

## Mathematics | Grade 4

In Grade 4, instructional time should focus on three critical areas: (1) developing understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends; (2) developing an understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers; (3) understanding that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures, and symmetry.

(1) Students generalize their understanding of place value to 1,000,000, understanding the relative sizes of numbers in each place. They apply their understanding of models for multiplication (equal-sized groups, arrays, area models), place value, and properties of operations, in particular the distributive property, as they develop, discuss, and use efficient, accurate, and generalizable methods to compute products of multi-digit whole numbers. Depending on the numbers and the context, they select and accurately apply appropriate methods to estimate or mentally calculate products. They develop fluency with efficient procedures for multiplying whole numbers; understand and explain why the procedures work based on place value and properties of operations; and use them to solve problems. Students apply their understanding of models for division, place value, properties of operations, and the relationship of division to multiplication as they develop, discuss, and use efficient, accurate, and generalizable procedures to find quotients involving multi-digit dividends. They select and accurately apply appropriate methods to estimate and mentally calculate quotients, and interpret remainders based upon the context.

(2) Students develop understanding of fraction equivalence and operations with fractions. They recognize that two different fractions can be equal (e.g.,  $15/9 = 5/3$ ), and they develop methods for generating and recognizing equivalent fractions. Students extend previous understandings about how fractions are built from unit fractions, composing fractions from unit fractions, decomposing fractions into unit fractions, and using the meaning of fractions and the meaning of multiplication to multiply a fraction by a whole number.

(3) Students describe, analyze, compare, and classify two-dimensional shapes. Through building, drawing, and analyzing two-dimensional shapes, students deepen their understanding of properties of two-dimensional objects and the use of them to solve problems involving symmetry.

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# Grade 4 Overview

## Operations and Algebraic Thinking

- Use the four operations with whole numbers to solve problems.
- Gain familiarity with factors and multiples.
- Generate and analyze patterns.

## Number and Operations in Base Ten

- Generalize place value understanding for multi-digit whole numbers.
- Use place value understanding and properties of operations to perform multi-digit arithmetic.

## Number and Operations—Fractions

- Extend understanding of fraction equivalence and ordering.
- Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.
- Understand decimal notation for fractions, and compare decimal fractions.

## Measurement and Data

- Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.
- Represent and interpret data.
- Geometric measurement: understand concepts of angle and measure angles.

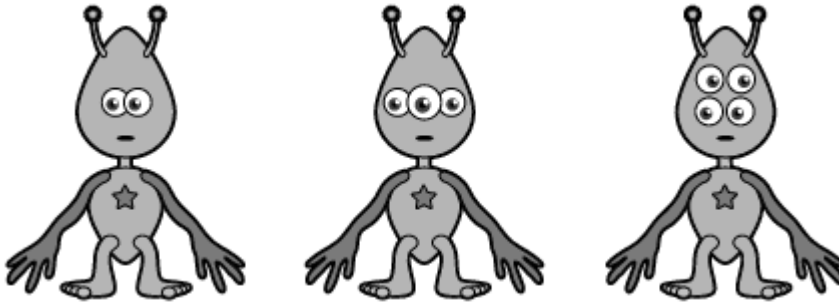
## Geometry

- Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

## 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.

**Example:** The two-eyed space creatures, three-eyed space creatures, and four-eyed space creatures are having a contest to create a group with 24 total eyes.



- How many two-eyed space creatures are needed to make a group with 24 total eyes?
- How many three-eyed space creatures are needed to make a group with 24 total eyes?
- How many four-eyed space creatures are needed to make a group with 24 total eyes?
- Somebody told the five-eyed space creatures that they could not join the contest. Explain why five-eyed space creatures cannot make a group with 24 eyes.

**Sample Top-Score Response:** 12, 8, 6

The five-eyed aliens can only make groups with eyes in a multiple of 5. 5, 10, 15, 20, 25. They will not be able to make a group with 24 eyes.

**For full credit (3 points):**

- The response demonstrates a full and complete understanding of communicating reasoning. The response contains the following evidence:
- The student correctly identifies the correct number of two-, three-, and four-eyed aliens needed to make a group with 24 eyes.

AND

- The student correctly explains that the five-eyed aliens cannot make a group with 24 eyes because 5 is not a factor of 24 or because the groups of eyes can only be multiples of 5.

**For partial credit (2 points):**

The response demonstrates a reasonable understanding of communicating reasoning. The response contains the following evidence:

- The student identifies one or two correct numbers of the two-, three-, or four-eyed aliens needed to make a group with 24 eyes.

AND

- The student correctly explains that the five-eyed aliens cannot make a group with 24 eyes because 5 is not a factor of 24 or because the groups of eyes can only be multiples of 5.

OR

- The student identifies the correct number of two-, three-, and four-eyed aliens needed to make a group with 24 eyes.

OR

- The student correctly explains that the five-eyed aliens cannot make up a group with 24 eyes because 5 is not a factor of 24 or because the groups of eyes can only be multiples of 5.

**For partial credit (1 point):**

The response demonstrates a partial understanding of communicating reasoning. The response contains the following evidence:

- The student identifies one or two of the correct numbers of two-, three-, or four-eyed aliens

needed to make a group with 24 eyes.

OR

- The student does not provide explanation for why the five-eyed aliens cannot make a group with 24 eyes.

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#31	3		3B, 2D	2	3.OA.2, 4.OA.3, 4.OA.4		12,8,6

Use the four operations with whole numbers to solve problems. (4.OA.A)

- a. Example: Tanya ran 400 meters on Tuesday. She ran 800 meters on Wednesday.  
What is the total number of meters Tanya ran on these two days?

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#1	1	OA, NBT	A	2	4.OA.A, 4.NBT.B.4	N/A	1200

1. Interpret a multiplication equation as a comparison, e.g., interpret  $35 = 5 \times 7$  as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. **(4.OA.A.1) (DOK 1,2)**

- a. Example: [Solution](#) (DOK 2)

There are almost 40 thousand fourth graders in Mississippi and almost 400 thousand fourth graders in Texas. There are almost 4 million fourth graders in the United States.

We write 4 million as 4,000,000. How many times more fourth graders are there in Texas than in Mississippi? How many times more fourth graders are there in the United States than in Texas? Use the approximate populations listed above to solve.

There are about 4 thousand fourth graders in Washington, D.C. How many times more fourth graders are there in the United States than in Washington, D.C.?

- b. Example: [Solution](#) (DOK 1)

Maned wolves are a threatened species that live in South America. People estimate that there are about 24,000 of them living in the wild.



The dhole is an endangered species that lives in Asia. People estimate there are ten times as many maned wolves as dholes living in the wild.



About how many dholes are there living in the wild?

- c. Example: Scott is reading a book that has 172 pages. Melanie is reading a book that has three times as many pages as Scott's book.

How many pages does Melanie's book have? Select **all** the equations that represent this problem.

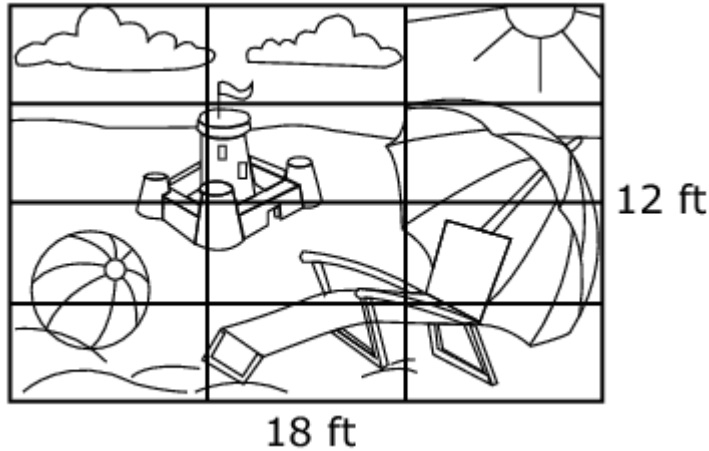
$172 \div 3 = \square$	$3 \times \square = 172$
$172 \times 3 = \square$	$\square \div 3 = 172$
$\square \div 172 = 3$	$172 \div \square = 3$

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key						
#10	4	OA	E	2	4.OA.A.1, 3.OA.B.6	4	<table border="1"> <tr> <td><math>172 \div 3 = \square</math></td> <td><math>3 \times \square = 172</math></td> </tr> <tr> <td><math>172 \times 3 = \square</math></td> <td><math>\square \div 3 = 172</math></td> </tr> <tr> <td><math>\square \div 172 = 3</math></td> <td><math>172 \div \square = 3</math></td> </tr> </table>	$172 \div 3 = \square$	$3 \times \square = 172$	$172 \times 3 = \square$	$\square \div 3 = 172$	$\square \div 172 = 3$	$172 \div \square = 3$
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1. Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.<sup>1</sup> **(4.OA.A.2) (DOK 1,2)**
  - a. Example: [Solution](#) (DOK 2)
    - a. Helen raised \$12 for the food bank last year and she raised 6 times as much money this year. How much money did she raise this year?
    - b. Sandra raised \$15 for the PTA and Nita raised \$45. How many times as much money did Nita raise as compared to Sandra?
    - c. Luis raised \$45 for the animal shelter, which was 3 times as much money as Anthony raised. How much money did Anthony raise?

<sup>1</sup> See Glossary, Table 2.

b. Example: Some students are painting this backdrop for the school play.



The backdrop is taped off into 12 equal sections for the students to paint.

Mark paints 2 times as much as Jill.

Sam paints 3 times as much as Lou.

Lou paints 1 section less than Mark.

Jill paints  $\frac{1}{12}$  of the backdrop.

Write the **fraction** of the backdrop that still needs painted.

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#27	4	NF, OA	A	2	4.NF.B, 4.OA.A.2	2	$\frac{5}{12}$

c. Example: A cat has 2 times as many toys as a puppy. The cat has 12 toys.  
How many toys does the puppy have?

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#21	1	OA	A	2	4.OA.A.2	N/A	6

d. Example: The cost of buying a movie is 4 times the cost of renting a movie. It costs \$20 to buy a movie. What is the cost, in dollars, of renting a movie?

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#15	1	OA	A	2	4.OA.A.2	N/A	5

e. Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. **(4.OA.A.3) (DOK 1,2,3)**

a. Example: [Solution](#) (DOK 2)



Karl's rectangular vegetable garden is 20 feet by 45 feet, and Makenna's is 25 feet by 40 feet. Whose garden is larger in area?

- b. Example: [Solution](#) (DOK 3)

Every year a carnival comes to Hallie's town. The price of tickets to ride the rides has gone up every year.

Year	Ticket Price
2008	\$2.00
2009	\$2.50
2010	\$3.00
2011	\$3.50
2012	\$4.00

- a. In 2008, Hallie's allowance was \$9.00 a month. How many carnival tickets could she buy with one month's allowance?
- b. If her allowance had stayed the same, \$9.00 a month, how many carnival tickets could she buy in 2012?
- c. In 2012, Hallie's allowance was \$14.00 per month. How much did her monthly allowance increase between 2008 and 2012?
- d. How much more did a carnival ticket cost in 2012 than it did in 2008?
- e. Was Hallie able to buy more carnival tickets in 2008 or in 2012 with one month's allowance?
- f. What would Hallie's allowance need to be in 2012 in order for her to be able to buy as many carnival tickets as she could in 2008?
- g. What happens to your ability to buy things if prices increase and your allowance doesn't increase?
- c. Example: Nicole is helping set up tables in the cafeteria.  
Each table in the cafeteria seats 8 students.  
Fourth grade students must fill a whole table before sitting at another table.  
There are 126 fourth grade students.  
Nicole needs to know how many seats might be empty at the last table after all 126 students are sitting at the table.  
She used these steps to solve the problem:

**Step 1:**  $8 \times 14 = 112$   
 $8 \times 15 = 120$   
 $8 \times 16 = 128$

**Step 2:**  $126 - 120 = 6$

**Step 3:**

Which equation could be Nicole’s Step 3 if she solved the problem correctly?

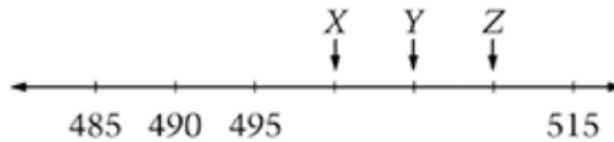
1.  $8-6=2$
2.  $6+15=21$
3.  $6 \times 8=48$
4.  $18/6=3$

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#12	3	OA	B	3	4.OA.A.3	1, 3	1

- d. Example: A teacher gives 6 students some cards to play a game. She has 52 cards total. The teacher gives each student 1 card until all 52 cards are gone. How many students get exactly 9 cards?
1. 2
  2. 4
  3. 5
  4. 6

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#8	2	OA	A	2	4.OA.A.3	1, 2	2

- e. Example: [Former NAEP question](#) (DOK 2)  
On the number line below, what is the sum of the numbers to which the arrows X, Y, and Z point?



- E. 1,491
- F. 1,515
- G. 1,530
- H. 1,545

Answer: F. 1,515

- f. Example: [Former NAEP question](#) (DOK 3)  
Raynold had 31 baseball cards. He gave the cards to his friends. Six of his friends received 3 cards each. Seven of his friends received 1 card each. The rest received 2 cards each. How many of his friends received exactly 2 cards from Raynold?

Explain how you found your answer.

Answer: 3 of his friends received exactly two cards. If six of his friends received 3 cards each that leaves  $(31-18 =)$  13 cards. If you take away 7 more cards for the seven friends you are left with  $(13-7=)$  6 cards. If he wants to give exactly two cards to the rest of his friends he must have  $(6 \div 2=)$  3 friends.

- g. Example: [Former NAEP question](#) (DOK 3)

<p style="text-align: center;"><b>AMUSEMENT PARK</b></p> <p style="text-align: center;"><i>70 things to do!</i></p> <p style="text-align: center;">34 rides plus games plus shows</p>
---

An amusement park has games, rides, and shows.

- The total number of games, rides, and shows is 70.
- There are 34 rides.
- There are two times as many games as shows.

How many games are there? \_\_\_\_\_

How many shows are there? \_\_\_\_\_

Use numbers, words, or drawings to show how you got your answer.

Answer: Games: 24, Shows: 12 I came to this answer by  $70 - 34 = 36$ . After that it was a matter of figuring out how to get two numbers that would add up to 36 and that would have one double the other.

- h. Example: ([Former NAEP question](#)) (DOK 3)  
A student had to multiply  $328 \times 41$ . The student's answer was 4,598.  
Use estimation to explain why this answer is not reasonable.

Answer: If you multiply this 328 and 41 by estimating it to 300 by 40, the answer would be around 12,000 not 4, 600.

- i. Example: ([Former NAEP question](#)) (DOK 2)  
Ms. Kim has 45 stickers that she wants to give out to 6 students. The students are sitting in a circle. Ms. Kim gives out one sticker at a time and keeps going around the circle until all the stickers are gone. How many of the students will get more than 7 stickers?
- A. 2
  - B. 3
  - C. 5
  - D. 6

Answer: B. 3

- j. Example: ([Former NAEP question](#)) (DOK 2)  
Five classes are going on a bus trip and each class has 21 students. If each bus holds only 40 students, how many buses are needed for the trip?

Answer: 3 buses

- k. Example: ([Former NAEP question](#)) (DOK 2)  
Stickers come in small booklets of 100 and in rolls of 1,000. On the store shelf, there are 6 booklets and 4 rolls of stickers. How many stickers are on the shelf?
- A. 1,100
  - B. 4,600
  - C. 6,400
  - D. 10,000

Answer: B. 4,600

- l. Example: ([Former NAEP question](#)) (DOK 2)  
There are 20 boxes of pencils in a case. Each box has the same number of pencils. The case has 420 pencils altogether. How many pencils are in each box?

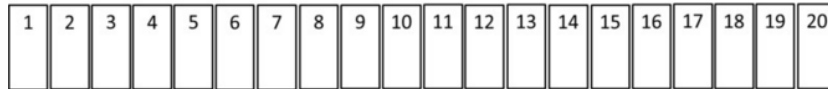
Answer: 21 pencils in each box

Gain familiarity with factors and multiples. (4.OA.B)

5. Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite. **(4.OA.B.4) (DOK 1)**

- a. Example: [Solution](#) (DOK 3)

The 20 students in Mr. Wolf's 4th grade class are playing a game in a hallway that is lined with 20 lockers in a row.







- The first student starts with the first locker and goes down the hallway and opens all the lockers.
- The second student starts with the second locker and goes down the hallway and shuts every other locker.
- The third student stops at every third locker and opens the locker if it is closed or closes the locker if it is open.
- The fourth student stops at every fourth locker and opens the locker if it is closed or closes the locker if it is open.

This process continues until all 20 students in the class have passed through the hallway.

- a. Which lockers are still open at the end of the game? Explain your reasoning.
- b. Which lockers were touched by only two students? Explain your reasoning.
- c. Which lockers were touched by only three students? Explain your reasoning.
- d. Which lockers were touched the most?
- b. Example: Marcia read books over the summer. She created the picture graph shown.

## Summer Reading

Month	Books
June	
July	
August	

 = 2 books

Create another picture graph that shows these data with a different key. You may use whole books and half books in your graph.

Select the key you will use.

Color in the books to complete your picture graph.




**A. Select the key you will use.**










= 3 books  
  = 4 books  
  = 5 books  
  = 6 books

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**B. New picture graph**

**Summer Reading**

Month	Books
June	
July	
August	

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key								
#5	4	MD, OA, NF	F	3	3.MD.B.3, 4.OA.B.4, 4.NF.B.4b	1, 6	<div style="border: 1px solid black; padding: 5px;"> <p><b>A. Select the key you will use.</b></p> <p> <input type="checkbox"/> = 3 books                               <input checked="" type="checkbox"/> = 4 books                               <input type="checkbox"/> = 5 books                               <input type="checkbox"/> = 6 books                         </p> <hr/> <p><b>B. New picture graph</b></p> <p style="text-align: center;"><b>Summer Reading</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Month</th> <th style="width: 75%;">Books</th> </tr> </thead> <tbody> <tr> <td>June</td> <td style="text-align: center;">  </td> </tr> <tr> <td>July</td> <td style="text-align: center;">  </td> </tr> <tr> <td>August</td> <td style="text-align: center;">  </td> </tr> </tbody> </table> <p style="text-align: center;"> <input checked="" type="checkbox"/> = 4 books                             </p> </div>	Month	Books	June		July		August	
Month	Books														
June															
July															
August															

- c. Example: ([Former NAEP question](#)) (DOK 1)  
Which factor of 12 is missing in this list of numbers?

**1, 2, 3, 4, \_\_\_\_, 12**

- A. 5
- B. 6
- C. 8

D. 10

Answer: B. 6

- d. Example: ([Former NAEP question](#)) (DOK 1)  
On the chart, circle all the numbers that have 4 as a factor.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15

Answer: Circle: 1, 2, 4

- e. Example: Which of these numbers is a prime number? ([Former NAEP question](#)) (DOK 1)
- A. 6
  - B. 27
  - C. 67
  - D. 81

Answer: 67

- f. Example: ([Former NAEP question](#)) (DOK 1)  
Which of the following true statements proves that 119 is not a prime number?
- A.  $17 \times 7 = 119$
  - B.  $119 \times 1 = 119$
  - C. 119 is greater than 100.
  - D. 119 is an odd number.
  - E. 119 is not divisible by 3

Answer: A.  $17 \times 7 = 119$

- g. Example: ([Former NAEP question](#)) (DOK 1)  
A certain even number is divisible by 9. This number is between 100 and 120. What is the number?

Answer: 108

- h. Example: ([Former NAEP question](#)) (DOK 1)  
The numbers 20 and 22 have a common factor. What is the common factor?
- A. 2
  - B. 4
  - C. 20
  - D. 22
  - E. 440

Answer: A. 2

- i. Example: Which of these numbers is a prime number? ([Former NAEP question](#)) (DOK 1)
- A. 15
  - B. 23
  - C. 34
  - D. 56

Answer: B. 23

Generate and analyze patterns. (4.OA.C)

6. Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. *For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.* (4.OA.C.5) (DOK 1,2)

- a. Example: [Solution](#) (DOK 3)

a. The table below shows a list of numbers. For every number listed in the table, multiply it by 2 and add 1. Record the result on the right.

number	double the number plus one
0	
1	
2	
3	
4	
5	
10	
23	
57	
100	
309	

- b. What do you notice about the numbers you entered into the table?



- c. Sherri noticed that all the numbers she entered are odd.
- i. Does an even number multiplied by 2 result in an even or odd number? Why do you think this is?
  - ii. Does an odd number multiplied by 2 result in an even or odd number? Why do you think this is?
  - iii. Does an even number plus 1 result in an even or odd number? Why do you think this is?
  - iv. Does an odd number plus 1 result in an even or odd number? Why do you think this is?
  - v. Explain why the numbers you entered in the table are all odd.

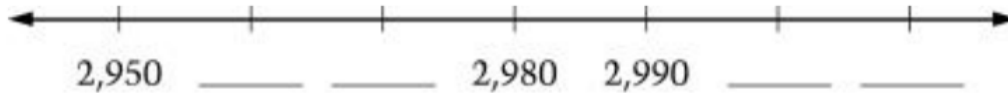
- b. Example: [Solution](#) (DOK 3)
- a. Starting with 9, list the first 10 multiples of 9.
  - b. In the list in part (a) what patterns do you see with the digits in the 10's place? What patterns do you see with the digits in the 1's place?
  - c. Using pictures, words, or equations, explain the patterns you observed in part (b).

- c. Example: A pattern is generated using this rule:  
 Start with the number 7 as the first term and add 5.  
 Write numbers in the boxes to complete the table.

Term	Number
First	7
Second	<input type="text"/>
Third	<input type="text"/>
Fourth	<input type="text"/>
Fifth	<input type="text"/>


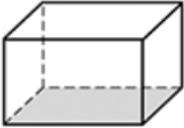
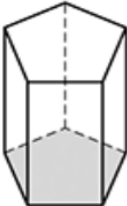
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#17	1	OA	C	2	4.OA.C.5	N/A	<table border="1"> <thead> <tr> <th>Term</th> <th>Number</th> </tr> </thead> <tbody> <tr> <td>First</td> <td>7</td> </tr> <tr> <td>Second</td> <td><input type="text" value="12"/></td> </tr> <tr> <td>Third</td> <td><input type="text" value="17"/></td> </tr> <tr> <td>Fourth</td> <td><input type="text" value="22"/></td> </tr> <tr> <td>Fifth</td> <td><input type="text" value="27"/></td> </tr> </tbody> </table>	Term	Number	First	7	Second	<input type="text" value="12"/>	Third	<input type="text" value="17"/>	Fourth	<input type="text" value="22"/>	Fifth	<input type="text" value="27"/>
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Fifth	<input type="text" value="27"/>																		

- d. Example: ([Former NAEP question](#)) (DOK 1)  
Fill in the four missing numbers on the number line below.



Answer: 2,960, 2,970... 3,000, 3,010

- e. Example: ([Former NAEP question](#)) (DOK 1)  
The table below shows the number of edges for each prism. What is the number of edges for a prism if the bottom face has 7 sides?
1. 18
  2. 20
  3. 21
  4. 22

Shape	Number of Edges
Triangular Prism 	9
Rectangular Prism 	12
Pentagonal Prism 	15

Answer: 3. 21

- f. Example: ([Former NAEP question](#)) (DOK 2)  
Every 30 minutes Dr. Kim recorded the number of bacteria in a test tube.

Time	Number of Bacteria
1:00 P.M.	600
1:30 P.M.	1,190
2:00 P.M.	2,390
2:30 P.M.	4,800

Which best describes what happened to the number of bacteria every 30 minutes?

- A. The number of bacteria increased by 500.
- B. The number of bacteria increased by 1,000.
- C. The number of bacteria doubled.
- D. The number of bacteria tripled.

Answer: C. The number of bacteria doubled

- g. Example: ([Former NAEP question](#)) (DOK 2)  
Write the next two numbers in the number pattern.

1 6 4 9 7 12 10 \_\_\_\_\_

Write the rule that you used to find the two numbers you wrote.

Answer: 15, 13 Rule: Plus 5 minus 2

Generalize place value understanding for multi-digit whole numbers. (4.NBT.A)

1. Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. *For example, recognize that  $700 \div 70 = 10$  by applying concepts of place value and division. (4.NBT.A.1) (DOK 1)*
  - a. Example: [Solution](#) (DOK 2)

There are almost 40 thousand fourth graders in Mississippi and almost 400 thousand fourth graders in Texas. There are almost 4 million fourth graders in the United States.

We write 4 million as 4,000,000. How many times more fourth graders are there in Texas than in Mississippi? How many times more fourth graders are there in the United States than in Texas? Use the approximate populations listed above to solve.

There are about 4 thousand fourth graders in Washington, D.C. How many times more fourth graders are there in the United States than in Washington, D.C.?

---

<sup>2</sup> Grade 4 expectations in this domain are limited to whole numbers less than or equal to 1,000,000.

- b. Example: [Solution](#) (DOK 2)

Maned wolves are a threatened species that live in South America.  
 People estimate that there are about 24,000 of them living in the wild.



The dhole is an endangered species that lives in Asia. People estimate there are ten times as many maned wolves as dholes living in the wild.



About how many dholes are there living in the wild?

- c. Example: Select the statement that explains how the values of the numbers 420 and 4,200 are different.
1. 4,200 is 1000 times as large as 420
  2. 4,200 is 100 times as large as 420
  3. 4,200 is 10 times as large as 420
  4. 4,200 is 1 time as large as 420

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#2	1	NBT	D	1	4.NBT.A.1	N/A	3

2. Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using  $>$ ,  $=$ , and  $<$  symbols to record the results of comparisons. **(4.NBT.A.2) (DOK 1)**

a. Example: [Solution](#) (DOK 1)

a. Arrange these numbers in increasing order, beginning with the least.

2400    4002    2040    420    2004

b. Arrange these numbers in decreasing order, beginning with the greatest.

1470    847    710    1047    147

b. Example: Select True or False for each comparison.

	True	False
1. 5 hundreds + 4 tens > 50 + 400		
2. 524 > 50 + 200 + 400		
3. 50 tens + 20 ones = 520		

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key	
#18	1	NBT	D	2	4.NBT.A.2	N/A		
							5 hundreds + 4 tens > 50 + 400	<input checked="" type="checkbox"/> True <input type="checkbox"/> False
							524 < 50 + 200 + 4	<input type="checkbox"/> True <input checked="" type="checkbox"/> False
							50 tens + 20 ones = 520	<input checked="" type="checkbox"/> True <input type="checkbox"/> False

c. Example: [Former NAEP question](#) (DOK 1)

Which set of numbers is listed from the smallest to largest?

A. 1,001    1,100    1,011

B. 2,200    2,022    2,020

C. 3,030    3,003    3,300

D. 4,004    4,040    4,044

Answer: D

d. Example: [Former NAEP question](#) (DOK 1)

Which of the following numbers is five million, eighty thousand?

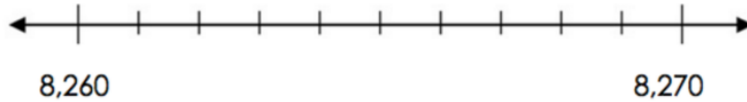
1. 5,800,000
2. 5,008,000
3. 5,000,008
4. 5,080,000

5. 580,000  
Answer: 4. 5,080,000

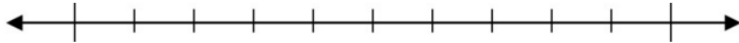
3. Use place value understanding to round multi-digit whole numbers to any place.  
(4.NBT.A.3) (DOK 1)

a. Example: [Solution](#) (DOK 3)

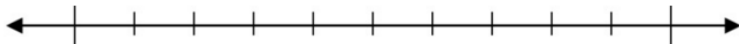
a. The number 8,263 lies between 8,260 and 8,270 on the number line.  
Label all the other tick marks between 8,260 and 8,270. Is 8,263 closer to 8,260 or 8,270 on the number line?



b. Which hundred is 8,263 nearest to on the number line? Plot 8,200 and 8,300 on the two outermost spots on the number line below. Then plot 8,263 to prove your answer.



c. Which thousand is 8,263 nearest to on the number line? Plot 8,000 and 9,000 on the two outermost spots on the number line below. Then plot 8,263 to prove your answer.



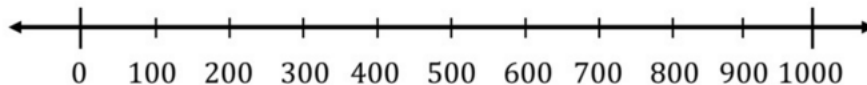
b. Example: [Solution](#) (DOK 2)

Plot the following numbers on the number line:

80

328

791

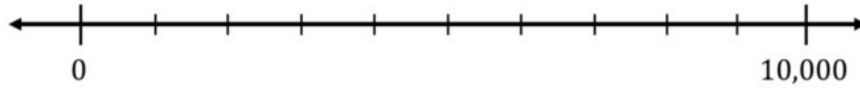


a. Round each number to the nearest 100. How can you see this on the number line?

b. Round each number to the nearest 1000. How can you see this on the number line?

c. Example: [Solution](#) (DOK 3)

The tick marks on the number line are evenly spaced. Label them.



Plot the following numbers on the number line:

85

940

2,316

5,090

7,784

Round each number to the nearest 1000. Explain how you can tell which thousand each number will round to by looking at the number line.

**Use place value understanding and properties of operations to perform multi-digit arithmetic. (4.NBT.B)**

1. Fluently add and subtract multi-digit whole numbers using the standard algorithm. **(4.NBT.B.4) (DOK 1)**
  - a. Example: Write one number in each box to complete the subtraction problem shown.

$$\begin{array}{r}
 50\boxed{\phantom{0}}6 \\
 - \boxed{\phantom{0}}48\boxed{\phantom{0}} \\
 \hline
 16\boxed{\phantom{0}}8
 \end{array}$$

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#23	2	NBT	A	2	4.NBT.B.4	1	$  \begin{array}{r}  50\boxed{9}6 \\  - \boxed{3}48\boxed{8} \\  \hline  16\boxed{0}8  \end{array}  $

- b. Example: Write the sum.

$$\begin{array}{r}
 4325 \\
 + 654 \\
 \hline
 \end{array}$$

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#9	1	NBT	E	1	4.NBT.B.4	N/A	4979



- c. Example: Tanya ran 400 meters on Tuesday. She ran 800 meters on Wednesday. 1200  
What is the total number of meters Tanya ran on these two days?

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#1	1	OA, NBT	A	2	4.OA.A, 4.NBT.B.4	N/A	1200

- d. Example: ([Former NAEP question](#)) (DOK 2)  
Sam's school is trying to collect one million pennies.  
Write this amount as a number.  
\_\_\_\_\_ pennies.  
So far, the school has collected 513, 462 pennies. How many more pennies does the school need to collect to reach one million?  
\_\_\_\_\_pennies.

Answer: 1,000,000 pennies, 486,538 pennies

- e. Example: ([Former NAEP question](#)) (DOK 1)  
What number is 10,000 more than 333,333?  
1. 333,433  
2. 334,333  
3. 343,333  
4. 433,333

Answer: 4. 433,333

- f. Example: ([Former NAEP question](#)) (DOK 1)  
Add: 20,000 + 790,000 =  
g. 792,000  
h. 810,000  
i. 811,000  
j. 990,000

Answer: h. 810, 000

- g. Example: ([Former NAEP question](#)) (DOK 1)  
Subtract:  
6,090  
-4,843

1. 1,147
2. 1,247
3. 2,257
4. 2,853

Answer: 2. 1,247

- h. Example: ([Former NAEP question](#)) (DOK 1)

What number is 10 more than 5,237?

1. 5,238
2. 5,247
3. 5,337
4. 6,237

Answer: 2. 5,247

- i. Example: ([Former NAEP question](#)) (DOK 1)

By how much will the value of the number 4,372 increase if the 3 is replaced with a 9?

1. 6
2. 60
3. 600
4. 6,000

Answer: 3. 600

- j. Example: ([Former NAEP question](#)) (DOK 1)

Which of these would be easiest to solve by using mental math?

1.  $\$65.12 - \$28.19$
2.  $358 \times 2$
3.  $1,625 \div 3$
4.  $\$100.00 \div \$10.00$

Answer: 4.  $\$100.00 \div \$10.00$

- k. Example: ([Former NAEP question](#)) (DOK 3)

Dianne found the torn piece of paper shown below.



Six numbers originally appeared in a column on this paper. The fourth number from the top of the column had been completely torn away. Dianne wondered whether the sum of the six numbers was odd or even. Give an example of a number that could be the fourth number in the column if the sum of the six numbers is an odd number.

Answer: \_\_\_\_\_

Explain why you chose that number.

Answer: I would make the fourth number an odd number. Because the numbers as is are going to be even, if you want an odd number than you would need to add an odd number onto the paper.

2. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. **(4.NBT.B.5) (DOK 1,2)**

- a. Example: [Solution](#) (DOK 2)

There are almost 40 thousand fourth graders in Mississippi and almost 400 thousand fourth graders in Texas. There are almost 4 million fourth graders in the United States.

We write 4 million as 4,000,000. How many times more fourth graders are there in Texas than in Mississippi? How many times more fourth graders are there in the United States than in Texas? Use the approximate populations listed above to solve.

There are about 4 thousand fourth graders in Washington, D.C. How many times more fourth graders are there in the United States than in Washington, D.C.?

- b. Write the unknown number that makes the equation true.

i.  $36 \times 94 = 2700 + ? + 540 + 24$

Item	Claim	Domain	Target	DOK	Content	MP	Key
#26	1	NBT	E	2	4.NBT.B.5	N/A	120

- a. Example: [Former NAEP question](#) (DOK 1)

Patty expects that each tomato plant in her garden will bear 24 tomatoes. If there are 6 tomato plants in her garden, how many tomatoes does she expect?

- 4
- 18
- 30
- 144

Answer: 4. 144

- b. Example: [Former NAEP question](#) (DOK 1)

74  
X16

- 90
- 518

3. 1,164
4. 1,184

Answer: 4. 1,184

3. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. **(4.NBT.B.6) (DOK 1,2)**
  - a. Example: [Solution](#) (DOK 3)

Jillian says

*I know that 20 times 7 is 140 and if I take away 2 sevens that leaves 126. So  $126 \div 7 = 18$ .*

- a. Is Jillian's calculation correct? Explain.
  - b. Draw a picture showing Jillian's reasoning.
  - c. Use Jillian's method to find  $222 \div 6$ .
- b. Example: ([Former NAEP question](#)) (DOK 1)  
Park School has 316 students. For field day, the students are put into 4 teams with the same number of students on each team. How many students are on each team?
    1. 79
    2. 312
    3. 320
    4. 1,264

Answer: 1. 79

- c. Example: ([Former NAEP question](#)) (DOK 1)  
 $476 \div 5 = \underline{\quad}$ 
  1. 85 R1
  2. 95 R1
  3. 96
  4. 135 R1

Answer: 2. 95 R1

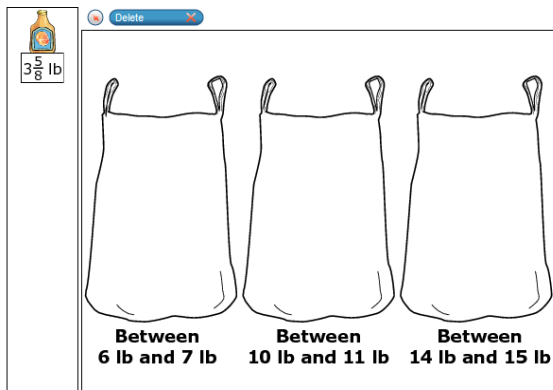
**Number and Operations—Fractions<sup>3</sup>**

**4.NF**

**Example:** Jared is testing how much weight a bag can hold. He plans to put juice bottles into three bags. He wants each bag to have a total weight within a given range.

- Draw juice bottles into each bag so that the weight is within the given range.
- Leave the bag empty if the given range is not possible using juice bottles.

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#28	2		2A	2	4.NF.4c		0,3,4



**Example:** Five friends ordered 3 large sandwiches.

- James ate  $\frac{3}{8}$  of a sandwich.
  - Katya ate  $\frac{1}{4}$  of a sandwich.
  - Ramon ate  $\frac{3}{8}$  of a sandwich.
  - Sienna ate  $\frac{2}{4}$  of a sandwich.
- How much sandwich is left for Oscar?

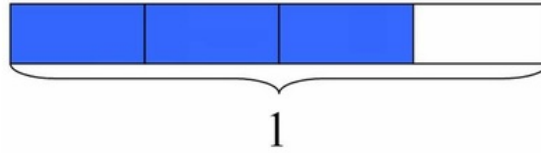
Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#29	2		2A, 2D	1	4.NF. 3		$\frac{3}{8}$

Extend understanding of fraction equivalence and ordering. (4.NF.A)

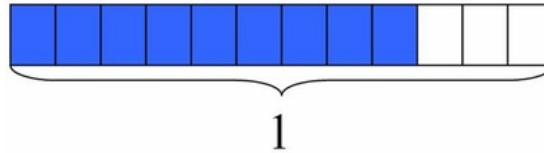
1. Explain why a fraction  $a/b$  is equivalent to a fraction  $(n \times a)/(n \times b)$  by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions. **(4.NF.A.1) (DOK 1,2,3)**
  - a. Example: [Solution](#) (DOK 3)

<sup>3</sup> Grade 4 expectations in this domain are limited to fractions with denominators 2,3, 4, 5, 6, 8, 10, 12, and 100.

a. The rectangle below has length 1. What fraction does the shaded part represent?



b. The rectangle below has the same length as the rectangle above. What fraction does the shaded part represent?



c. Use the pictures to explain why the two fractions represented above are equivalent.

b. Example: [Solution](#) (DOK 3)

a. What fraction of the rectangle below is shaded?



b. Laura says that  $\frac{1}{4}$  of the rectangle is shaded. Do you think she is correct? Explain why or why not by using the picture.



**Figure A**

c. Example: Figure A has  $\frac{2}{3}$  of its whole shaded gray.

Decide if each fraction is equal to  $\frac{2}{3}$ . Check Yes or No for each fraction.

	Yes	No
$\frac{4}{6}$	<input type="checkbox"/>	<input type="checkbox"/>
$\frac{1}{2}$	<input type="checkbox"/>	<input type="checkbox"/>
$\frac{8}{12}$	<input type="checkbox"/>	<input type="checkbox"/>

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key												
#11	1	NF	F	1	4.NF.A.1	N/A	<table border="1"> <thead> <tr> <th></th> <th>Yes</th> <th>No</th> </tr> </thead> <tbody> <tr> <td><math>\frac{4}{6}</math></td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><math>\frac{1}{2}</math></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><math>\frac{8}{12}</math></td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </tbody> </table>		Yes	No	$\frac{4}{6}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>	$\frac{1}{2}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	$\frac{8}{12}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Yes	No																	
$\frac{4}{6}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>																	
$\frac{1}{2}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>																	
$\frac{8}{12}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>																	

- d. Example: Figure A has  $\frac{4}{12}$  of its whole shaded.



**Figure A**

Write **another** fraction that is equal to  $\frac{4}{12}$ .

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#3	1	NF	F	1	4.NF.A.1	N/A	1/3 or equivalent

2. Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as  $\frac{1}{2}$ . Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols  $>$ ,  $=$ , or  $<$ , and justify the conclusions, e.g., by using a visual fraction model.
- (4.NF.A.2) (DOK 1,2,3)**
- a. Example: Write one fraction in each box to create two true comparisons.

$\square > \square$   
  
 $\square < \square$

$\frac{1}{2}$     $\frac{2}{3}$     $\frac{3}{5}$     $\frac{4}{6}$     $\frac{5}{8}$     $\frac{6}{10}$

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#25	3	NF	A	3	4.NF.A.2	6	$\frac{2}{3} > \frac{1}{2}$ $\frac{3}{5} < \frac{4}{6}$ (Other correct responses are possible)

b. Example: Select True or False for each comparison.

	True	False
$\frac{1}{4} < \frac{2}{12}$	<input type="checkbox"/>	<input type="checkbox"/>
$\frac{2}{10} > \frac{3}{5}$	<input type="checkbox"/>	<input type="checkbox"/>
$\frac{4}{6} > \frac{5}{12}$	<input type="checkbox"/>	<input type="checkbox"/>

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key												
#16	1	NF	F	2	4.NF.A.2	N/A	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td><math>\frac{1}{4} &lt; \frac{2}{12}</math></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><math>\frac{2}{10} &gt; \frac{3}{5}</math></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><math>\frac{4}{6} &gt; \frac{5}{12}</math></td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </tbody> </table>		True	False	$\frac{1}{4} < \frac{2}{12}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	$\frac{2}{10} > \frac{3}{5}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	$\frac{4}{6} > \frac{5}{12}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	True	False																	
$\frac{1}{4} < \frac{2}{12}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>																	
$\frac{2}{10} > \frac{3}{5}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>																	
$\frac{4}{6} > \frac{5}{12}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>																	

c. Example: A student claims that all fractions greater than  $\frac{3}{7}$  have a denominator less than 7. Show that the student's claim is only sometimes true.

Write one number in each box to create a fraction greater than  $\frac{3}{7}$  with a denominator less than 7.



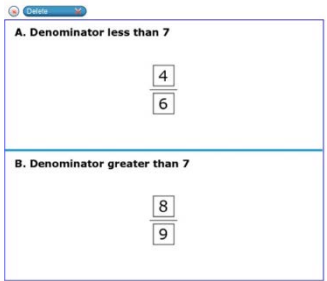
**A. Denominator less than 7**

$$\frac{\square}{\square}$$

Write one number in each box to create a fraction greater than  $\frac{3}{7}$  with a denominator greater than 7.

**B. Denominator greater than 7**

$$\frac{\square}{\square}$$

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#7	3	NF	F	2	4.NF.A.2	2, 3	

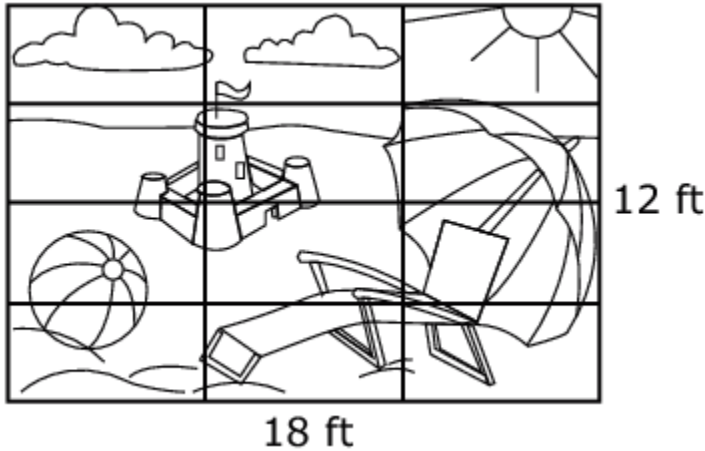
- d. Example: ([Former NAEP question](#)) (DOK 1)  
Which fraction has a value closest to  $\frac{1}{2}$ ?

- A.  $\frac{5}{8}$
- B.  $\frac{1}{6}$
- C.  $\frac{2}{2}$
- D.  $\frac{1}{5}$

Answer: A.

Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers. (4.NF.B)

1. Example: Some students are painting this backdrop for the school play.



The backdrop is taped off into 12 equal sections for the students to paint.

Mark paints 2 times as much as Jill.  
 Sam paints 3 times as much as Lou.  
 Lou paints 1 section less than Mark.

Jill paints  $\frac{1}{12}$  of the backdrop.

Write the fraction of the backdrop that still needs painted.

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#27	4	NF, OA	A	2	4.NF.B, 4.OA.A.2	2	$\frac{5}{12}$

2. Understand a fraction  $a/b$  with  $a > 1$  as a sum of fractions  $1/b$ .
  - a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.
  - b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples:*  $3/8 = 1/8 + 1/8 + 1/8$ ;  $3/8 = 1/8 + 2/8$ ;  $2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8$ .
  - c. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.
3. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem. **(4.NF.B.3)** **(DOK 1,2,3)**
  - a. Example: [Solution](#) (DOK 2)

Use  $<$ ,  $=$ , or  $>$  to compare the following sums:

a.  $\frac{1}{2} + \frac{1}{4}$  | \_\_\_\_\_ |  $\frac{1}{3} + \frac{1}{5}$

b.  $\frac{1}{3} + \frac{1}{2}$  | \_\_\_\_\_ |  $\frac{1}{3} + \frac{1}{4}$

b. Example: [Solution](#) (DOK 3)

Ben wrote a mixed number as the fraction  $7\frac{1}{3}$ . Here is his work:

$$\begin{aligned} 7\frac{1}{3} &= \frac{7}{1} + \frac{1}{3} && \text{(Step 1)} \\ &= \frac{(7 \times 3) + 1}{3} && \text{(Step 2)} \\ &= \frac{21 + 1}{3} && \text{(Step 3)} \\ &= \frac{22}{3} && \text{(Step 4)} \end{aligned}$$

Explain what Ben did in each step.

c. Example: [Solution](#) (DOK 2)

Which of the following sums are equal to  $\frac{22}{17}$ ?

a.  $\frac{5}{17} + \frac{4}{17} + \frac{3}{17} + \frac{10}{17}$

b.  $\frac{3}{17} + \frac{8}{17} + \frac{3}{17} + \frac{10}{17}$

c.  $\frac{6}{17} + \frac{4}{17} + \frac{3}{17} + \frac{5}{17} + \frac{2}{17} + \frac{2}{17}$

d.  $\frac{12}{17} + \frac{10}{17}$

e.  $\frac{1}{17} + \frac{1}{17} + \frac{9}{17} + \frac{3}{17}$

Find another way to write  $\frac{22}{17}$  as a sum of fractions.

d. Example: [Solution](#) (DOK 2)

Dennis and Cody are building a castle out of plastic building blocks. They will need  $2\frac{1}{2}$  buckets of blocks for the castle they have in mind. Dennis used to have two full buckets of blocks but lost some and now has  $1\frac{3}{4}$  buckets. Cody used to have two full buckets of blocks too, but now has  $1\frac{1}{4}$  buckets. If Dennis and Cody combine their buckets of blocks, will they have enough to build their castle?

e. Example: [Solution](#) (DOK 2)

Cynthia is making her famous "Perfect Punch" for a party. After looking through the recipe, Cynthia knows that she needs to mix  $4\frac{5}{8}$  gallons of fruit juice concentrate with  $3\frac{7}{8}$  gallons of sparkling water.

a. Just as she is about to get started she realizes that she only has one 10-gallon container to use for mixing. Will this container be big enough to hold all the ingredients?

b. How much punch will this recipe make?

f. Example: [Solution](#) (DOK 1)

Alfredo picked  $2\frac{3}{4}$  pounds of peaches from the tree in his backyard. He gave  $1\frac{1}{4}$  pounds to his neighbor Madeleine. How many pounds of peaches does Alfredo have left?

g. Example: Michael eats  $\frac{4}{6}$  of a bag of crackers. Erin eats  $\frac{5}{6}$  of a bag of crackers.

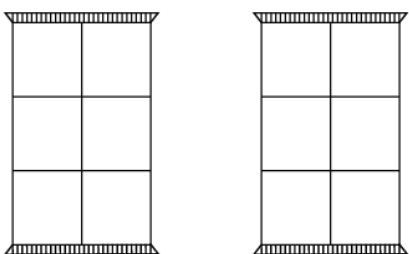


represents one full  
bag of crackers

**Part A:** Color in the spaces on the model to show how many bags of crackers Michael and Erin eat together.

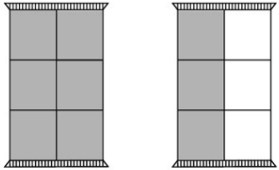
**Part B:** Circle the total number of bags of crackers Michael and Erin eat together.

**Part A:**



**Part B:**

$\frac{9}{12}$      $1\frac{3}{6}$      $\frac{1}{6}$      $1\frac{3}{12}$

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#24	1	NF	G	1	4.NF.B.3	N/A	<p><b>Part A:</b></p>  <p><b>Part B:</b></p> <p><math>\frac{9}{12}</math>    <math>1\frac{3}{6}</math>    <math>\frac{1}{6}</math>    <math>1\frac{3}{12}</math></p>

h. Example: Check **all** the numbers that make this inequality true.

$$2\frac{1}{8} > ? + 1 + \frac{1}{8}$$

- a.  $\frac{1}{8}$
- b.  $\frac{4}{8}$
- c.  $\frac{10}{8}$

d.  $\frac{16}{8}$

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#19	3	NF	D	3	4.NF.B.3	7	<input checked="" type="checkbox"/> $\frac{1}{8}$ <input checked="" type="checkbox"/> $\frac{4}{8}$ <input type="checkbox"/> $\frac{10}{8}$ <input type="checkbox"/> $\frac{16}{8}$

- i. Example: ([Former NAEP question](#)) (DOK 1)  
 Change the following mixed numeral to an improper fraction.

$$2\frac{1}{8} = \underline{\hspace{2cm}}$$

Answer: 17/8

4. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.
- Understand a fraction  $a/b$  as a multiple of  $1/b$ . *For example, use a visual fraction model to represent  $5/4$  as the product  $5 \times (1/4)$ , recording the conclusion by the equation  $5/4 = 5 \times (1/4)$ .*
  - Understand a multiple of  $a/b$  as a multiple of  $1/b$ , and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express  $3 \times (2/5)$  as  $6 \times (1/5)$ , recognizing this product as  $6/5$ . (In general,  $n \times (a/b) = (n \times a)/b$ .)*
  - Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat  $3/8$  of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie? (4.NF.B.4) (DOK 1,2)*
    - Example: [Solution](#) (DOK 2)  
 For a certain brand of orange soda, each can contains  $\frac{4}{15}$  cup of sugar.
      - How many cups of sugar are there in six cans of this orange soda?
      - Draw a picture representing the answer to (a).
    - Example: [Solution](#) (DOK 3)
      - Write a story problem that can be solved by finding  $5 \times 4$ .
      - Draw two different diagrams that show that  $5 \times 4 = 20$ . Explain how your diagrams represent  $5 \times 4 = 20$ .
      - Which of the diagrams you used to represent  $5 \times 4 = 20$  can be used to represent  $5 \times \frac{2}{3}$ ? Draw the diagram if possible.
    - Example: Decide whether each expression is equal to  $5 \times \frac{2}{4}$ . Check your answer within the table.

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key												
#22	1	NF	G	2	4.NF.B.4b	N/A	<table border="1"> <thead> <tr> <th></th> <th>Equal to <math>5 \times \frac{2}{4}</math></th> <th>Not Equal to <math>5 \times \frac{2}{4}</math></th> </tr> </thead> <tbody> <tr> <td><math>2 \times \frac{1}{20}</math></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><math>4 \times \frac{2}{5}</math></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><math>10 \times \frac{1}{4}</math></td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </tbody> </table>		Equal to $5 \times \frac{2}{4}$	Not Equal to $5 \times \frac{2}{4}$	$2 \times \frac{1}{20}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	$4 \times \frac{2}{5}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	$10 \times \frac{1}{4}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Equal to $5 \times \frac{2}{4}$	Not Equal to $5 \times \frac{2}{4}$																	
$2 \times \frac{1}{20}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>																	
$4 \times \frac{2}{5}$	<input type="checkbox"/>	<input checked="" type="checkbox"/>																	
$10 \times \frac{1}{4}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>																	

	Equal to $5 \times \frac{2}{4}$	Not Equal to $5 \times \frac{2}{4}$
$2 \times \frac{1}{20}$	<input type="checkbox"/>	<input type="checkbox"/>
$4 \times \frac{2}{5}$	<input type="checkbox"/>	<input type="checkbox"/>
$10 \times \frac{1}{4}$	<input type="checkbox"/>	<input type="checkbox"/>




4. Example: A bottle holds  $\frac{3}{5}$  liters of water. Sam needs 8 full bottles of water to fill his fish tank.  
How many liters of water does Sam need to fill the fish tank?


- $2\frac{1}{5}$
- $4\frac{4}{5}$
- $7\frac{2}{5}$
- $8\frac{3}{5}$

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#13	1	MD	K	1	4.MD.C.6	N/A	44-46

5. Example: Marcia read books over the summer. She created the picture graph shown.

### Summer Reading

Month	Books
June	
July	
August	

 = 2 books

Create another picture graph that shows these data with a different key. You may use whole books and half books in your graph.  
Select the key you will use.

Color in the books to complete your picture graph.

**A. Select the key you will use.**

= 3 books  
  = 4 books  
  = 5 books  
  = 6 books

---

**B. New picture graph**

**Summer Reading**

Month	Books
June	
July	
August	

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key								
#5	4	MD, OA, NF	F	3	3.MD.B.3, 4.OA.B.4, 4.NF.B.4b	1, 6	<p><b>A. Select the key you will use.</b></p> <p> <input type="checkbox"/> = 3 books                               <input checked="" type="checkbox"/> = 4 books                               <input type="checkbox"/> = 5 books                               <input type="checkbox"/> = 6 books                         </p> <hr/> <p><b>B. New picture graph</b></p> <p style="text-align: center;"><b>Summer Reading</b></p> <table border="1"> <thead> <tr> <th>Month</th> <th>Books</th> </tr> </thead> <tbody> <tr> <td>June</td> <td></td> </tr> <tr> <td>July</td> <td></td> </tr> <tr> <td>August</td> <td></td> </tr> </tbody> </table> <p style="text-align: center;"><input checked="" type="checkbox"/> = 4 books</p>	Month	Books	June		July		August	
Month	Books														
June															
July															
August															



Understand decimal notation for fractions, and compare decimal fractions. (4.NF.C)

6. Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.<sup>4</sup> For example, express  $\frac{3}{10}$  as  $\frac{30}{100}$ , and add  $\frac{3}{10} + \frac{4}{100} = \frac{34}{100}$ . **(4.NF.C.5) (DOK 1)**

- a. Example: [Solution](#) (DOK 1)

Finish the equations to make true statements. Write one number in each space.

- a. 1 tenth + 4 hundredths = \_\_\_\_\_ hundredths
- b. 4 hundredths + 1 tenth = \_\_\_\_\_ hundredths
- c. 5 tenths + 2 hundredths = \_\_\_\_\_ hundredths
- d. 5 hundredths + 2 tenths = \_\_\_\_\_ hundredths
- e. 14 hundredths = \_\_\_\_\_ hundredths + 4 hundredths
- f. 14 hundredths = \_\_\_\_\_ tenths + 4 hundredths
- g. 14 hundredths = 1 tenth + 3 hundredths + \_\_\_\_\_ hundredths
- h. 80 hundredths = \_\_\_\_\_ tenths

- b. Example: [Solution](#) (DOK 1)

Complete the table.

$43\frac{65}{100}$	$40 + 3 + \frac{6}{10} + \frac{5}{100}$	$40 + 3 + 0.6 + 0.05$	43.65
$21\frac{90}{100}$			
$40\frac{76}{100}$			
$7\frac{82}{100}$			
$18\frac{3}{100}$			

- c. Example: [Solution](#) (DOK 2)

<sup>4</sup> Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with unlike denominators in general is not a requirement at this grade.

A dime is  $\frac{1}{10}$  of a dollar and a penny is  $\frac{1}{100}$  of a dollar.

What fraction of a dollar is 6 dimes and 3 pennies? Write your answer in both fraction and decimal form.

- d. Example: [Solution](#) (DOK 1)  
Find the sums.

a.  $\frac{9}{10} + \frac{8}{100}$  |

b.  $\frac{7}{100} + \frac{3}{10}$  |

c.  $\frac{2}{10} + \frac{41}{100}$  |

d.  $\frac{23}{100} + \frac{7}{10}$  |

e.  $\frac{7}{10} + \frac{20}{100}$  |

f.  $\frac{1}{10} + \frac{9}{100} + \frac{13}{10} + \frac{21}{100}$  |

- e. Example: [Solution](#) (DOK 3)

Explain why  $\frac{6}{10} = \frac{60}{100}$ . Draw a picture to illustrate your explanation.

7. Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram. **(4.NF.C.6) (DOK 1)**

- a. Example: [Solution](#) (DOK 1)

Finish the equations to make true statements. Write one number in each space.

- a. 1 tenth + 4 hundredths = \_\_\_\_\_ hundredths
- b. 4 hundredths + 1 tenth = \_\_\_\_\_ hundredths
- c. 5 tenths + 2 hundredths = \_\_\_\_\_ hundredths
- d. 5 hundredths + 2 tenths = \_\_\_\_\_ hundredths
- e. 14 hundredths = \_\_\_\_\_ hundredths + 4 hundredths
- f. 14 hundredths = \_\_\_\_\_ tenths + 4 hundredths
- g. 14 hundredths = 1 tenth + 3 hundredths + \_\_\_\_\_ hundredths
- h. 80 hundredths = \_\_\_\_\_ tenths

- b. Example: [Solution](#) (DOK 1)  
Complete the table.

$43\frac{65}{100}$	$40 + 3 + \frac{6}{10} + \frac{5}{100}$	$40 + 3 + 0.6 + 0.05$	43.65
$21\frac{90}{100}$			
$40\frac{76}{100}$			
$7\frac{82}{100}$			
$18\frac{3}{100}$			

- c. Example: [Solution](#) (DOK 2)

A dime is  $\frac{1}{10}$  of a dollar and a penny is  $\frac{1}{100}$  of a dollar.

What fraction of a dollar is 6 dimes and 3 pennies? Write your answer in both fraction and decimal form.

- d. Example: Check **all** equations that are true.

1.  $\frac{4}{10} = 0.04$

2.  $\frac{17}{100} = 0.17$

$$3. \frac{9}{100} = 0.09$$

$$4. \frac{6}{100} = 0.60$$

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#20	1	NF	H	1	4.NF.C.6	N/A	<input type="checkbox"/> $\frac{4}{10} = 0.04$ <input checked="" type="checkbox"/> $\frac{17}{100} = 0.17$ <input checked="" type="checkbox"/> $\frac{9}{100} = 0.09$ <input type="checkbox"/> $\frac{6}{100} = 0.60$

e. Example: Write as a decimal. ([Former NAEP question](#)) (DOK 1)

$$\frac{136}{100} = \underline{\hspace{2cm}}$$

Answer: 1.36

8. Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols  $>$ ,  $=$ , or  $<$ , and justify the conclusions, e.g., by using a visual model. **(4.NF.C.7) (DOK 1,2,3)**

a. Example: [Solution](#) (DOK 1)

a. Fill in the following blanks to:

**0.17, 0.27,** \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

\_\_\_\_\_, \_\_\_\_\_, **0.56, 0.66,** \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, **103.12,** \_\_\_\_\_, **103.32,** \_\_\_\_\_, \_\_\_\_\_

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, **103.12,** \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, **103.16**

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, **103.12, 113.12,** \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

- Count by tenths:
- Count by tenths:
- Count by tenths:
- Count by hundredths
- Count by tens:

b. Fill in the blank with  $<$ ,  $=$ , or  $>$  to make the correct comparison.

- 4 tenths + 3 hundredths \_\_\_\_\_ 2 tenths + 12 hundredths
- 3 hundredths + 4 tenths \_\_\_\_\_ 2 tenths + 22 hundredths
- 5 hundredths + 1 tenth \_\_\_\_\_ 11 tenths + 4 hundredths
- 5 hundredths + 1 tenth \_\_\_\_\_ 15 hundredths + 0 tenths
- 5 hundredths + 1 tenth \_\_\_\_\_ 0 tenths + 15 hundredths

c. Fill in the blank with  $<$ ,  $=$ , or  $>$  to complete the equation.

- 0.01 \_\_\_\_\_ 0.11
- 0.2 \_\_\_\_\_ 0.20
- 0.6 \_\_\_\_\_ 0.41
- 0.07 \_\_\_\_\_ 0.70
- 0.57 \_\_\_\_\_ 0.75

**Measurement and Data****4.MD**

**Example:** A rectangle is 6 feet long and has a perimeter of 20 feet. What is the width of this rectangle? Explain how you solved this problem.

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#30	2		2A, 2C	1	4.MD.3		See Below

Sample Top-Score Response:  $20 - 6 - 6 = 8$  feet

Half of 8 feet is 4 feet, so the width is 4 feet long.

Full credit (2 points):

- The response demonstrates a full and complete understanding of problem solving. The response contains the following evidence:
- The student determines that 4 feet is the width of the rectangle with a correct process clearly demonstrated.

Partial credit (1 point):

- The response demonstrates a partial understanding of problem solving. The response contains the following evidence:
  - The student determines 4 feet is the width, but does not show sufficient work to support this conclusion.
- OR
- The student begins a correct process for determining the missing width, but ends up with an incorrect solution due to an incomplete process, computational mistake, or other mechanical error in the process.

Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit. (4.MD.A)

1. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...* **(4.MD.A.1) (DOK 1)**

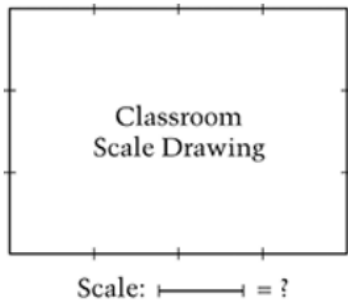
- a. Example: [Solution](#) (DOK 1)

Mr. Liu asked the students in his fourth grade class to measure their heights. Here are some of the heights they recorded:





Student	Height
Sarah	50 inches
Jake	$4\frac{1}{4}$ feet
Andy	$1\frac{1}{2}$ yards
Emily	4 feet and 4 inches

List the four students from tallest to shortest.

- b. Example: ([Former NAEP question](#)) (DOK 1)



The picture shows Jackie's scale drawing of her classroom. Which scale did she use?

- A.  = 1 inch
- B.  = 10 feet
- C.  = 100 feet
- D.  = 1 mile

Answer: B. 10 feet

- c. Example: ([Former NAEP question](#)) (DOK 1)

Which unit would be best to measure the amount of liquid in a spoonful of lemon juice?

1. Milliliters
2. Liters
3. Millimeters
4. Meters

Answer: 1. Milliliters

- d. Example: ([Former NAEP question](#)) (DOK 1)

It takes Ms. Wylie 15 minutes to drive from her house to the store. Which is the best estimate of the distance from her house to the store?

1. 5 feet
2. 5 miles
3. 20 feet
4. 200 miles

Answer: 5 miles

- e. Example: ([Former NAEP question](#)) (DOK 1)

Which of these units would be the best to use to measure the length of a school building?

1. Millimeters
2. Centimeters
3. Meters
4. Kilometers

Answer: 3

- f. Example: ([Former NAEP question](#)) (DOK 1)

Which of the following is the largest unit of measurement?

1. Centiliter
2. Kiloliter
3. Liter
4. Milliliter

g. Example: ([Former NAEP question](#)) (DOK 1)

How many grams are in one kilogram?

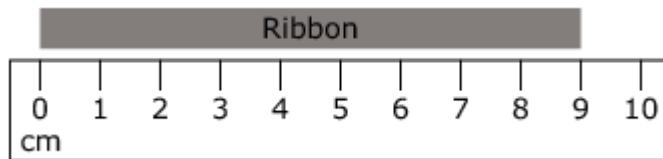
1. 1
2. 10
3. 100
4. 1,000

2. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. **(4.MD.A.2) (DOK 1,2)**

a. Example: [Solution](#) (DOK 2)

Margie bought 3 apples that cost 50 cents each. She paid with a five-dollar bill. How much change did Margie receive?

b. Example: Write the length, in millimeters, of the ribbon.



Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#6	1	MD	I	2	4.MD.A.2	N/A	Any # from 89-91

c. Example: ([Former NAEP question](#)) (DOK 2)

4 quarts = 1 gallon

Amy wants to put 8 gallons of water into her aquarium. She has a 2-quart pitcher to carry water from the sink. How many times will she need to fill her pitcher?

5. 4
6. 10
7. 16
8. 32

Answer: 7. 16

d. Example: ([Former NAEP question](#)) (DOK 1)

Michelle has a container with 3 quarts of juice. She pours 1 cup of juice for each person. At most, how many people can she serve? (1 quart = 4 cups)

- a. 4
- b. 7
- c. 8
- d. 12

Answer: 4. 12



- e. Example: ([Former NAEP question](#)) (DOK 2)  
Emily needs to measure the length of a table. She has a dollar bill that is about 6 inches long. It fits end to end, 10 times along the length of the table. Which is the best estimate for the length of the table?
1. 5 feet
  2. 6 feet
  3. 10 feet
  4. 12 feet

Answer: 1. 5 feet

- f. Example: ([Former NAEP question](#)) (DOK 1)  
Mr. Harper bought 6 pints of milk. How many quarts of milk is this equal to?
1. 3
  2. 4
  3. 6
  4. 12

Answer: 1. 3 quarts

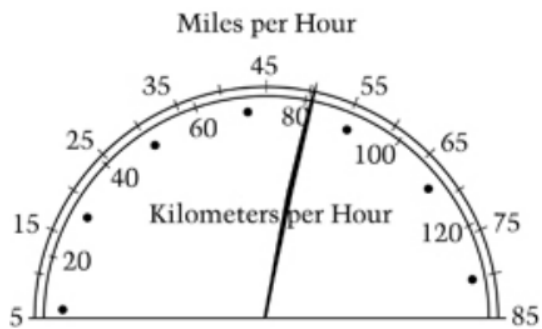
- g. Example: ([Former NAEP question](#)) (DOK 1)  
The clock shows the time that Bill leaves his house in the morning. He returns 6 hours and 25 minutes later. At what time does he return?



1. 5:15 a.m.
2. 5:40 a.m.
3. 5:15 p.m.
4. 5:40 p.m.

Answer: 5:40 p.m.

- h. Example: ([Former NAEP question](#)) (DOK 1)  
The speedometer shows how fast Dale is driving. If the speed limit is 55 miles per hour (mph), which of the following is true?



1. Dale is going about 5 mph over the speed limit.
2. Dale is going about 25 mph over the speed limit.
3. Dale is going about 5 mph under the speed limit.
4. Dale is going about 25 mph under the speed limit.

Answer: 3. Dale is going about 5 mph under the speed limit.

- i. Example: [\(Former NAEP question\)](#) (DOK 1)  
The bicycle speedometer below shows about what speed?



1. 10 miles per hour
2. 15 miles per hour
3. 20 miles per hour
4. 45 miles per hour

Answer: 2. 15 miles per hour

- j. Example: [\(Former NAEP question\)](#) (DOK 3)  
Rico bought 10 cards, which cost \$12.20 before tax. How many packages of each type did he buy?



\_\_\_\_\_ Packages of postcards

\_\_\_\_\_ Packages of greeting cards

Explain how you know your answer is correct. Rico said that one postcard is cheaper than one greeting card. Show that Rico is correct.

Answer: 1 package of greeting cards and 2 packages of postcards is 10 cards for \$12.20. One postcard cost \$1.20 ( $\$3.60 \div 3$ ) while one greeting card cost \$1.25 ( $\$5.00 \div 4$ ).

- k. Example: ([Former NAEP question](#)) (DOK 2)  
Sally buys a package of 6 candy bars for \$3.30 and then sells the candy bars at the school play for 75 cents each. How much money does Sally earn on each candy bar?

Answer: 20 cents

3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems. *For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.* **(4.MD.A.3) (DOK 1,2)**

- a. Example: ([Solution](#)) (DOK 1)

Karl's rectangular vegetable garden is 20 feet by 45 feet, and Makenna's is 25 feet by 40 feet. Whose garden is larger in area?

- b. Example: ([Former NAEP question](#)) (DOK 2)

Mark's room is 12 feet wide and 15 feet long. Mark wants to cover with carpet. How many square feet of carpet does he need?

Answer: \_\_\_\_\_ square feet

The carpet costs \$2.60 per square foot. How much will the carpet cost?

Answer: \$ \_\_\_\_\_

Answer: 180 square feet, \$468.00

- c. Example: ([Former NAEP question](#)) (DOK 1)

Megan drew a rectangle that has an area of 24 square centimeters. Which of the following could be the dimensions of her rectangle?

1. 2 centimeters by 12 centimeters
2. 3 centimeters by 9 centimeters
3. 4 centimeters by 20 centimeters
4. 6 centimeters by 6 centimeters
5. 12 centimeters by 12 centimeters

Answer: 1. 2 centimeters by 12 centimeters

- d. Example: ([Former NAEP question](#)) (DOK 1)  
Mr. Hardt bought a square piece of carpet with an area of 39 square yards. The length of each side of this carpet is between which of the following?
1. 4 yards and 5 yards
  2. 5 yards and 6 yards
  3. 6 yards and 7 yards
  4. 7 yards and 8 yards
  5. 9 yards and 10 yards

Answer: 3. 6 yards and 7 yards

- e. The Morrises are going to build a new one-story house. The floor of the house will be rectangular with a length of 30 feet and a width of 20 feet.

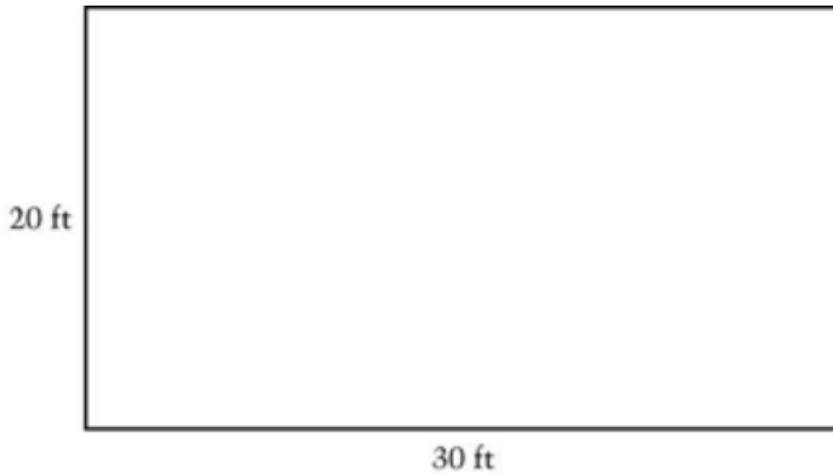
The house will have a living room, a kitchen, two bedrooms, and a bathroom. In part (a) below create a floor plan that shows these five rooms by dividing the rectangle into rooms.

Your floor plan should meet the following conditions.

- Each one of the five rooms must share at least one side with the rectangle in part (a); that is, each room must have at least one outside wall
- The floor area of the bathroom should be 50 square feet.
- Each of the other four rooms (not the bathroom) should have a length of at least 10 feet and a width of at least 10 feet.

Be sure to label each room by name (living room, kitchen, bedroom, etc.) and include its length and width, in feet. (Do not draw any hallways on your floor plan.)

- (a) Draw your floor plan on the figure below. Remember to label your rooms by name and include the length and width, in feet, for each room.



- (b) Example: ([Former NAEP question](#)) (DOK 2)  
 Complete the table below by filling in the floor area, in square feet, for each room in your floor plan.

Room	Floor Area (in square feet)
Living	
Kitchen	
Bedroom	
Bedroom	
Bathroom	
Total Floor Area	600

- f. Example: ([Former NAEP question](#)) (DOK 1)  
 The perimeter of a square is 36 centimeters. What is the area of the square?
1. 6 square cm
  2. 9 square cm
  3. 18 square cm
  4. 81 square cm

Answer: 4. 81 square cm.

Represent and interpret data. (4.MD.B)

4. Make a line plot to display a data set of measurements in fractions of a unit ( $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{1}{8}$ ). Solve problems involving addition and subtraction of fractions by using information presented in line plots. *For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect*

collection. **(4.MD.B.4) (DOK 1,2)**

- a. Example: [Solution](#) (DOK 3)
- 



- a. With a partner or group, gather a handful of round buttons from a diverse collection, and use a ruler to measure the diameter of each button to the nearest eighth-inch.
- b. Make a line plot of button diameters, marking your scale in eighth-inch increments.
- c. What is the most common diameter in your collection? How does that compare with the collection from another group?
- d. Now measure the diameters of these same buttons to the nearest quarter-inch.
- e. Make a line plot of button diameters, marking your scale in quarter-inch increments.
- f. Describe the differences between the two line plots you created. Which one gives you more information? Which one is easier to read?

**Geometric measurement: understand concepts of angle and measure angles. (4.MD.C)**

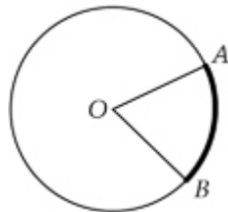
5. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:
- a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through  $1/360$  of a circle is called a "one-degree angle," and can be used to measure angles.
- b. An angle that turns through  $n$  one-degree angles is said to have an angle measure of  $n$  degrees.
- (4.MD.C.5) (DOK 1)**
1. Example: [Former NAEP question](#) (DOK 1)  
How many degrees are in the acute angle formed by the hands of the clock in the figure above?



1. 10 degrees
2. 30 degrees
3. 36 degrees
4. 60 degrees
5. 120 degrees

Answer: 2. 30 degrees

2. Example: ([Former NAEP question](#)) (DOK 2)



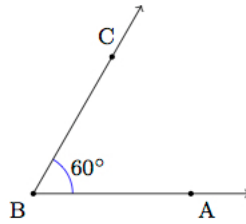
The circle above has center  $O$ . If the length of the darkened arc is  $\frac{1}{6}$  of the circumference, what is the degree measure of  $\angle AOB$ ?

- A.  $75^\circ$
- B.  $60^\circ$
- C.  $45^\circ$
- D.  $36^\circ$
- E.  $30^\circ$

Answer: B. 60 degrees

6. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure. **(4.MD.C.6) (DOK**
  - a. Example: [Solution](#) (DOK 2)

a. Draw an angle that measures 60 degrees like the one shown here:



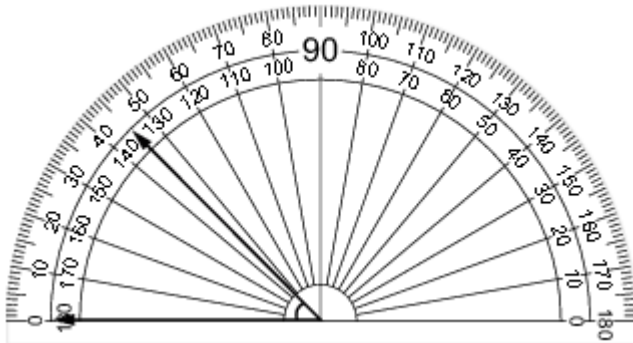
b. Draw another angle that measures 25 degrees. It should have the same vertex and share side  $\overrightarrow{BA}$ .

c. How many angles are there in the figure you drew? What are their measures?

d. Make a copy of your 60 degree angle. Draw a different angle that measures 25 degrees and has the same vertex and also shares side  $\overrightarrow{BA}$ .

e. How many angles are there in the figure you drew? What are their measures?

b. Example: Write the measure of the angle, in degrees.



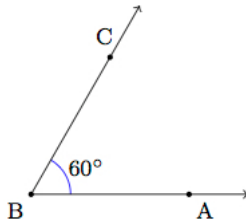
Item	Claim	Domain	Target	DOK	CONTENT	MP	Key
#13	1	MD	K	1	4.MD.C.6	N/A	44-46

7. Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure. **(4.MD.C.7) (DOK 1,2)**

a. Example: [Solution](#) (DOK 2)



a. Draw an angle that measures 60 degrees like the one shown here:



b. Draw another angle that measures 25 degrees. It should have the same vertex and share side  $\overrightarrow{BA}$ .

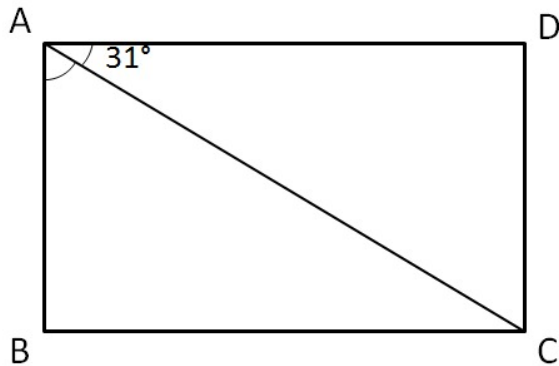
c. How many angles are there in the figure you drew? What are their measures?

d. Make a copy of your 60 degree angle. Draw a different angle that measures 25 degrees and has the same vertex and also shares side  $\overrightarrow{BA}$ .

e. How many angles are there in the figure you drew? What are their measures?

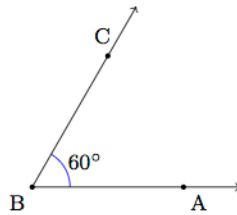
b. Example: [Solution](#) (DOK 1)

In the figure,  $ABCD$  is a rectangle and  $\angle CAD = 31^\circ$ . Find  $\angle BAC$ .



Draw and identify lines and angles, and classify shapes by properties of their lines and angles. (4.G.A)

1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. **(4.G.A.1) (DOK 1)**
  - a. Example: [Solution](#) (DOK 2)
    - a. Draw an angle that measures 60 degrees like the one shown here:



- b. Draw another angle that measures 25 degrees. It should have the same vertex and share side  $\overrightarrow{BA}$ .
      - c. How many angles are there in the figure you drew? What are their measures?
      - d. Make a copy of your 60 degree angle. Draw a different angle that measures 25 degrees and has the same vertex and also shares side  $\overrightarrow{BA}$ .
      - e. How many angles are there in the figure you drew? What are their measures?

- b. Example: [Solution](#) (DOK 2)  
Letters can be thought of as geometric figures.

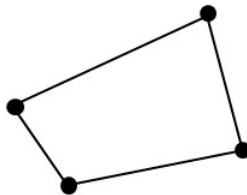
A	B	C	D	E	F	G
H	I	J	K	L	M	N
O	P	Q	R	S	T	U
V	W	X	Y	Z		

- a. How many line segments are needed to make the letter A? How many angles are there? Are they acute, obtuse, or right angles? Are any of the line segments perpendicular? Are any of the line segments parallel?
- b. We can build all of these letters from line segments and arcs of circles. Build all of the capital letters with the smallest number of "pieces," where each piece is either a line segment or an arc of a circle.
- c. Which letters have perpendicular line segments?
- d. Which letters have parallel line segments?
- e. Which letters have no line segments?
- f. Do any letters contain both parallel and perpendicular lines?
- g. What makes the lower case letters "i" and "j" different than all of the capital letters?

- c. Example: [Solution](#) (DOK 2)

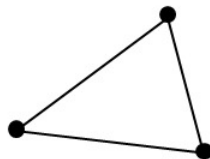
The students in Ms. Sun's class were drawing geometric figures. First she asked them to draw some points, and then she asked them to draw all the line segments they could that join two of their points.

- a. Joni drew 4 points and then drew 4 line segments between them:



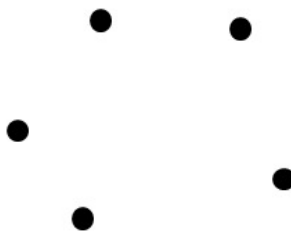
Are there other line segments that Joni could have drawn?

- b. Tony drew 3 points and then drew 3 line segments between them:



Are there other line segments that Tony could have drawn?

- c. Here are 5 points. Draw all the line segments you can connecting pairs of them.



- d. Starting with just two points, how many line segments can you draw between them?

- e. Tony decided that he could actually draw two line segments between two points, and maybe even more. This is what he drew:



What do you think of Tony's idea? Discuss it with a partner.

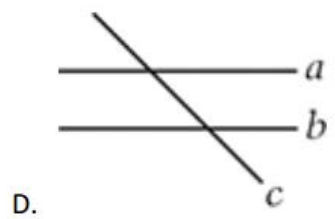
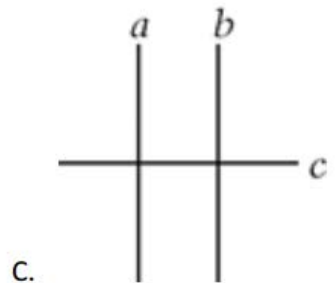
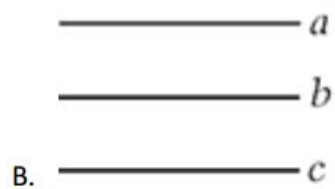
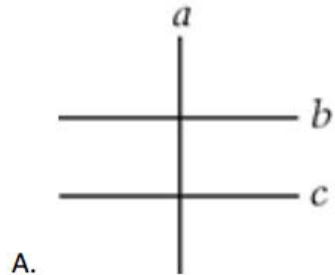
- d. Example: ([Former NAEP question](#)) (DOK 1)

Lines a and b are parallel to each other.

Line  $c$  is perpendicular to these lines.

Jan correctly draws lines  $a$ ,  $b$ , and  $c$ .

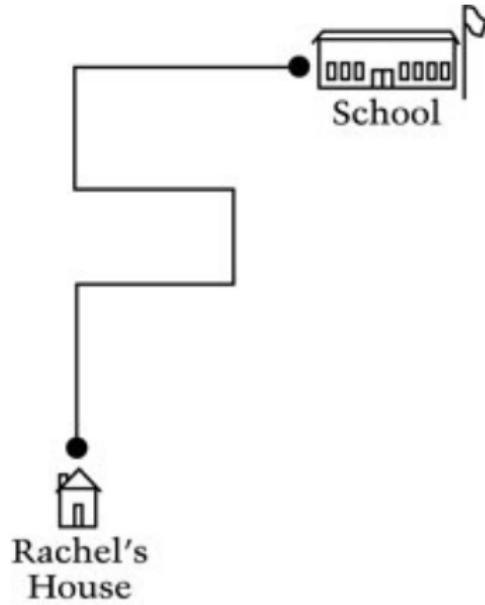
Which of these could be Jan's drawing?



Answer: C.

e. Example: ([Former NAEP questions](#)) (DOK 1)

The picture shows Rachel's path to school. How many right angle turns does Rachel make to get to school?



1. Two
2. Three
3. Five
4. Seven

Answer. 3. Five

- f. Example: ([Former NAEP question](#)) (DOK 1)  
 Lines  $k$ ,  $l$ , and  $m$  are three different lines. If line  $k$  is parallel to line  $l$  and line  $l$  is parallel to line  $m$ , which of the following statements must be true?
1. Line  $k$  is perpendicular to line  $l$ .
  2. Line  $k$  is perpendicular to line  $m$ .
  3. Line  $k$  is parallel to line  $m$ .
  4. Line  $k$  intersects line  $l$ .
  5. Line  $k$  intersects line  $m$ .

Answer: 3. Line  $k$  is parallel to line  $m$

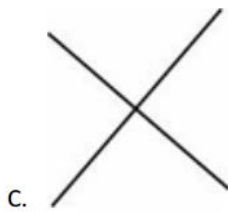
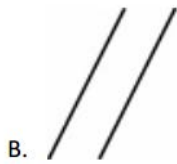
- g. Example: ([Former NAEP question](#)) (DOK 1)  
 What is the intersection of rays  $PQ$  and  $QP$  in the figure below?



1. Segment  $PQ$
2. Line  $PQ$
3. Point  $P$
4. Point  $Q$
5. The empty set

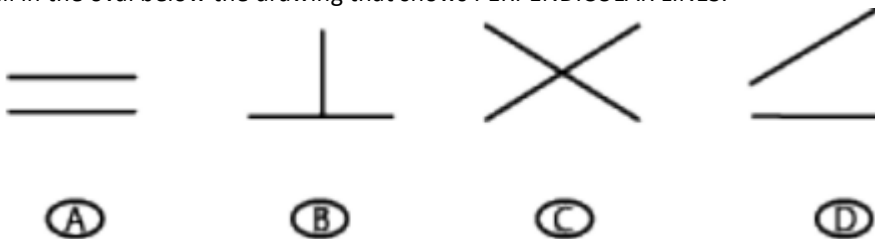
Answer: 1. Line  $PQ$

- h. Example: ([Former NAEP question](#)) (DOK 1)  
Which of the following shows perpendicular lines?



Answer: C.

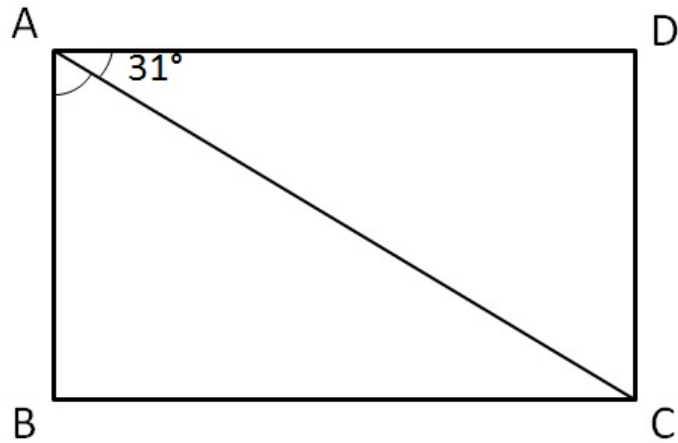
- i. Example: ([Former NAEP question](#)) (DOK 1)  
Fill in the oval below the drawing that shows PERPENDICULAR LINES.



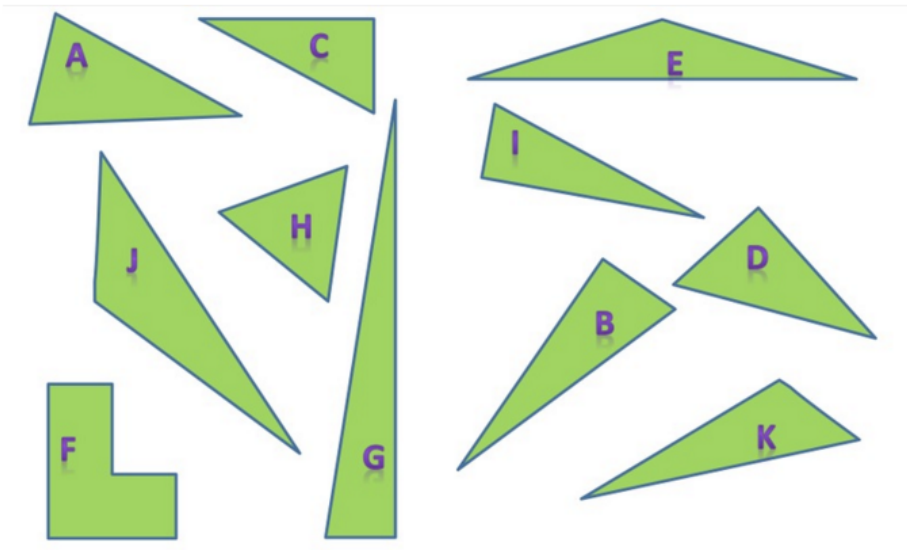
Answer: C

2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles. **(4.G.A.2) (DOK 1,2)**
- a. Example: [Solution](#) (DOK 1)

In the figure,  $ABCD$  is a rectangle and  $\angle CAD = 31^\circ$ . Find  $\angle BAC$ .



- b. Example: [Solution](#) (DOK 3)  
 a. Which of the polygons are right triangles? Choose a measuring tool to help you determine this.



These are right triangles	These are not right triangles

- b. For each right triangle, identify the right angle by marking it with a small square. Explain why the other polygons are not right triangles.  
 c. Example: [Solution](#) (DOK 2)



a. Draw at least two examples and two non-examples of each of the quadrilaterals defined below.

- **Parallelogram:** A quadrilateral with 2 pairs of parallel sides.
- **Rectangle:** A parallelogram with 4 right angles.
- **Rhombus:** A parallelogram with 4 sides with equal length.

b. I am a shape that is a parallelogram, a rectangle, and at the same time a rhombus. What shape am I? Draw a diagram of what I look like. Use the vocabulary words and their definitions given in part (a) to explain what shape I am.

d. Example: [Solution](#) (DOK 3)

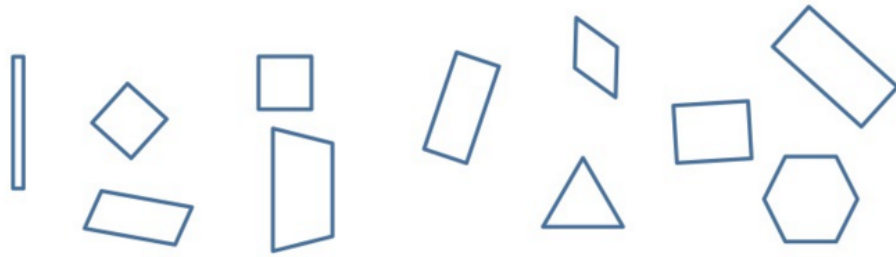
a. Look at each figure. Read each of the descriptions. Place an X in the box if it appears to describe the figure pictured.

	A.	B.	C.	D.
				
4 vertices				
Four sides				
Opposite sides parallel				
Perpendicular sides				
Opposite sides have equal length				
All sides have equal length				
Contains right angle(s)				
Contains acute angle(s)				
Contains obtuse angle(s)				

b. What is true of all the figures?

b. What is true of all the figures?

All of the figures above are rectangles. Ring the rectangles below. Using what you know that is true of all rectangles to help you.



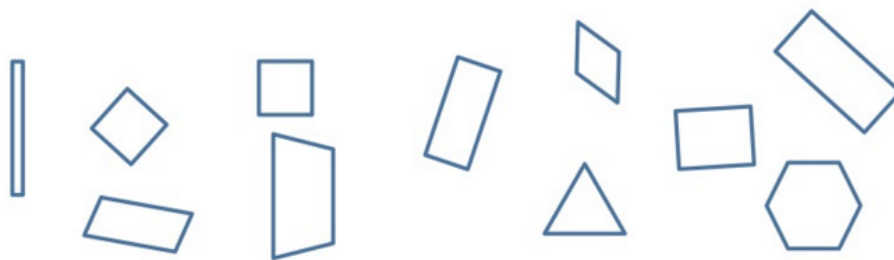
Choose one figure you did not ring. Explain why it is not a rectangle.

Look at each figure. Read each of the attributes. Place an X in the box if it appears to be an attribute of the figure pictured.

	Closed shape	4 sides	Opposite sides parallel	Perpendicular line segments	Opposite sides congruent	All sides congruent	Right angle(s)	Acute angle(s)	Obtuse angle(s)

What is true of all the figures?

All of the figures above are parallelograms. Ring all the parallelograms below. Using what you know that is true of all parallelograms to help you.



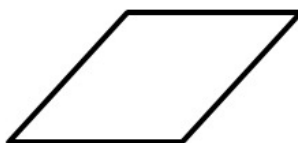
Choose one figure you did not ring. Explain why it is not a parallelogram.

e. Example: [Solution](#) (DOK 3)




These are trapezoids:	These are not trapezoids:










a. Say what a trapezoid is in your own words. Compare your definition with a partner.

b. Is this parallelogram a trapezoid according to your definition? Explain.

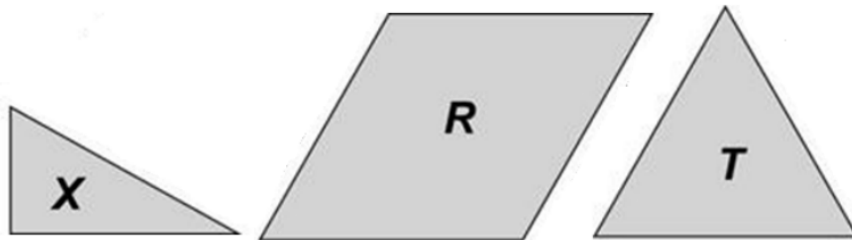


f. Example: Check the box that matches each figure with its description. Each figure may be matched to more than one description.

	Has at Least One Right Angle	Has at Least One Pair of Perpendicular Sides	Has at Least One Pair of Parallel Sides
 Rectangle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
 Rhombus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
 Parallelogram	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Item	Claim	Domain	Target	DOK	CONTENT	MP	Key																
#4	1	G	L	2	4.G.A.2	N/A	<table border="1"> <thead> <tr> <th></th> <th>Has at Least One Right Angle</th> <th>Has at Least One Pair of Perpendicular Sides</th> <th>Has at Least One Pair of Parallel Sides</th> </tr> </thead> <tbody> <tr> <td>             Rectangle         </td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>             Rhombus         </td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>             Parallelogram         </td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </tbody> </table>		Has at Least One Right Angle	Has at Least One Pair of Perpendicular Sides	Has at Least One Pair of Parallel Sides	 Rectangle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	 Rhombus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	 Parallelogram	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Has at Least One Right Angle	Has at Least One Pair of Perpendicular Sides	Has at Least One Pair of Parallel Sides																				
 Rectangle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																				
 Rhombus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																				
 Parallelogram	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																				

g. Example: ([Former NAEP question](#)) (DOK 1)



You will need one piece labeled *X*, one piece labeled *R*, and one piece labeled *T* to answer this question.

Which of the pieces has an angle greater than a right angle?

- A. Only *X*
- B. Only *R*
- C. Only *T*
- D. Both *R* and *T*

Answer: A. Only *X*

h. Example: ([Former NAEP question](#)) (DOK 1)  
 How are the right triangle and the rectangle alike?



1. Each figure has at least one right angle.
2. Each figure has parallel sides.
3. Each figure has at least one line of symmetry.
4. Each figure has at least two sides that are the same length.

Answer: 1. Each figure has at least one right angle.

- i. Example: ([Former NAEP question](#)) (DOK 1)

Figure 1 is a regular hexagon with its center at point P. The dotted lines divide the hexagon completely into 6 congruent triangles sharing a vertex at point P.

Figure 2 is a regular octagon with its center at point Q. The octagon can be completely divided into congruent triangles sharing a vertex at point Q.

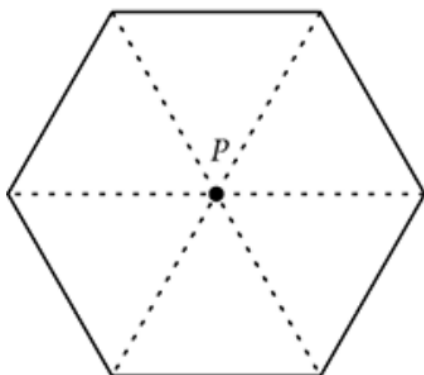


Figure 1

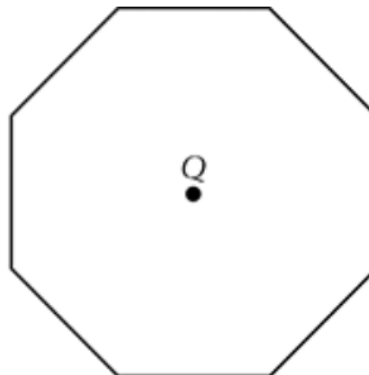


Figure 2

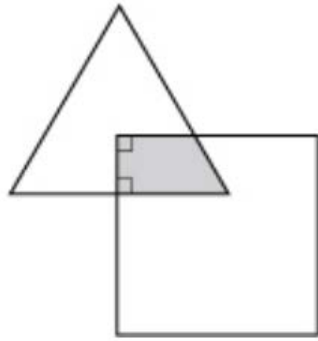
This division could produce:

1. Sixteen congruent equilateral triangles.
2. Sixteen congruent isosceles triangles.
3. Eight congruent right triangles.
4. Eight congruent equilateral triangles.
5. Eight congruent isosceles triangles.

Answer: 5. Eight congruent isosceles triangles.

- j. Example: ([Former NAEP question](#)) (DOK 1)

In the figure below, the intersection of the triangle and the square forms the shaded region. What is the shape of this region?



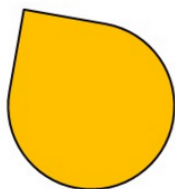
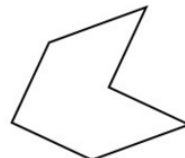
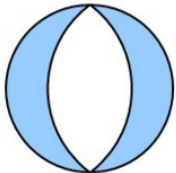
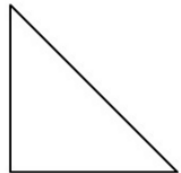
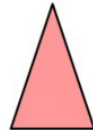
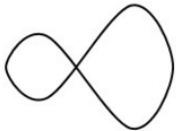
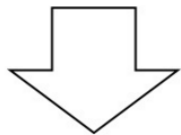
1. An equilateral triangle
2. A rectangle
3. A square
4. A rhombus
5. A trapezoid

Answer: 5. A trapezoid

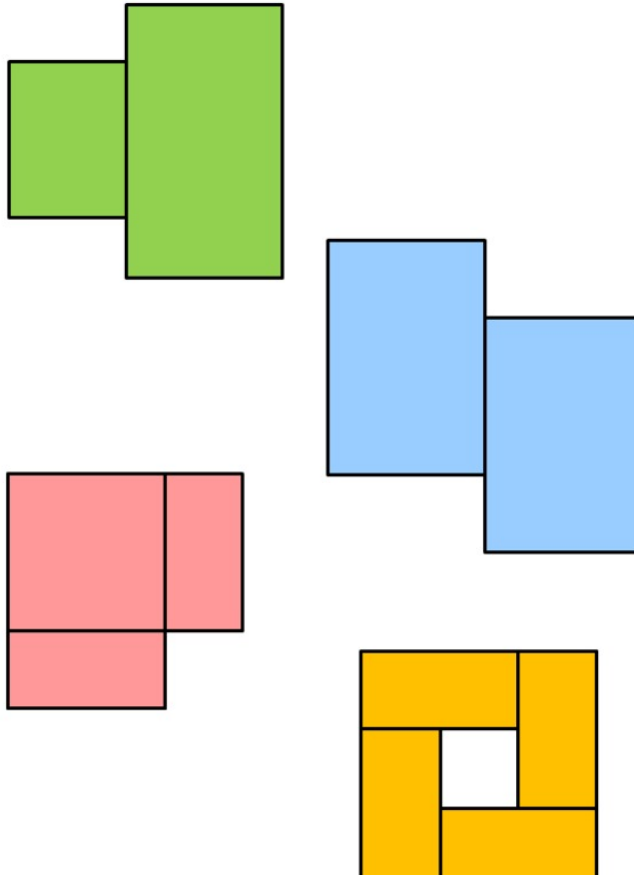
3. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. **(4.G.A.3)**  
**(DOK 1)**

a. Example: [Solution](#) (DOK 2)

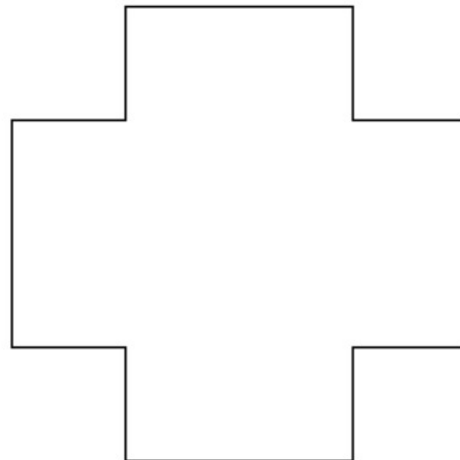
a. Each shape below has a line of symmetry. Draw a line of symmetry for each shape.



b. Not every shape has a line of symmetry. Which of the four shapes below have a line of symmetry? Draw a line of symmetry on them.

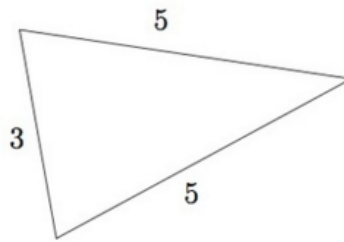
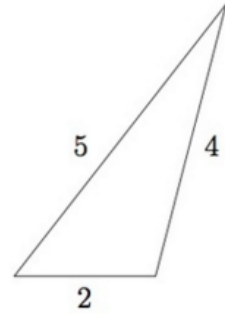
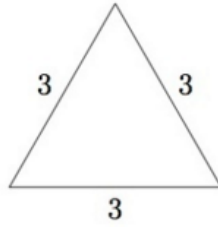
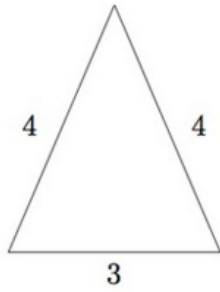


c. Some shapes have many lines of symmetry. Draw all the lines of symmetry you can on the shape below. How many are there?



b. Example: [Solution](#) (DOK 2)

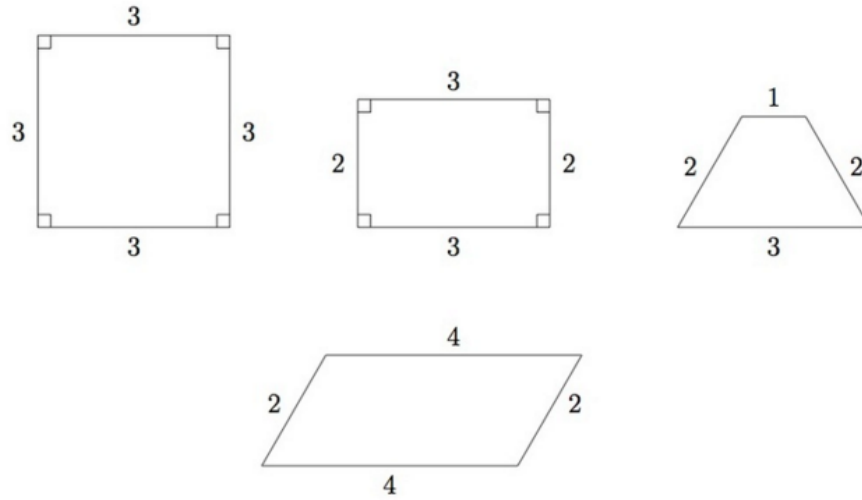
Below are pictures of four triangles with given side lengths:



For each triangle, find and draw all lines of symmetry.

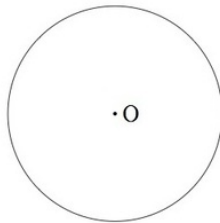


- c. Example: [Solution](#) (DOK 1)  
 Below are pictures of four quadrilaterals: a square, a rectangle, a trapezoid and a parallelogram.

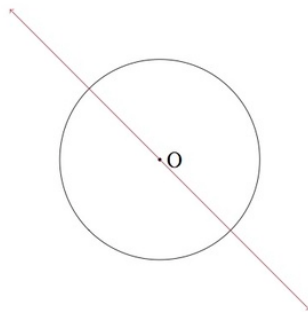


For each quadrilateral, find and draw all lines of symmetry.

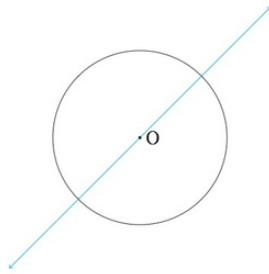
- d. Example: [Solution](#) (DOK 3)  
 Mr. Watkins asked his students to draw a line of symmetry for a circle with center  $O$  pictured below:



- a. Lisa drew the picture below. Is Lisa correct?



b. Brad drew the picture below. Is Brad's picture correct?



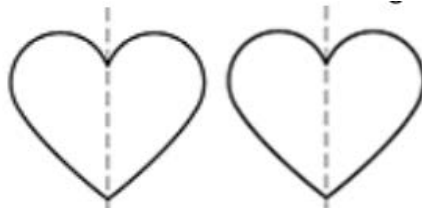
c. How many lines of symmetry does a circle have? Explain.

d. Explain why each line of symmetry divides the circle in half.

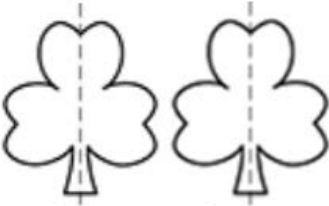
e. Explain why each line of symmetry for the circle must go through the center.

e. Example: [\(Former NAEP question\)](#) (DOK 1)

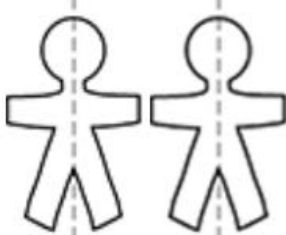
Which decoration CANNOT be folded along the dotted line so that both parts match?



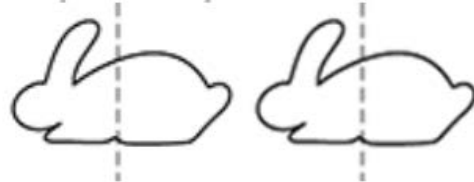
E.



F.



G.



H.

Answer: H.

**Performance Task Example:**

**A TRIP TO THE ZOO**

Anna and her family go to the zoo. The zoo ticket prices, snack shop menu, and gift store prices are shown in the tables.

**Zoo Ticket Prices**

Type of Ticket	Price
Adult (ages 12-64)	\$16
Senior (ages 65+)	\$13
Child (ages 2-11)	\$11
Under 2	Free

**Snack Shop Menu**

Food	Price
Hamburger	\$5
Cheeseburger	\$6
Salad	\$3
Pizza	\$3
Drinks	Price
Water	\$1
Milk	\$2
Juice	\$3
Soda	\$3

### Gift Store Prices

Gift	Price
 Stuffed panda bear	\$ 9
 Zoo magnet	\$4
 Pack of 4 pens	\$6
 Photo frame	\$8

### Anna's Family

- Betsy is an adult (ages 12-64)
- Grandma is a senior (ages 65 and up)
- Ray is a child (ages 2-11)
- Anna is a child (ages 2-11)

The family has \$100 to spend at the zoo.

1.

Use the **Zoo Ticket Prices** table and **Anna's Family** list to answer the question.

What is the total cost, in dollars, of zoo tickets for Anna's family?

For this item, a full-credit response (1 point) includes

- 51.

For this item, a no-credit response (0 points) includes none of the features of a full-credit response.

2.

**Part A**

Use the **Snack Shop Menu** and **Anna's Family** list to answer the question.

Each person in Anna's family will buy one food item and one drink. Choose one food and one drink item for each person.

Enter the name for the food and drink choices for each member of the family and the total cost of the food and drink for each person.

	Food Choice	Drink Choice	Total Food and Drink Cost for Each Person
<b>Betsy</b>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<b>Grandma</b>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<b>Ray</b>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<b>Anna</b>	<input type="text"/>	<input type="text"/>	<input type="text"/>

For this item, a full-credit response (1 point) includes:

	Food Choice	Drink Choice	Total Food and Drink Cost for Each Person
<b>Betsy</b>	Hamburger	Juice	8
<b>Grandma</b>	Pizza	Soda	6
<b>Ray</b>	Salad	Soda	6
<b>Anna</b>	Pizza	Water	4

OR

- any four partial sums that are correct based on the food and drink choices in the table.

For this item, a no-credit response (0 points) includes none of the features of a full-credit response.

3.

**Part B**

Use the **Snack Shop Menu** and **Anna's Family** list to answer the question.

Based on your response in Part A, what is the total cost, in dollars, of the food and drinks for Anna's family?

For this item, a full-credit response includes (1 point) includes:

- 24

OR

- any total sum that is correct based on the student's response to item 1586.

For this item, a no-credit response (0 points) includes none of the features of a full-credit response.

4.

Grandma says they will spend the remaining money at the gift store.

**Part A**

How much money, in dollars, is remaining after the family buys zoo tickets, food, and drinks? (Remember they started with \$100.)

For this item, a full-credit response includes (1 point) includes:

- 25

OR

- any difference that is correct based on the student's responses to items 206 and 210.

For this item, a no-credit response (0 points) includes none of the features of a full-credit response.

5.

Use the **Gift Store Prices** table to answer the question.

**Part B**

Anna and Ray go into the gift store. Grandma says there are 2 rules for choosing what to buy:

- Do not buy more than one of any gift.
- You must buy at least two gifts.

In your answer, you must have the following:

- Tell which gifts Anna and Ray can buy.
- Explain why there is enough money for the gifts you choose.

For this item, a full-credit response (2 points) includes

- stating correct gifts that Anna and Ray can buy based on the student's response to item 217 and the restrictions in the stem AND
- explaining why there is enough money for the gifts based on the student's response to item 217.

For example,

- "Anna and Ray can buy a zoo magnet and a photo frame. There is enough money for these gifts because they cost 10 dollars total and there is 25 dollars left to buy gifts. 10 dollars is less than 25 dollars."

For this item, a partial-credit response (1 point) includes:

- stating correct gifts that Anna and Ray can buy based on student's response to item 217 and the restrictions in the stem.

For example,

- "They can buy a stuffed panda bear and a zoo magnet." OR
- "Anna and Ray can buy a pack of 4 pens and a photo frame that cost 14 dollars total."

For this item, a no-credit response (0 points) includes none of the features of a full- or partial-credit response.

For example,

- "They can buy 4 stuffed panda bears."

OR

- "Anna and Ray can buy 2 stuffed panda bears and 2 photo frames."

*This item is not graded on spelling or grammar*