- 20 counters or linking cubes per pair of students
- pencil
- copy of the problem

Actions

The teacher poses the problem:

Bo bought 20 tickets to play games at Family Fun Night at his school. He wants to play each game at least once. He needs to use all of his tickets. How many times might he play each game? Find at least two ways he can do it.

Game	Number of Tickets Needed
Ring Toss	1
Putt-Putt Golf	2
Soccer Kick	3
Moonwalk	5

When all pairs of students have had a chance to find at least one solution, the teacher can lead a whole-group discussion and record each solution as an equation on chart paper or the chalkboard/whiteboard/SmartBoard.

l. Example: Solution (DOK 3)

Materials

- pictures of water bottle, snack, and ball (see black line master)
- tools such as snap cubes, number lines, or number grids
- paper, pencil, scissors, and glue for each students

Actions

The teacher should pose the following question to the students:

> ***It's field day! The sun is shining and the students are having fun playing games with their friends. Your teacher gives you $7 to spend at the school store. Here are the options of what you can buy.***

Water bottle	$2
Snack	$4
Ball	$5

a. How much money would you need to buy one of everything on the list?

b. Do you have enough money to buy one of everything? How do you know? How much more money would you need to buy one of everything?

c. What can you buy using only $7? Show your work.

d. What would you choose to buy? Why?

m. Example: Solution (DOK 1)

Materials

- Chart paper
- Word problem

Peyton had 16 books to take on his trip. He lost some. Now he has 7 books. How many books did Peyton lose?

n. Example: Solution (DOK 2)

Materials

- Link-cubes or snap-cubes (2 colors for each student or pair of students)
- A die
- Paper and pencil

Actions

a. Roll the die.

b. Using a single color, snap together the same number of cubes as is shown on the die.

c. Roll the die again.

d. Using the other color, snap together the same number of cubes as is shown on the die.

e. Snap the two groups of cubes together.

f. Write an addition equation that uses the number of each color of cube and the total number of cubes.

g. Write as many addition and subtraction equations as possible using the same three numbers.

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. (1.OA.A.2) **(DOK 2)**
    a. Example: Solution (DOK 3)

Jasmine has eight daisies and three vases - one large, one medium-sized and one small.

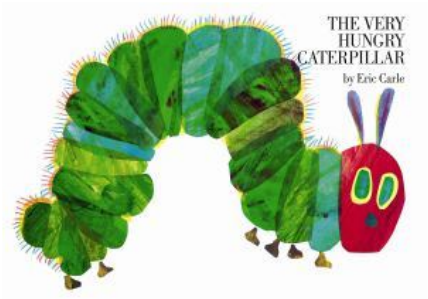
She puts 5 daisies in the large vase, 2 in the medium vase and 1 in the small vase.

- Can you find another way to put daisies so that there are the most in the large vase and least in the small vase?
- Try to find as many ways as you can put the daisies in the vases with the most in the large vase and the least in the smallest vase. If you think you have found them all, explain how you know those are all the possibilities.

    b. Example: Solution (DOK 2)

Materials

- *The Very Hungry Caterpillar* by Eric Carle



The students work individually or in pairs. Each student or pair needs:

- Three ten-frames for each student or pair of students (see PDF for black line master)
- 30 counters or unifix cubes per pair of students
- One small dry-erase board and dry-erase maker per pair of students

Actions

The teacher reads the book to the class and asks, “How many things do you think the caterpillar ate in this story?” The students take a minute to share their estimate with a partner. Next, the teacher reads *The Very Hungry Caterpillar* again. After each page, the teacher pauses so that the students can add counters or unifix cubes to the ten-frame to represent the number of things the caterpillar ate, and then write an equation on the dry-erase board connecting addition to the number of counters used. After each ten-frame is filled in the students move to the next one. If the students are working in pairs, one student can add the counters/unifix cubes to the ten-frame while the other student writes the equation. By the end of the story, there should be a total of 25 food items eaten and 1 leaf eaten. (The students can decide as a class whether to count the leaf as a food). There will be two ten-frames completed with 5 or 6 counters/unifix cubes on the third ten-frame. If students come up with different, but correct, equations, then discuss the different equations and ask students, "Can all of these be correct?"

Understand and apply properties of operations and the relationship between addition and subtraction. (1.OA.B)

3. Apply properties of operations as strategies to add and subtract.[3] *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.B.3)** **(DOK 2)**
    a. Example: Solution (DOK 2)

Materials

- A large set of dominoes to affix to a whiteboard or place in a pocket chart, or a regular set to use on a document projector.
- One set of dominoes for each student or pair of students
- Domino addition worksheets

Actions

- The teacher asks a child to choose a domino from a stack or bag. As the teacher holds up the domino, the students call out how many dots are on the domino altogether.
- Next the class counts the number of dots on each end of the domino to check their responses. Then the class names an addition equation that represents the relation between total number of dots and the number of dots on each end. For example, if the domino has 4 dots on one side and 2 dots on the other, the teacher can show the domino with the 4 on the left and the 2 on the right and the class names the equation 4+2=6. The teacher then writes the equation.
- Then the teacher rotates the domino so the 2 is on the left and the 4 is on the right, and the class can name the equation 2+4=6. The teacher then writes the equation. The teacher then draws the dots from the chosen domino on a blank domino.

[3] Students need not use formal terms for these properties.

- Once the students understand the task, they can work on their own. Students should have a set of dominoes to explore individually or with a partner, along with the domino addition worksheet. There are two variants of this task.
    i. Students can choose dominoes at random, draw the dot pattern, and write the two related equations.

    ii. Students can find all of the dominoes that have a particular sum, and then draw all the related dot patterns and equations. For example, they could look for all the dominoes that have 6 dots all together, then draw the dot patterns for those dominoes and write the corresponding equations.

b. Example: Solution (DOK 2)

Abel said,

How 6 + 6 should be 11:

Because 5 + 5 is 10 and 6 is one more than 5 and 11 is one more than 10. That's why 6 + 6 should be 11.

Rula said,

How 6 + 6 should be 12:

Because 5 + 5 is 10 and the sixes don't have room to get in and it's two sixes right, so

| |

that is why 6 + 6 should be 12.

Who is right?

4. Understand subtraction as an unknown-addend problem. *For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.* **(1.OA.B.4) (DOK 2)**
    a. Example: Solution (DOK 1)

Materials

- A cup for each student to represent his/her cave
- Counters
- Recording sheet

Actions

The teacher begins by counting out a certain number of counters to find the total number of counters in the whole collection. For example,

> ***One, two, three, four, five, six, seven, eight nine, ten. There are ten counters all together.***

This number should be small enough that the students have already found sums equal to that number, for example, 10. The teacher then hides some in the cup, calling it a cave. The students are shown how many counters are remaining outside of the cup, but not how many are in the cup. The number outside of the cup is called the part that they know.

Next, the teacher shows the students an equation like this

10 - ___ = 6

if the teacher is hiding 4 counters. The students need to find the missing number. By adding, or counting on to 6, the students determine that the teacher is hiding 4 counters. The equation is completed, and checked for accuracy by seeing how many counters are hidden under the cup.

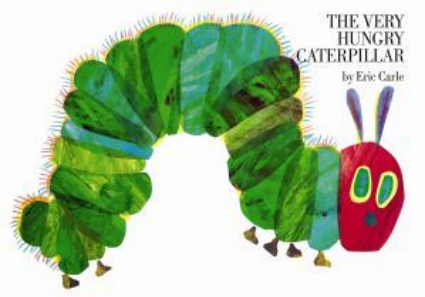
The students are then asked to help the teacher find another way to play the game with the same total number and a different part that they know. The goal is to find all the subtraction equations for the total they started with. When the teacher determines that the students understand the procedures of the game, they may play independently or in partners.

Add and subtract within 20. (1.OA.C)

5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2). **(1.OA.C.5)** **(DOK 1,2)**
   a. Example: Solution (DOK 2)

Materials

- *The Very Hungry Caterpillar* by Eric Carle



The students work individually or in pairs. Each student or pair needs:

- Three ten-frames for each student or pair of students (see PDF for black line master)
- 30 counters or unifix cubes per pair of students
- One small dry-erase board and dry-erase maker per pair of students

Actions

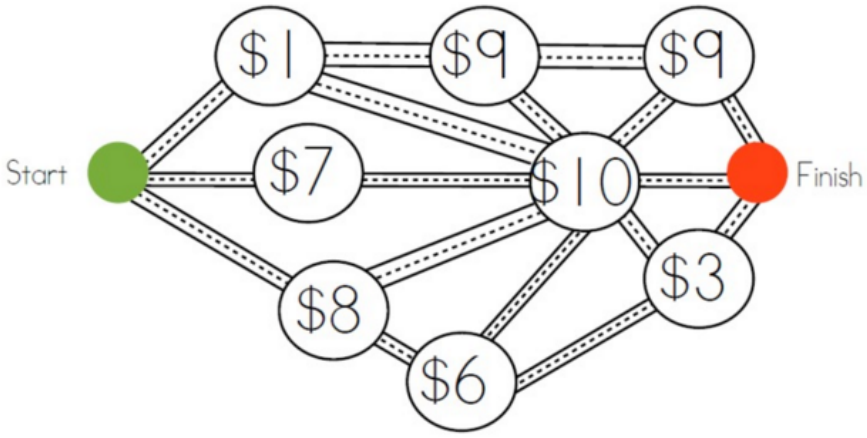
The teacher reads the book to the class and asks, "How many things do you think the caterpillar ate in this story?" The students take a minute to share their estimate with a partner. Next, the teacher reads *The Very Hungry Caterpillar* again. After each page, the teacher pauses so that the students can add counters or unifix cubes to the ten-frame to represent the number of things the caterpillar ate, and then write an equation on the dry-erase board connecting addition to the number of counters used. After each ten-frame is filled in the students move to the next one. If the students are working in pairs, one student can add the counters/unifix cubes to the ten-frame while the other student writes the equation. By the end of the story, there should be a total of 25 food items eaten and 1 leaf eaten. (The students can decide as a class whether to count the leaf as a food). There will be two ten-frames completed with 5 or 6 counters/unifix cubes on the third ten-frame. If students come up with different, but correct, equations, then discuss the different equations and ask students, "Can all of these be correct?"

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). **(1.OA.C.6) (DOK 1,2)**

a. Example: Solution (DOK 2)

The attached graphic shows a map. You must get from start to finish by visiting three of the dots, at each dot you have to pay the specified number of dollars. If you have $20 can you get from start to finish and visit three dots?



Bonus Question #1: Can you find a way to get from start to finish and spend all $20? Can you find a way to get from start to finish and spend less then $20?

Bonus Question #2: How many different routes can you find from start to finish that go to three dots and cost $20 or less?

b. Example: Solution (DOK 3)

Materials

- Copies of a table of sums for numbers 1 through 9:

+	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	10
2	3	4	5	6	7	8	9	10	11
3	4	5	6	7	8	9	10	11	12
4	5	6	7	8	9	10	11	12	13
5	6	7	8	9	10	11	12	13	14
6	7	8	9	10	11	12	13	14	15
7	8	9	10	11	12	13	14	15	16
8	9	10	11	12	13	14	15	16	17
9	10	11	12	13	14	15	16	17	18

- Colored markers or crayons

Actions

a. Ask the students to shade in the 10's in the table. What do they notice about where these 10's are in the table?

b. Point out that if they start from the 10 in the bottom left corner and follow the red arrows shown below, they get to another 10:

+	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	10
2	3	4	5	6	7	8	9	10	11
3	4	5	6	7	8	9	10	11	12
4	5	6	7	8	9	10	11	12	13
5	6	7	8	9	10	11	12	13	14
6	7	8	9	10	11	12	13	14	15
7	8	9	10	11	12	13	14	15	16
8	9	10	11	12	13	14	15	16	17
9	10	11	12	13	14	15	16	17	18

Ask them to explain what that path means and why they get to another 10.

c. Point out that if they start from the 10 in the 5+5 box and follow the purple arrows shown above, they get to another 10. Ask them to explain what that path means and why they get to another 10.

Work with addition and subtraction equations. (1.OA.D)

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.D.7) (DOK 3)**
    a. Example: Solution (DOK 3)

Decide if the equations are true or false. Explain your answer.

a. $2 + 5 = 6$

b. $3 + 4 = 2 + 5$

c. $8 = 4 + 4$

d. $3 + 4 + 2 = 4 + 5$

e. $5 + 3 = 8 + 1$

f. $1 + 2 = 12$

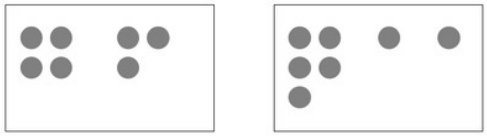
g. $12 = 10 + 2$

h. $3 + 2 = 2 + 3$

i. $32 = 23$

b. Example: Solution (DOK 1)

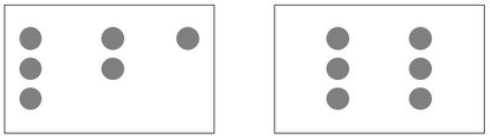
Compare the number of circles in each box. If they are equal, write a number sentence. For example:



$4 + 3 = 5 + 1 + 1$

If they are not equal, write "not equal."

a.



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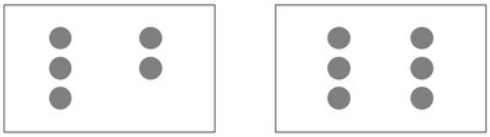

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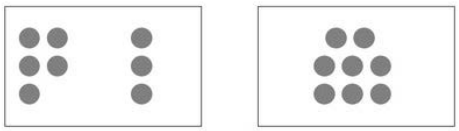

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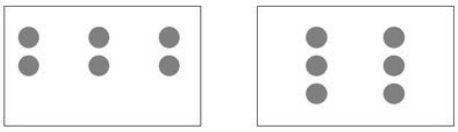
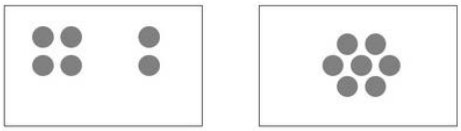
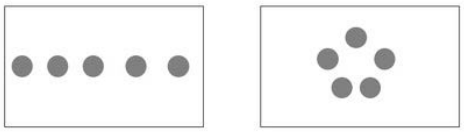


e.



f.



c. Example: Solution (DOK 2)

Materials

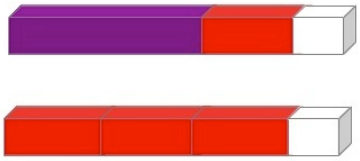
Cuisenaire rods or paper strips cut to whole centimeter lengths

Actions

Students work in pairs.

- One student puts a few rods (or strips) end-to-end.
- The other student matches that length with a different combination of rods (or strips).
- When two different ways of making the same length are found, the students write a number sentence reflecting the equality.

For example, if the first student uses a rod of length 4, a rod of length 2 and a rod of length 1 and the second student uses three rods of length 2 and a rod of length 1 (as shown below), they should write $4 + 2 + 1 = 2 + 2 + 2 + 1$.

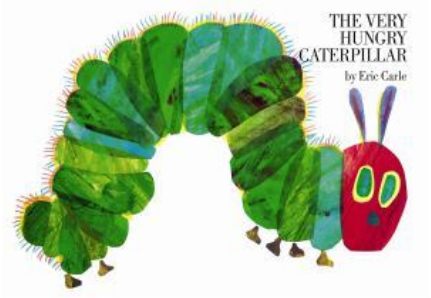


$$4 + 2 + 1 = 2 + 2 + 2 + 1$$

d. Example: Solution (DOK 2)

Materials

- *The Very Hungry Caterpillar* by Eric Carle



The students work individually or in pairs. Each student or pair needs:

- Three ten-frames for each student or pair of students (see PDF for black line master)
- 30 counters or unifix cubes per pair of students
- One small dry-erase board and dry-erase maker per pair of students

Actions

The teacher reads the book to the class and asks, “How many things do you think the caterpillar ate in this story?” The students take a minute to share their estimate with a partner. Next, the teacher reads *The Very Hungry Caterpillar* again. After each page, the teacher pauses so that the students can add counters or unifix cubes to the ten-frame to represent the number of things the caterpillar ate, and then write an equation on the dry-erase board connecting addition to the number of counters used. After each ten-frame is filled in the students move to the next one. If the students are working in pairs, one student can add the counters/unifix cubes to the ten-frame while the other student writes the equation. By the end of the story, there should be a total of 25 food items eaten and 1 leaf eaten. (The students can decide as a class whether to count the leaf as a food). There will be two ten-frames completed with 5 or 6 counters/unifix cubes on the third ten-frame. If students come up with different, but correct, equations, then discuss the different equations and ask students, "Can all of these be correct?"

e. Example: Solution (DOK 2)

Materials

- 20 counters or linking cubes per pair of students
- pencil
- copy of the problem

Actions

The teacher poses the problem:

> ***Bo bought 20 tickets to play games at Family Fun Night at his school. He wants to play each game at least once. He needs to use all of his tickets. How many times might he play each game? Find at least two ways he can do it.***

Game	Number of Tickets Needed
Ring Toss	1
Putt-Putt Golf	2
Soccer Kick	3
Moonwalk	5

When all pairs of students have had a chance to find at least one solution, the teacher can lead a whole-group discussion and record each solution as an equation on chart paper or the chalkboard/whiteboard/SmartBoard.

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 = □.* **(1.OA.D.8) (DOK 2)**
   a. Example: Solution (DOK 1)

Find the missing number in each of the following equations:

$9 - 3 = \square$ $\quad$ $8 + \square = 15$ $\quad$ $16 - \square = 5$

$\square = 7 - 2$ $\quad$ $13 = \square + 7$ $\quad$ $6 = 14 - \square$

   b. Example: Solution (DOK 2)

- Students can play in groups of 2-4.
- An array of cards (twelve to twenty in total) is placed face down and one card, called the target card, is put face up.
- The students take turns flipping over two cards, one at a time.
- If the sum or difference of the values on the two cards equals the value on the target card, the student who exposed those cards should say a number sentence to express the relationship. If they are correct, the three cards are removed and replaced so there is again a full array.
- If a student does not combine the values of flipped cards to make the value on the target card, then it is the next student's turn.
- In the no-memory-needed version of the game, all chosen cards are left face up (after an unsuccessful turn) and may be used to make matches. In the light-memory version, cards are left face up until there is a match, after which all are put face down. In the memory version, cards are put face down after an unsuccessful turn before the next player's turn.

c. Example: (Former NAEP question) (DOK 1)
____ + 4 = 12

Which number should go in the blank to make this number sentence TRUE?

1. 3
2. 4
3. 8
4. 16

Answer: 3. 8

d. Example: (Former NAEP question) (DOK 1)
____ - 8 = 21

Which number should be put in the blank to make the number sentence above true?

Answer: 29

e. Example: (Former NAEP question) (DOK 1)
Which number does *n* represent in the table?

$2 + n$	5
$3 + n$	6
$4 + n$	7
$5 + n$	8

1. 2
2. 3
3. 4
4. 5

Answer: 2.3

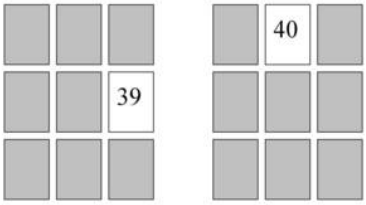
Extend the counting sequence. (1.NBT.A)

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. **(1.NBT.A.1)** **(DOK 1,2)**
    a. Example: Solution (DOK 2)

This game is a version of the traditional memory or concentration game.

You will need to create a set of number cards for each of the pair of numbers that cross the decade, i.e., 19 and 20, 29 and 30, 39 and 40, 49 and 50, etc.

Students place all the number cards that end with "_9" face down in an 3x3 array on the left and all the number cards that end with "_0" face down in a 3x3 array on the right. Working in pairs or trios, students take turns. The first student selects a card from the left array, stating the number name and the counting number that follows ("I have 39, I need 40").



He or she then picks one card from the array on the right (the "_0" numbers), hoping to find the target number. If the student does not find a pair, both cards are replaced face down in their original spots. It is now the second student's turn to choose a card from the "_9" array and to try to find the appropriate "_0" card. Students should try to remember where each number is located. (The game is called "Concentration" not "Guessing.")

When a student finds a matching pair he or she keeps that pair of cards. Play continues until all cards have been matched. The student with the most matched pairs wins.

    b. Example: Solution (DOK 1)

Materials

- 100 chart or large number line, preferably one that extends beyond 100.
- A pointer

Setup

Have students sit in the whole group meeting area.

Actions

Lead the students in chanting the counting sequence starting with one to one hundred; use the pointer to follow the number sequence. Then start counting at various numbers other than one that are randomly selected from 1-120. Have a student take over the job of pointing out the number sequence. Highlight the multiples of ten using a marker or a colored screen and have students chant the counting sequence by 10s, by 5s and by 2s. This should be done daily.

c. Example: Solution (DOK 2)

Materials

- A 100 chart per pair of students
- A set of digit cards per pair of students (four each of cards 0-9)
- Two different colors of counting chips, one for each student

Action

- Player One draws two cards and then makes and reads aloud both of the numbers that can be made with those digits. Player One then chooses which of the two numbers to cover on their 100 chart.
- Player Two draws two cards and then makes and reads aloud both of his /her numbers and chooses which number to cover on the 100 chart.
- Players cannot cover a number that has already been covered, but they may have more than one counter in each row.
- If a player cannot make a number that is uncovered/available with the cards they drew, they lose their turn for that round.
- Play continues until one player has at least one number covered in each row of the 100 chart.
- If students run out of cards they should re-shuffle the cards and continue play.
- For a shorter version, students work together to cover at least one number in each row on the 100 chart.
- This can be extended by asking students to record the numbers they create.

d. Example: Solution (DOK 1)

Setup

Students should be seated on chairs at their tables or desks. The teacher will give a counting sequence (for example, 20-120) to the students.

Actions

Begin with the teacher walking around the room while counting aloud from a number between 1 and 20. The teacher continues to count until he/she chooses a student by patting them on the shoulder. The student and teacher switch roles, the teacher sits in the student's chair while the student resumes the count and walks around the room. At the teacher's signal (clap, snap, chime etc.) the student selects the nearest student and switches places with another child who continues the count. Repeat this until each child has had a turn counting. If a child reaches 120 before each child has been given a chance to count, begin the sequence over again or if the children are ready reverse the sequence.

e. Example: Solution (DOK 1)

Materials

- Set of cards from 1-100, these can be purchased or created using a black marker and index cards

Setup

Sort the 1-100 cards into sequential groups based on the number of students in your classroom, for example if you have 25 students you might sort them into 1-25, 26-50, 51-75, 76-100. Gather students in the meeting area.

Actions

This activity is designed to be a short, repeatable activity to build student flexibility with the number sequence. Begin by randomly giving each student in the classroom one card from one of the sets you have made. Challenge the students to get themselves into order as quickly as they can. Once they are in order have the students read the cards beginning with the student with the smallest number to the largest. Repeat with a different set of cards as time allows. Vary the activity by changing the order of the sets for example sequence 75-100 and then 26-50 or by changing the sequence in the sets, for example 10-34, 35-59 etc.

f. Example: Solution (DOK 1)

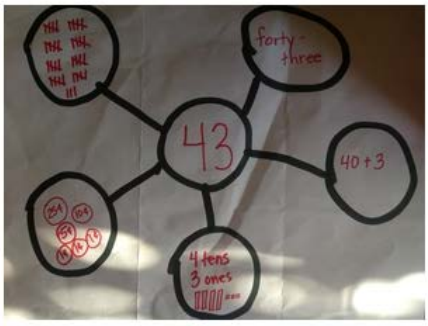
Materials

Large chart paper, markers, math journals, pencils, 100 chart.

Directions

Students will count the "Number of the Day" beginning with 1 on the first day of school, and adding one number for each day of school. Each day the class will chorally count up to the last number added to the 100 chart (or a hand drawn chart of numbers) by 1s or 10s. The teacher will then add the next number in the counting sequence to the chart to represent the number of the current day (this way the chart grows by one for each day students are in school).

The teacher then draws a bubble map on chart paper with the number of the day in the middle bubble. The teacher models and guides students in drawing and writing the number in different ways; see the picture below.



Understand place value. (1.NBT.B)

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). **(1.NBT.B.2)** **(DOK 2)**
        1. Example: Solution (DOK 2)

Materials

For each pair:

- 2 ten-sided dice with the numbers 0 to 9 or two spinners with the numbers 0 to 9
- Base-10 blocks, linking cubes, or bundled and loose popsicle sticks
- Paper and pencil

Play

- Student A rolls the dice.
- Student B makes a number using the values on the dice as digits and both students write it on the paper. For example, if student A rolled a 3 and a 4, the number can be 34 or 43.
- Student A represents the number with the tens and ones blocks/popsicle sticks.
- Student B counts the blocks to check that they correctly represent the number.
- Both students draw a picture of the tens and ones on the paper.

The students should take turns.

2. Example: Solution (DOK 2)

Materials

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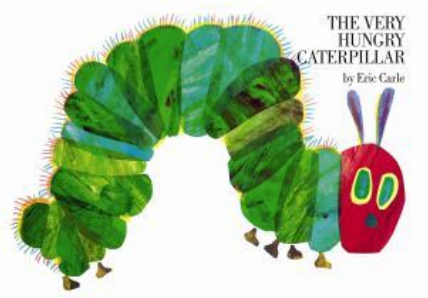


The students work individually or in pairs. Each student or pair needs:

- Three ten-frames for each student or pair of students (see PDF for black line master)
- 30 counters or unifix cubes per pair of students
- One small dry-erase board and dry-erase maker per pair of students

Actions

The teacher reads the book to the class and asks, "How many things do you think the caterpillar ate in this story?" The students take a minute to share their estimate with a partner. Next, the teacher reads *The Very Hungry Caterpillar* again. After each page, the teacher pauses so that the students can add counters or unifix cubes to the ten-frame to represent the number of things the caterpillar ate, and then write an equation on the dry-erase board connecting addition to the number of counters used. After each ten-frame is filled in the students move to the next one. If the students are working in pairs, one student can add the counters/unifix cubes to the ten-frame while the other student writes the equation. By the end of the story, there should be a total of 25 food items eaten and 1 leaf eaten. (The students can decide as a class whether to count the leaf as a food). There will be two ten-frames completed with 5 or 6 counters/unifix cubes on the third ten-frame. If students come up with different, but correct, equations, then discuss the different equations and ask students, "Can all of these be correct?"

3. Example: (Former NAEP question) (DOK 1)
Which one of the following represents 3 tens?
a. 3
b. 30
c. 300

d. 310

Answer: b. 30

3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <. **(1.NBT.B.3) (DOK 2)**
   a. Example: Solution (DOK 1)

Malik is given a list of numbers:

$$1 \qquad 5 \qquad 10 \qquad 50 \qquad 100$$

He wants to include the following numbers so all numbers will be listed in order from least (on the left) to greatest (on the right):

$$49, 7, 22, 98, \text{ and } 3$$

Where in the list should he put each of these numbers?

   b. Example: Solution (DOK 1)

Materials

- Set of cards from 1-100, these can be purchased or created using a black marker and index cards

Setup

Sort the 1-100 cards into sequential groups based on the number of students in your classroom, for example if you have 25 students you might sort them into 1-25, 26-50, 51-75, 76-100. Gather students in the meeting area.

Actions

This activity is designed to be a short, repeatable activity to build student flexibility with the number sequence. Begin by randomly giving each student in the classroom one card from one of the sets you have made. Challenge the students to get themselves into order as quickly as they can. Once they are in order have the students read the cards beginning with the student with the smallest number to the largest. Repeat with a different set of cards as time allows. Vary the activity by changing the order of the sets for example sequence 75-100 and then 26-50 or by changing the sequence in the sets, for example 10-34, 35-59 etc.

   c. Example: Solution (DOK 2)

Materials

- A spinner with the numbers 0, 1, 2, ... 9
- A spinner with the decades 00, 10, 20, ... 90
- Math journal or teacher-made worksheet
- Pencil

Actions

a. Partner #1 spins the decade spinner and writes the number in the tens place.

b. Partner #1 spins the 0-9 spinner and writes the number in the ones place to make a two-digit number.

c. Partner #2 repeats steps 1 and 2 to make another two-digit number and writes it in their math journal or on the worksheet.

d. Partners decided together whether the first number is greater than, less than, or equal to the second number.

e. Partners write the corresponding symbol (<, >, =) between the two numbers.

f. Partners repeat until the teacher ends the game.

d. Example: (Former NAEP question) (DOK 1)
Which of the following is TRUE?

A. $8 > 9$
B. $8 > 6$
C. $8 = 6$
D. $8 < 6$

Answer: B. 8 > 6

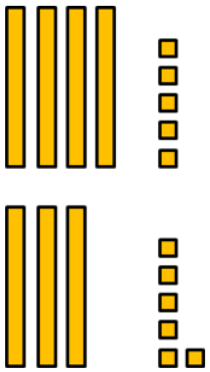
Use place value understanding and properties of operations to add and subtract. (1.NBT.C)

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. **(1.NBT.C.4) (DOK 1,2,3)**
   a. Example: Solution (DOK 2)

Actions

Part One: Solve the problem and explain your thinking.

45+36



Part Two: Ford and Logan each solved the problem using a different strategy.

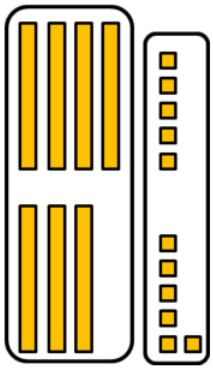
a. How did Ford solve the problem? Will his strategy always work?

b. How did Logan solve the problem? Will her strategy always work?

c. How are their strategies similar or different?

d. How was your strategy similar or different than Ford or Logan's?

Ford's thinking:

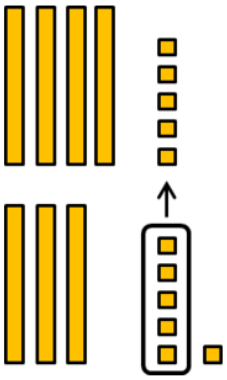


I Counted the tens first, so 10, 20, 30, 40, 50, 60, 70.

Then I counted the ones, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81.

So 45+36=81.

Logan's thinking:



First I broke 36 into 30+1+5.

Then I gave 5 from 36 to the 45 to make 50 because 50 is a friendly number.

Then I added 30+50 to make 80. Then I added 1 to 80 to get 81.

So 45+36=81.

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.C.5) (DOK 2,3)**
   a. Example: Solution (DOK 3)

Part 1

The teacher explains the Number Square:

- *In this big number square, the numbers in the little individual boxes get bigger by one as we travel to the right.*
- *When we get to the end of a row, the next number is found at the start of the line below.*
- *Notice how the numbers get smaller by one as we travel to the left.*
- *When we get to the beginning of a row, the previous number is found at the end of the line above.*
- *The first number on this number square is 1 and the last number is 100.*

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Class discussion (think and share) and/or individual work (e.g. on white boards) given orally by the teacher:

a. What number is to the right of 78? How does that number compare to 78?

b. What number is three to the right of 34? How does that number compare to 34?

c. What number is five to the left of 18? How does that number compare to 18?

d. Start at 13 and move 11 steps forward (starting to the right) on the number square; where do we end up? What did we have to do after seven steps?

Part 2

If need be, the teacher can review the basics of the 1-100 Number Square. Class discussion and/or individual work proceeds through the following types of questions.

a. Find the number $12 - 5$ by starting at 12 on the number square and counting back 5 steps, moving to the left and going up to the previous row as needed.

b. Find the sum $37 + 10$ by starting at 37 on the number square and counting forward 10 spaces, moving to the right and going down to the next row as needed.

c. Find the difference $37 - 10$ by starting at 37 on the number square and counting back 10 spaces, moving to the left and going up to the previous row as needed.

Part 3

If needed, the teacher can review basic adding and subtracting on the 1-100 Number Square. Class discussion and/or individual work proceeds through the following types of questions.

a. Find the following sums using the number square:

- $2 + 10$|
- $19 + 10$|
- $20 + 10$|
- $74 + 10$|
- $88 + 10$|

b. Where on the number square is the result of adding ten to a number? Use your answers above to help you.

c. What happens when we add ten to a number? How would you explain what is happening?

d. Find the following differences using the number square.

- $13 - 10$|
- $39 - 10$|
- $40 - 10$|
- $65 - 10$|
- $92 - 10$|

e. Where on the number square is the result of subtracting ten from a number? Use your answers above to help you.

f. What happens when we subtract ten from a number? How would you explain what is happening?

Extension

a. Find the following sums without any tools (pencil and paper, blocks, or the number square). Use the number square to check your work.

- $38 + 10$
- $23 + 10$
- $51 + 10$
- $77 + 10$
- $5 + 10$

b. Find the following differences without any tools (pencil and paper, blocks, or the number square). Use the number square to check your work.

- $45 - 10$
- $31 - 10$
- $60 - 10$
- $78 - 10$
- $12 - 10$

b. Example: (Former NAEP question) (DOK 1)
What number is 10 LESS than 95?
Answer: 85

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.NBT.C.6)** **(DOK 2,3)**

Measurement and Data	*1.MD*

Measure lengths indirectly and by iterating length units. (1.MD.A)

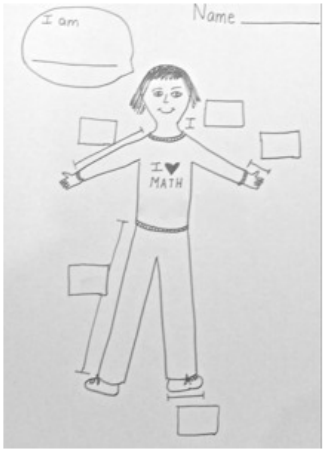
1. Order three objects by length; compare the lengths of two objects indirectly by using a third object. **(1.MD.A.1)** **(DOK 2,3)**
2. Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length 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.* **(1.MD.A.2)** **(DOK 1,2)**
   a. Example: Solution (DOK 1)

Materials

* Student worksheet * Unifix cubes * Pencils * Clip boards (optional)

Actions

Students will work on the rug in pairs and measure each other. Student A starts with a worksheet:



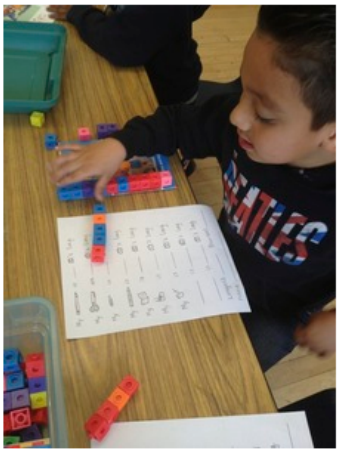
and writes their name on top. Then they write their partner's name in the speech bubble where it says "I am_____". Student A measures Student B using the unifix cubes and records the length of Student B's arm, leg, foot, hand and neck in the corresponding boxes. Students should connect the unifix cubes to make a measuring stick from them as opposed to lining individual cubes up next to their partner. Once Student A finishes, the partners switch and, using a second worksheet (or the reverse side if the teacher copies the worksheets so that they are double sided), Student B now measures Student A and records the values. Once they are finished, the students return to the whole group where the teacher can ask,

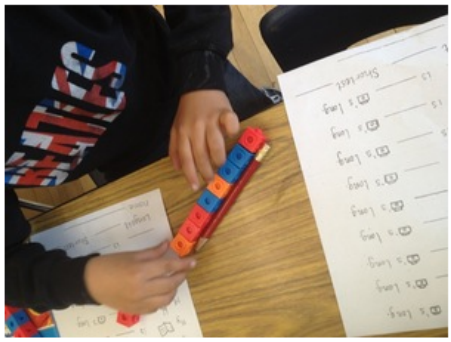
> ***Who has the longest leg, you or your partner?***

The students should then stand side-by-side to verify that their measurements correctly identified the longest leg. If they don't, then students should re-measure their legs. It is easy for students to lose track while counting or to measure imprecisely. This would be a good opportunity for teachers to talk about how it is important to measure carefully in order to get accurate measurements. Students who finish early can measure other objects in the classroom.

b. Example: Solution (DOK 2)

You will need various items to measure, a large set of cubes such as unifix or snap cubes, and a recording sheet with 4 sections. In each section would be the words: _____ cubes long with enough space for a small drawing. The students work in pairs. They choose an item to measure. First they line up the cubes along the longest side of the item. They count and record the number on the first line in the first section. They draw a picture of the item they measured. They continue same routine 3 more times with different items.





c. Example: Solution (DOK 2)

Materials

- Unifix cubes
- Large blocks in different sizes or varying lengths of sentence strips

Note: The large blocks or the cut-up lengths of sentence srtips need to measure a whole number of unifix cubes whose combined length is less than or equal to 20 unifix cubes.

Actions

- Have students work in pairs. Give each pair two blocks or strips to measure using unifix cubes. After they have measured their block, say,

> ***Ask your partner how many unifix cubes long their block/paper strip is. How long will the two different blocks be together if they are laid end-to-end? First try to figure this out. Then put the blocks end-to-end and measure it to check your answer.***

- Ask students to explain how they solved the problem and whether their answer checked out correctly. Even if students added correctly, they may not have lined up the unifix cubes very carefully and could get different lengths. This is a good opportunity to talk about how important it is to be careful when measuring. The teacher may also need to ensure that all students are "clicking" their unifix cubes together so that there aren't gaps between the unifix cubes which would alter the measurements.
- Finally, ask the students to write equations to represent their work.

For students who are ready for a more complex question ask,

> ***Imagine you put another block end-to-end with the first one you measured. Together, they measure [X number] of unifix cubes. How long is the new block? Draw a picture to explain how you know.***

d. Example: Solution (DOK 2)

Materials

- 2 clear plastic cups for each pair of students
- 4 bean seeds for each pair
- soil
- unifix cubes
- a plant or math journal to record data in

Actions

a. Students in pairs grow bean plants from seed. Students should label the first cup with a A and the second cup with a B and write their names on the cups. Then they fill their plastic cups 2/3 full with soil and place two bean seeds in each cup about one inch below the surface of the soil. Water the seeds and place the cups on a window ledge where they will receive sun light. The teacher should grow several cups to be "class plants" and as backups.

b. The beans will sprout within 7-10 days. When the bean seeds start to grow, choose two plants to be the class plants. Every few days, the class should water the plants. As a whole group, they measure the height of the class plants with unifix cubes. The first few times the teacher can do it, then the students can take turns measuring and recording the height in a table.

Date	Plant A	Plant B
March 1	2	1
March 4	4	3
March 8	8	5
March 11	11	7

The measurements should be recorded to the closest whole number.

c. Once students have done the measuring and recording as a whole group, the pairs of students can measure their own bean plants. They should measure the tallest plant in each cup if more than one bean sprouts. Students record each measurement in a table with the date in a math journal (or a plant journal for this project only if the class does not keep math journals).

d. After the students have measured their plants, they answer these two questions:

- Which plant is tallest today?
- How much taller is it?

e. On the last day of the activity, the students can compare the tallest plant in the room with the shortest plant.

Tell and write time. (1.MD.B)

3. Tell and write time in hours and half-hours using analog and digital clocks. **(1.MD.B.3)** **(DOK 1)**

Represent and interpret data. (1.MD.C)

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.MD.C.4)** **(DOK 2,3)**
   a. Example: Solution (DOK 2)

Materials

- Pocket chart
- Sentence strip
- Square pieces of paper for each student
- Popsicle sticks

Setup

Write a question that has three choices as an answer on a sentence strip. For example,

> ***"Which flavor of ice cream do you like best?"***

Put the three categories on the bottom of the pocket chart. For example,

> ***Chocolate Vanilla Strawberry***

Write interpretation questions on the popsicle sticks. For example,

- "How many students answered this question?"
- "Which has the most?"
- "Which has the fewest?"
- "Are any the same?"
- "How many are in each category?"

Actions

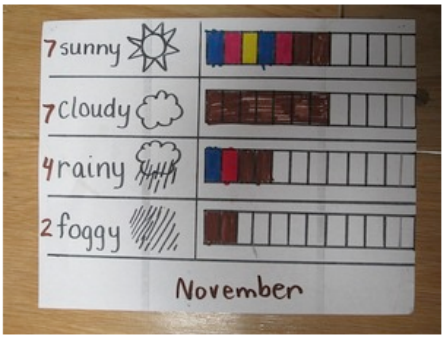
Begin with all students sitting together in the meeting area. Read the question aloud to the students, and ask individual students to answer the question by putting a paper square above their answer. Ensure that as each child answers, they put their paper above the previous square, not to the side of the square. When each child has answered, you will have a bar graph with three categories.

Draw a popsicle stick and model answering the question to the whole group. Divide students into five groups and have each group pick a popsicle stick. Students then read the question on the popsicle stick, discuss the question as a group, and then answer it in front of the class using the graph as a model to defend their answer.

b. Example: Solution (DOK 2)

Materials

- Completed monthly weather recording sheet



- Crayons
- Sentence strips with frames (see below)
- Student worksheet

Actions

- Every day for a month the students record the weather by shading in an appropriate box on the recording sheet (attached).
- At the completion of a month of school, the teacher projects the completed recording sheet using a document projector (if working with the whole class) or shows it to the students (if working in a small group setting).
- The teacher asks the students to count how many days in the month each type of weather occurred, writing the number by the type of weather.

- The teacher or another student asks questions like these:
  - *How many rainy days did we have this month?*
  - *How many more rainy days did we have than sunny days?*
  - *How many days did we record the weather?*

Students compose answers to the questions using sentence frames like these:

- **In September there were ___ _____ days**
- **There were ___ more _____ days than _____ days**
- **There were ___ fewer _____ days than _____ days**
- **We recorded ____ days of weather altogether.**

Both numbers and types of weather are used to fill in the blanks. Students pair up and share an idea for each sentence frame; then the teacher chooses a student to fill in one of the frames orally, while it is recorded onto the sentence frame.

- The students copy the data from the recording sheet onto their worksheet to create their own graph. The teacher may need to model this for the students the first time they do it.
- The students choose a sentence based on the completed frames to match each of the weather pictures given. So, for the sunny picture a student could write, "There were 5 more sunny days than rainy days," or "There were 12 sunny days in September." The frame of "We recorded ___ days of weather altogether" could be stated orally, or added at the bottom of the recording sheet to be filled in. The teacher may need to model this for the students the first time they do it.

c. Example: (Former NAEP question) (DOK 2)
Mr. Bell's class voted for where they want to go on their school trip. The chart shows the students' votest.

SCHOOL TRIP

Place	Votes
City park	||||
Museum	𝍸 𝍸 ||
Theater	𝍸 𝍸 𝍸

How many more students voted to go to the theater than to go to the city park?

1. 3
2. 4
3. 11
4. 15

Answer: 1. 3

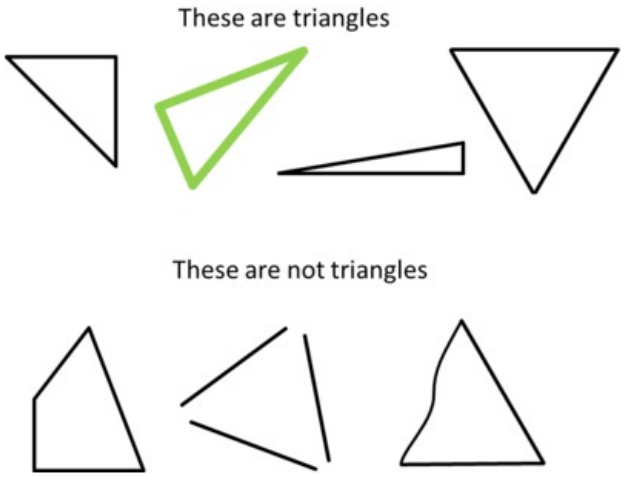
Geometry	***1.G***

Reason with shapes and their attributes. (1.G.A)

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.A.1)** **(DOK 2)**
   a. Example: Solution (DOK 2)

First pose the question:

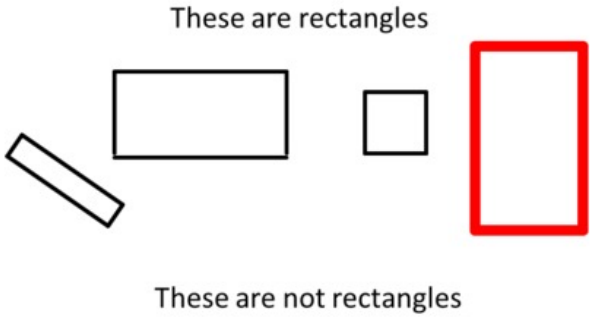
Here are four triangles. What do all of these triangles have in common? What makes them different from the figures that are not triangles? What is true for some but not all of these triangles?

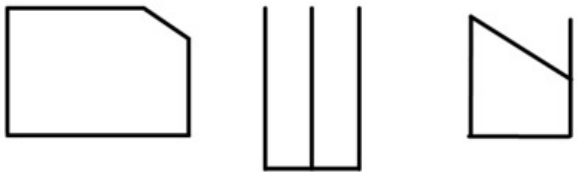


If students come up with a statement that is true about all of the triangles that they see but not true of all triangles in general, the teacher should ask students if they can imagine a triangle without that attribute. For example, if a student says, "All of the triangles are white on the inside," the teacher can ask, "Would it be possible for a triangle to have a different color on the inside?" When the class comes up with an attribute that is truly shared by all triangles, then the class can complete the sentence frame: **All triangles _____, but only some triangles _____.** When the students have written (or composed) their sentences based on the sentence frames, the class can write the definition of a triangle together:

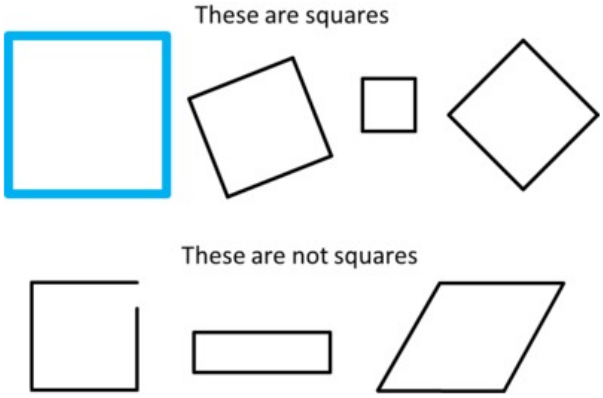
> ***A triangle is a closed shape with three straight sides that meet at three corners.***

The teacher will repeat the process for rectangles and then squares. Each time, the class should complete the appropriate sentence frame once they have settled on a universal attribute. Then the teacher can help them compose a definition for the shape.



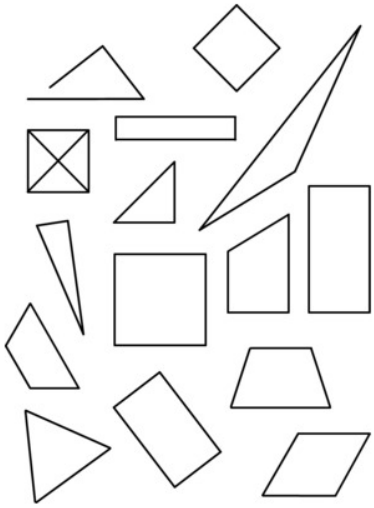


A rectangle is a closed shape with four straight sides and four square corners.



A square is a closed shape with four straight sides and four square corners. The four sides are the same length.

Once the class has working definitions in grade appropriate language for these shapes, students can identify the triangles, rectangles, and squares below. * Color all the triangles blue. * Color all the squares red. * Color all the rectangles green.



b. Example: Solution (DOK 2)

As a whole group, students will sort a collection of three-dimensional objects into categories by shape. There should be several that fall into each of the categories below:

- sphere
- cone
- pyramid
- cube
- cylinder
- rectangular prism

As a class, students brainstorm attributes of the objects they have classified, and the teacher writes those attributes where the entire class can see them. Students then use one of the following sentence frames as they classify the objects. The sentence frames should be written on sentence strips or some other large paper so that the entire class can read/see them during the activity.)

The _____ is in the shape of a _____ . It is/has _____ , just like all _____.

The _____ is in the shape of a _____ . It is/has _____ , but some _____ aren't/don't.

The teacher models with one or two objects to start. An example would be:

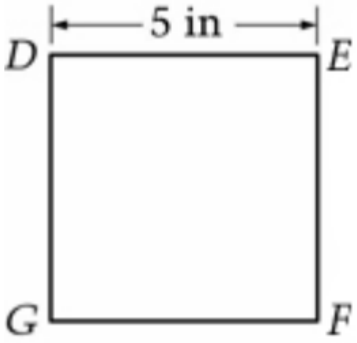
"The can is in the shape of a cylinder. It has circles on the ends, just like all cylinders."

"The can is a in the shape of a cylinder. It is made of metal, but some cylinders aren't."

This will help students distinguish between defining attributes and non-defining attributes.

Once students are familiar with this task they can be given a set of cards and can work in pairs to classify by defining attribute using the (now familiar) sentence frames.

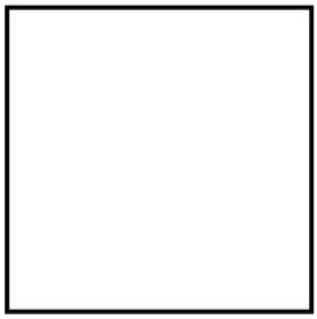
c. Example: (Former NAEP question) (DOK 1)
Below is a square. If side *DE* is five inches long, how long, in inches, is side *EF*?



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.[4] **(1.G.A.2) (DOK 2,3)**
   a. Example: Solution (DOK 2)

[4] Students do not need to learn formal names such as "right rectangular prism."

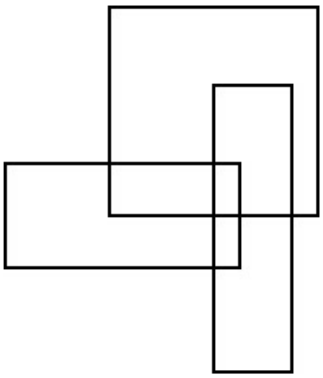
Give each student scissors, an envelope, and a square of colored paper (the colored paper should be of a wide spectrum to make it easier to keep puzzles apart).



Have the students cut the square into four pieces, then put those pieces in the envelope. The student can then trade puzzles as many times as they like and try to solve each others' puzzles by reassembling the shapes into a square.

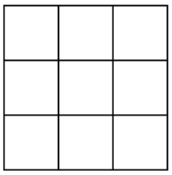
b. Example: Solution (DOK 1)

How many rectangles are in this picture?



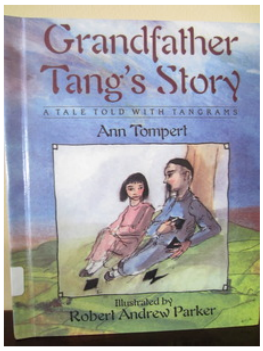
c. Example: Solution (DOK 1)

How many squares are in this picture?



d. Example: Solution (DOK 2)

Materials



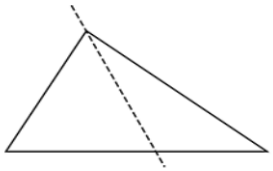
- A copy of *Grandfather Tang's Story* by Ann Tompert
- One set of tangrams for each student (see note in commentary)
- A set of tangrams for the teacher (magnetic for the whiteboard or colored to use on a document projector)
- Character worksheet
- Crayons

Actions

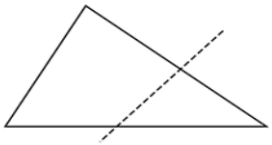
- The teacher reads Grandfather Tang's Story to the class. As the teacher comes to each character in the story, note the picture of the animal that is an outline of a shape that can be made with tangrams. Students may need to spend some time looking to see how these outlines represent the animals since they are somewhat abstract. Ask the students if they see familiar shapes as components of the animal outlines--for example, the tail of the fox is a trapezoid and the wings of the hawk are triangles.
- After the class has read the story, the students choose animals from the story to make with the tangrams. The worksheet shows the tangram animals, and when they have made an animal, they color the corresponding shape on the worksheet.
- The teacher can demonstrate for students how to turn and place the tangram shapes as needed to support the students.
- After the students have worked on making 2 or more animals from the book, they can make their own animals.

e. Example: (Former NAEP question) (DOK 1)

When a triangle is divided by a straight line, these results are possible.

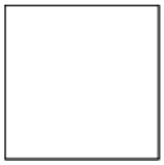


Two triangles

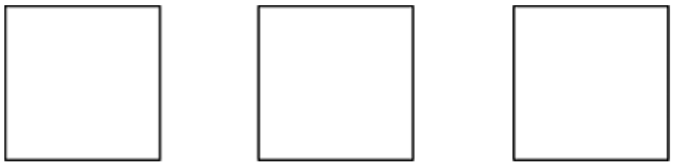


A triangle and
a quadrilateral

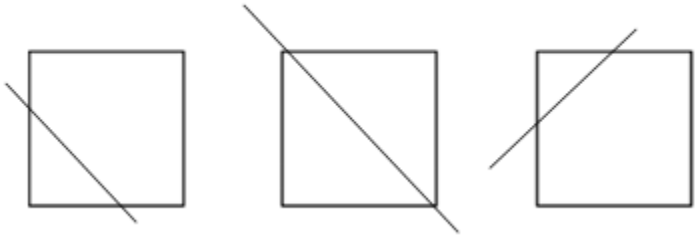
Draw one straight line to divide the square below into two rectangles.



Draw one straight line to divide each square below into two shapes that are not rectangles.
The results should be different for each square.

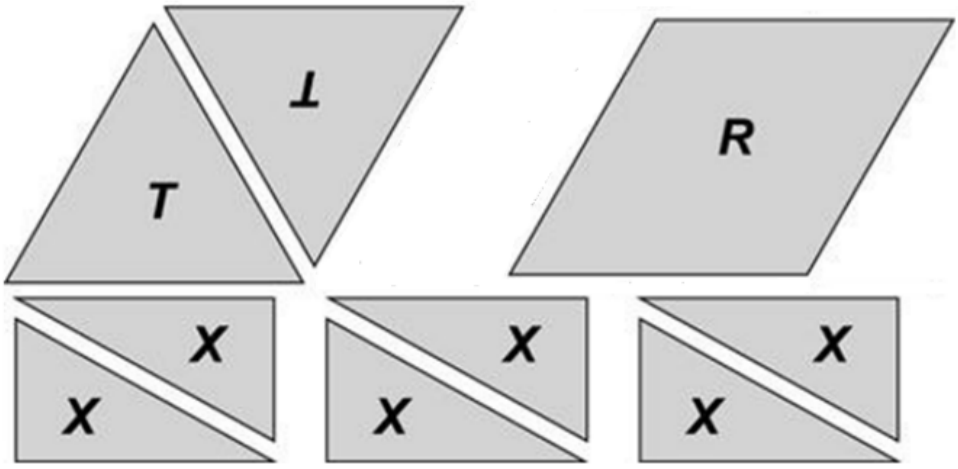


Answer:

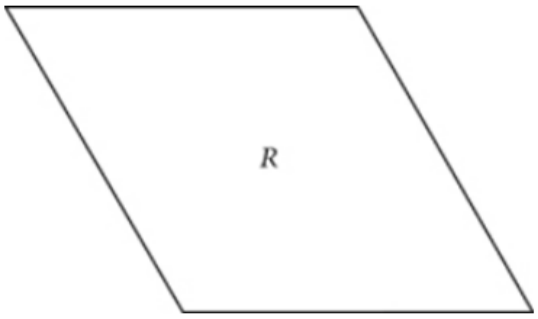


f. Example: (Former NAEP question) (DOK 1)

This question requires these additional materials:



The following question refers to pieces R, T and X.



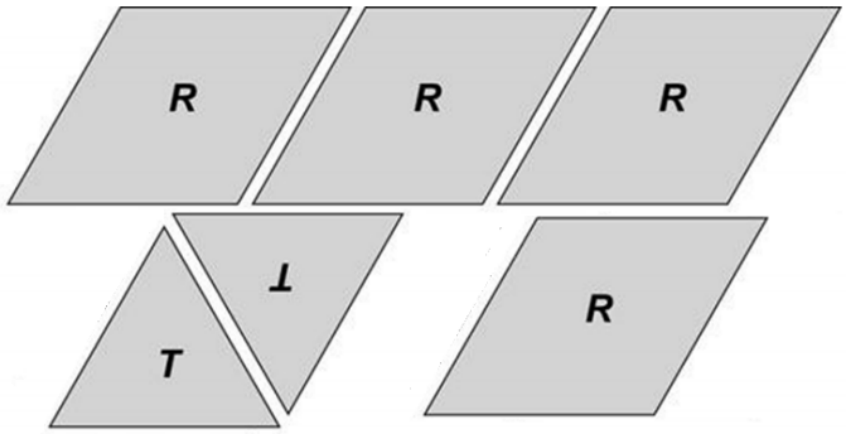
You can cover the piece labeled *R* with two of the pieces labeled *T*.

How many of the pieces labeled *X* are needed to cover the piece labeled *R* ?

A. Two
B. Three
C. Four
D. Six

Answer: C. Four

g. Example: (Former NAEP question) (DOK 1)



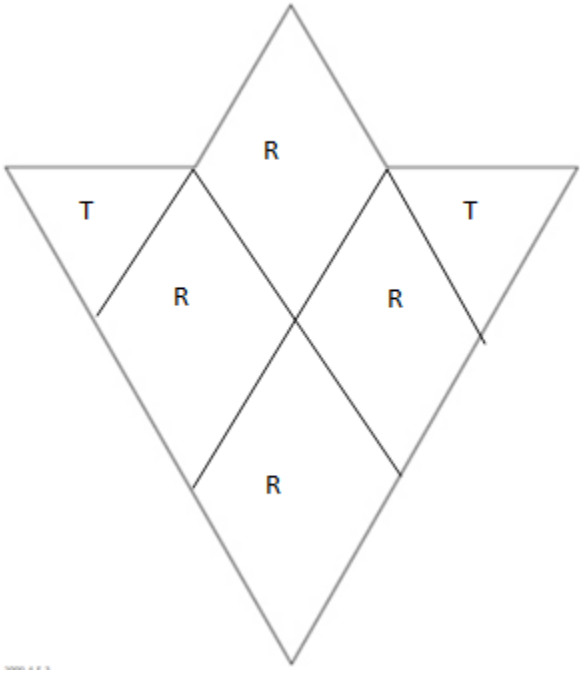
You will need four pieces labeled *R* and two pieces labeled *T* to answer this question.

Use these pieces to cover the figure below.

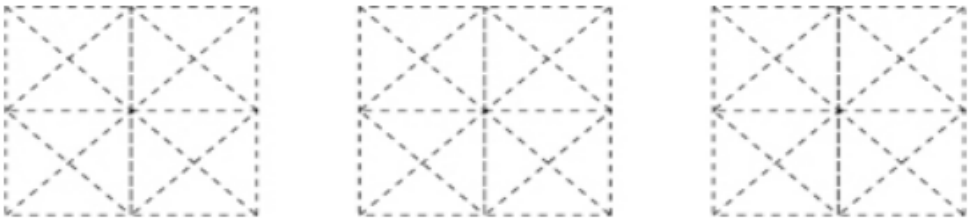
Draw the lines to show where the pieces meet.

Label the pieces on the figure.

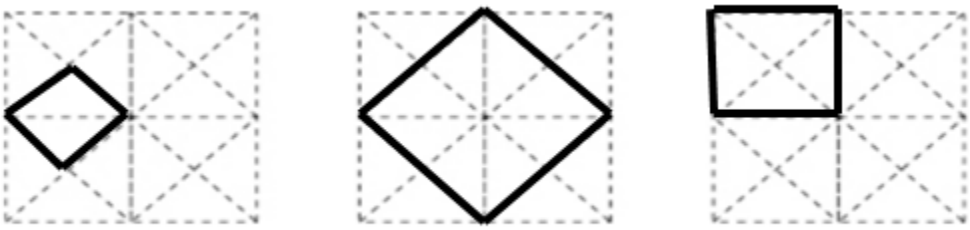
Answer:



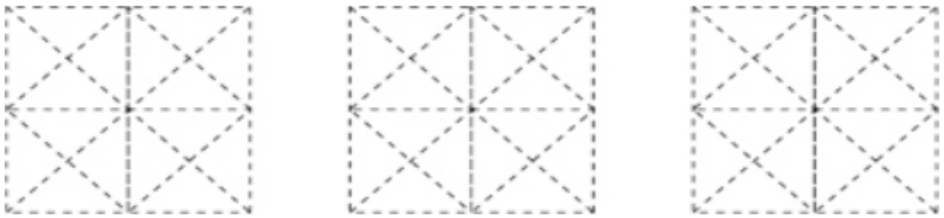
e. Example: (Former NAEP question) (DOK 1)
In each figure below, outline a square. The squares must not be the same size.



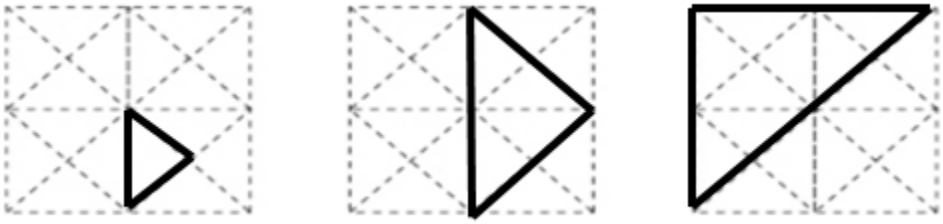
Answer:



f. Example: (Former NAEP question) (DOK 1)
In each figure below, outline a triangle. The triangles must not be the same size.



Answer:



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. **(1.G.A.3)** **(DOK 1,2)**
   a. Example: Solution (DOK 3)

Materials

- Paper cut outs of rectangles, circles, and squares
- Blank paper

Actions

Part One:

a. Give each pair of students a square and ask, “How can you share the square equally so that you and your partner get the same size piece?”

b. Ask students to fold the paper to show how they could get two equal parts.

c. Call on student volunteers to share, asking the class as each example is displayed, “Is the paper shared equally? Will each person get the same size piece? How do you know?”

d. Create a chart, showing some of the ways students folded the square to make two equal parts. Students may fold vertically, horizontally, or diagonally.

e. Tell students, “There are two equal parts.” Ask students, “What can we call each part of the rectangle?” Elicit student thinking, building the understanding that each piece is one of two equal parts, or half of the rectangle. The standard calls for students to "describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of." Helping students develop this language is critical. If students don't come up with this language, it's important to introduce it. After introducing the terms "half" and "half of" in this case, adding labels to the chart will help anchor the language.

You may repeat this with other shapes (circle, rectangle) or increase the number of students sharing the paper shape from 2 to 4. If you repeat with a rectangle some students may a scissors as scaffolding to cut the rectangle instead of folding when they divide the rectangle diagonally.

Part Two:

a. Pose the problem to students: "If you and three friends want to share a cake so that you each get the same amount, how can you much can each person have?" Ask questions to ensure students understand the context and problem being posed. Questions might include:

- *What is the story about?*
- *How many people are sharing the cake?*
- *What does it mean for each person to get the same amount?*

Provide students with tools such as blank paper and/or paper shapes to solve the problem. The cake context was selected to allow students to explore with multiple shapes as cakes may be round, square, or rectangular in shape.

b. As students solve the problem, monitor their progress looking for students that partition a shape into four equal shares.

c. Conduct a share out, showing several different student solutions that show a shape partitioned into four equal parts. It may be helpful to consider the features of each solution being shared by posing questions that get at student thinking and the essential mathematical ideas.

The teacher might ask questions such as:

- *How many people are sharing the cake?*
- *What does the picture represent? What is the circle? What is the square? What is the rectangle?*
- *How is __'s picture similar or different than ___'s?*
- *How much cake does each person get?*
- *Some people represented the cake with rectangles and others with squares or circles, did that change the amount of cake each person gets? Why or why not?*
- *What can we call these parts? How can we label them?*
- *Why do the parts need to be equal?*