Mathematics | Grade 3

In Grade 3, instructional time should focus on four critical areas: (1) developing understanding of multiplication and division and strategies for multiplication and division within 100; (2) developing understanding of fractions, especially unit fractions (fractions with numerator 1); (3) developing understanding of the structure of rectangular arrays and of area; and (4) describing and analyzing two-dimensional shapes.

(1) Students develop an understanding of the meanings of multiplication and division of whole numbers through activities and problems involving equal-sized groups, arrays, and area models; multiplication is finding an unknown product, and division is finding an unknown factor in these situations. For equal-sized group situations, division can require finding the unknown number of groups or the unknown group size. Students use properties of operations to calculate products of whole numbers, using increasingly sophisticated strategies based on these properties to solve multiplication and division problems involving single-digit factors. By comparing a variety of solution strategies, students learn the relationship between multiplication and division.

(2) Students develop an understanding of fractions, beginning with unit fractions. Students view fractions in general as being built out of unit fractions, and they use fractions along with visual fraction models to represent parts of a whole. Students understand that the size of a fractional part is relative to the size of the whole. For example, 1/2 of the paint in a small bucket could be less paint than 1/3 of the paint in a larger bucket, but 1/3 of a ribbon is longer than 1/5 of the same ribbon because when the ribbon is divided into 3 equal parts, the parts are longer than when the ribbon is divided into 5 equal parts. Students are able to use fractions to represent numbers equal to, less than, and greater than one. They solve problems that involve comparing fractions by using visual fraction models and strategies based on noticing equal numerators or denominators.

(3) Students recognize area as an attribute of two-dimensional regions. They measure the area of a shape by finding the total number of same-size units of area required to cover the shape without gaps or overlaps, a square with sides of unit length being the standard unit for measuring area. Students understand that rectangular arrays can be decomposed into identical rows or into identical columns. By decomposing rectangles into rectangular arrays of squares, students connect area to multiplication, and justify using multiplication to determine the area of a rectangle.

(4) Students describe, analyze, and compare properties of two-dimensional shapes. They compare and classify shapes by their sides and angles, and connect these with definitions of shapes. Students also relate their fraction work to geometry by expressing the area of part of a shape as a unit fraction of the whole.
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Grade 3 Overview

Operations and Algebraic Thinking

- Represent and solve problems involving multiplication and division.
- Understand properties of multiplication and the relationship between multiplication and division.
- Multiply and divide within 100.
- Solve problems involving the four operations, and identify and explain patterns in arithmetic.

Number and Operations in Base Ten

- Use place value understanding and properties of operations to perform multi-digit arithmetic.

Number and Operations—Fractions

- Develop understanding of fractions as numbers.

Measurement and Data

- Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.
- Represent and interpret data.
- Geometric measurement: understand concepts of area and relate area to multiplication and to addition.
- Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.

Geometry

- Reason with shapes and their attributes.

Mathematical Practices

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

1. Interpret products of whole numbers, e.g., interpret $5 \times 7$ as the total number of objects in 5 groups of 7 objects each. For example, describe a context in which a total number of objects can be expressed as $5 \times 7$. (3.OA.A.1) (DOK 1,2)
   a. Example: (Former NAEP question) (DOK 1)
      Each of 7 houses has 5 people in it. How many people are there in all?
      1. 5
      2. 7
      3. 12
      4. 35
      5. 50
      Answer: 4. 35

2. Interpret whole-number quotients of whole numbers, e.g., interpret $56 \div 8$ as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. For example, describe a context in which a number of shares or a number of groups can be expressed as $56 \div 8$. (3.OA.A.2) (DOK 1,2)
   a. Example: Solution (DOK 2)

   **Task**

   Suppose there are 4 tanks and 3 fish in each tank. The total number of fish in this situation can be expressed as $4 \times 3 = 12$.

   a. Describe what is meant in this situation by $12 \div 3 = 4$
   b. Describe what is meant in this situation by $12 \div 4 = 3$

   b. Example: Solution (DOK 2)
3. Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.¹ \( \text{[3.OA.A.3]} \text{ (DOK 1,2)} \)

a. Example: Solution (DOK 2)
   a. Juanita spent $9 on each of her 6 grandchildren at the fair. How much money did she spend?

   b. Nita bought some games for her grandchildren for $8 each. If she spent a total of $48, how many games did Nita buy?

   c. Helen spent an equal amount of money on each of her 7 grandchildren at the fair. If she spent a total of $42, how much did each grandchild get?

b. Example: Solution (DOK 2)
   a. Maria cuts 12 feet of ribbon into 3 equal pieces so she can share it with her two sisters. How long is each piece?

   b. Maria has 12 feet of ribbon and wants to wrap some gifts. Each gift needs 3 feet of ribbon. How many gifts can she wrap using the ribbon?

   c. Example: Solution (DOK 3)

¹ See Glossary, Table 2.
Many problems can be solved in different ways. Decide if the following word problems can be solved using multiplication. Explain your thinking. Then solve each problem.

a. Liam is cooking potatoes. The recipe says you need 5 minutes for every pound of potatoes you are cooking. How many minutes will it take for Liam to cook 12 pounds of potatoes?

b. Mel is designing cards. She has 4 different colors of paper and 7 different pictures she can glue on the paper. How many different card designs can she make using one color of paper and one picture?

c. Nina can practice a song 6 times in an hour. If she wants to practice the song 30 times before the recital, how many hours does she need to practice?

d. Owen is building a rectangular tile patio that is 4 tiles wide and 6 tiles long. How many tiles does he need?

d. Example: Solution (DOK 3)

Your teacher was just awarded $1,000 to spend on materials for your classroom. She asked all 20 of her students in the class to help her decide how to spend the money. Think about which supplies will benefit the class the most.
a. Write down the different items and how many of each you would choose. Find the total for each category.
   - Supplies
   - Books and maps
   - Puzzles and games
   - Special items

b. Create a bar graph to represent how you would spend the money. Scale the vertical axis by $100. Write all of the labels.

c. What was the total cost of all your choices? Did you have any money left over? If so, how much?

d. Compare your choices with a partner. How much more or less did you choose to spend on each category than your partner? How much more or less did you choose to spend in total than your partner?

e. Example: Each page in the picture album has 3 rows, and there are 4 pictures in each row.
How many pictures are on each page?
1. 9
2. 11
3. 12
4. 15

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</table>

f. Example: Lindsay has 18 flowers. She plants them in 6 flower pots. Each flower pot has an equal number of flowers.
How many flowers are in each flower pot?

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</table>

g. Example: (Former NAEP question) (DOK 1)
Write a multiplication sentence to find the number of circles below.

Answer: _____ X _____ = _______

Answer: 3 X 4 = 12

h. Example: (Former NAEP question) (DOK 1)
Each of the 18 students in Mr. Hall’s class has p pencils. Which expression represents the total number of pencils that Mr. Hall’s class has?
1. 18 + p
2. 18 – p
3. 18 x p
4. 18 ÷ p

Answer: 3. 18 X p

i. There are 5 rows of trading cards with 3 trading cards in each row. How many trading cards are there?
Rubric: (1 point) The student writes the correct number of trading cards.
j. Jack has 24 fish. He puts them into 4 bowls. Each bowl has an equal number of fish. How many fish are in each bowl?

Rubric: (1 point) The student writes the correct number of fish.

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4. Determine the unknown whole number in a multiplication or division equation relating three whole numbers. For example, determine the unknown number that makes the equation true in each of the equations $8 \times ? = 48$, $5 = \Box \div 3$, $6 \times 6 = ?$. (3.OA.A.4) (DOK 1,2)

   a. Example: Solution (DOK 3)

   Tehya and Kenneth are trying to figure out which number could be placed in the box to make this equation true.

   Tehya insists that 12 is the only number that will make this equation true.

   Kenneth insists that 3 is the only number that will make this equation true.

   $$2 = \Box \div 6$$

   Who is right? Why? Draw a picture to support your idea.

   b. Example: What unknown number makes this equation true?

   $$8 \times \Box = 56$$

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5. Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that $8 \times 5 = 40$, one knows $40 \div 5 = 8$) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers. (3.OA.C.7) (DOK 1,2)

   a. Example: Decide if each equation is true or false. Check True or False for each equation.
### Example: Does replacing the unknown number with 7 make each equation true? Check Yes or No for each equation.

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<td>3</td>
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</table>

b. Example: Does replacing the unknown number with 7 make each equation true? Check Yes or No for each equation.

### Example: What unknown number makes this equation true?

6 × □ = 36
8 × □ = 64
49 ÷ □ = 7
54 ÷ □ = 6

Rubric: (1 point) The student enters the correct number.
Understand properties of multiplication and the relationship between multiplication and division. (3.OA.B)

6. Apply properties of operations as strategies to multiply and divide.\(^1\) Examples: If \(6 \times 4 = 24\) is known, then \(4 \times 6 = 24\) is also known. (Commutative property of multiplication.) \(3 \times 5 \times 2\) can be found by \(3 \times 5 = 15\), then \(15 \times 2 = 30\), or by \(5 \times 2 = 10\), then \(3 \times 10 = 30\). (Associative property of multiplication.) Knowing that \(8 \times 5 = 40\) and \(8 \times 2 = 16\), one can find \(8 \times 7\) as \(8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56\). (Distributive property.) (3.OA.B.5) (DOK 1,2)
a. Example: Solution (DOK 3)

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

a. \(4 \times 5 = 20\)
b. \(34 = 7 \times 5\)
c. \(3 \times 6 = 9 \times 2\)
d. \(5 \times 8 = 10 \times 4\)
e. \(6 \times 9 = 5 \times 10\)
f. \(2 \times (3 \times 4) = 8 \times 3\)
g. \(8 \times 6 = 7 \times 6 + 6\)
h. \(4 \times (10 + 2) = 40 + 2\)

b. Example: Tasha is doing an art project with square tiles. She needs to figure out how many tiles she will need. This picture shows her design. Tasha thinks:

\(^1\) Students need not use formal terms for these properties.
Tasha says, “I need \((9 \times 3) + (3 \times 9) = 27 + 27 = 54\) tiles to make the design.”

Which statement explains why Tasha is not correct?

1. \(27 + 27\) does not equal 54.
2. \((3 \times 9)\) does not equal \((9 \times 3)\).
3. Tasha multiplied \(9 \times 3\) incorrectly.
4. Tasha included the 9 squares in the middle twice.

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<td>#21</td>
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<td>E</td>
<td>3</td>
<td>3.OA.B.5, 3.MD.C.7a</td>
<td>1, 6</td>
<td>4</td>
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</tbody>
</table>

c. Example: Which expression is equal to \(3 \times 7\)?
   1. \((2 \times 7) + (1 \times 7)\)
   2. \((7 \times 5) - 2\)
   3. \((3 \times 4) + (3 \times 5)\)
   4. \((3 \times 4) \times 3\)

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<td>B</td>
<td>1</td>
<td>3.OA.B.5</td>
<td>7</td>
<td>1</td>
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</table>

d. Example: (Former NAEP question) (DOK 1)
   What value of \(b\) makes the following sentence TRUE?
   \(26 \times b = 26\)
Answer: $b=1$

e. Which expression is equal to $6 \times 3$, and why?
   1. $6 + 3$, because the numbers are in the same order
   2. $6 \div 3$, because division and multiplication are inverse operations
   3. $3 + 6$, because the order of the numbers does not matter in addition
   4. $3 \times 6$, because the order of the numbers does not matter in multiplication

Rubric: (1 point) The student identifies the correct expression and reason.

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<td>2</td>
<td>3.OA.B</td>
<td>2, 4</td>
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7. Understand division as an unknown-factor problem. For example, find $32 \div 8$ by finding the number that makes $32$ when multiplied by $8$. (3.OA.B.6) (DOK 1,2)

a. 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.

\[
\begin{align*}
172 \div 3 &= \square \\
3 \times \square &= 172 \\
172 \times 3 &= \square \\
\square \div 3 &= 172 \\
\square \div 172 &= 3 \\
172 \div \square &= 3
\end{align*}
\]

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</table>

b. Example: Which equation has the same unknown value as $48 \div 6 = \square$?
1. $6 \div 48 = □$
2. □ x 6 = 48
3. $48 \times □ = 6$
4. □ ÷ 6 = 48

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</table>

c. Example: Which equation has the same unknown value as $30 \div □ = 6$?
1. $6 \times 30 = □$
2. $6 \div 30 = □$
3. $6 \times □ = 30$
4. $6 \div □ = 30$

Rubric: (1 point) The student selects the correct equation.

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Multiply and divide within 100 (3.OA.C)

8. Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that $8 \times 5 = 40$, one knows $40 \div 5 = 8$) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers. (3.OA.C.7) (DOK 1,2)
   a. Example: Solution (DOK 2)
To play, two decks of cards are needed: the "matching" cards and the "target" cards.

An array of matching cards, which have numbers on their faces, is dealt face down. There can be twelve to twenty-four cards in the array. A single target card is dealt face up.

A turn consists of a student flipping over matching cards one at a time, then trying to combine them to meet the criterion of the target card. The quantity of flipped cards and method of combination can be varied to utilize different skills and give variety to the game. Two possible versions of the game are described below. The student wins a point if they state a correct mathematical relationship between the matching cards and the target card.

\[ 8 \times 4 = 32 \]

\[ 30 \text{ to } 35 \]
In one version, a player reveals two cards each turn. The player wins a point if they can produce a product which matches the target card. Those who wish to keep track of points can do so by keeping target cards that are correctly “matched”. Target cards can be single numbers but will more generally be descriptions of possible products. For example, the target card could be 24, in which case the player would be looking for pairs 6 and 4, 8 and 3, or 12 and 2. But the target could also say “30 to 35”. In this case, if a player turns over a 4, for example, they would then need to try to find an 8, and to win the point they would need to say “8 times 4 is 32, which is between 30 and 35.”

Another version of the game lets each player reveal three cards each turn. The player wins a point if they can produce an equation with their three cards and the target card that involves any of the operations of addition, subtraction, multiplication, or division. For example, suppose the target card is 7, and the player turns 15, 3, and 2. The player can win a point by stating that 15 ÷ 3 + 2 = 7-

In each case, once a target card is “matched”, a new target card is revealed. If a target card is not matched, the next player has a chance to match it.

Both of these versions of Kiri’s Mathematical Match Game could be played as no-memory, light-memory, or memory games.

In the no-memory version, the chosen matching cards are left face-up after they are revealed.

In the light-memory version, the chosen matching cards are left face-up until some player is able to “match” the target card and wins a point. When a match is made, all of the matching cards that are face-up are turned back face-down, the board is replenished, and a new target card is drawn, so the next player sees the initial set-up.

In the memory version, the chosen matching cards are turned back face-down after every turn, so students would need to remember the locations of previously overturned cards in order to make use of them.

b. Example: Does replacing the unknown number with 7 make each equation true? Check Yes or No for each equation.
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<table>
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<tbody>
<tr>
<td>8 × 2 = 4 × 6</td>
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<tr>
<td>7 × 3 = 3 × 7</td>
<td></td>
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<tr>
<td>5 × 6 = 3 × 10</td>
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Rubric: (1 point) The student correctly identifies the true equations.
Exemplar:

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<td>8 × 2 = 4 × 6</td>
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<tr>
<td>7 × 3 = 3 × 7</td>
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<tr>
<td>5 × 6 = 3 × 10</td>
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d. Example: Write the unknown numbers that make each equation true.
5 × 8 = □
8 × 7 = □

Rubric: (1 point) The student enters the correct products.

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</table>

Solve problems involving the four operations, and identify and explain patterns in arithmetic. (3.OA.D)

a. Example: There are 425 boys and 510 girls in Hank's school. How many more girls are there than boys?
9. Solve two-step word problems using the four operations. 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.\(^1\) (3.OA.D.8) (DOK 1,2,3)

a. Example: Solution (DOK 1)
Masha had 120 stamps. First, she gave her sister half of the stamps and then she used three to mail letters. How many stamps does Masha have left?

b. Example: Solution (DOK 2)
Mrs. Moore’s third grade class wants to go on a field trip to the science museum. * The cost of the trip is $245. * The class can earn money by running the school store for 6 weeks. * The students can earn $15 each week if they run the store. 1. How much more money does the third grade class still need to earn to pay for their trip? 2. Write an equation to represent this situation.

c. Example: Lisa has 3 pizzas. Each pizza is cut into 8 pieces. Lisa eats 2 pieces. How many pieces are left? Write an equation to show how many pieces are left.

d. Example: Jen has 5 stacks of quarters. Lee has 9 stacks of quarters. Each stack of quarters is worth $10. How much more money, in dollars, does Lee have than Jen?

e. Example: Christy has $60 to spend on plants. She buys a peach tree for $23 and a plum tree for $19. She wants to buy one more plant. Write the numbers in the boxes and the symbols in the circles to create an equation to show how much money Christy has left to spend. Choose one plant she could buy with the money she has left.

\(^1\) This standard is limited to problems posed with whole numbers and having whole-number answers; students should know how to perform operations in the conventional order when there are no parentheses to specify a particular order (Order of Operations).
<table>
<thead>
<tr>
<th>Item</th>
<th>Claim</th>
<th>Domain</th>
<th>Target</th>
<th>DOK</th>
<th>CONTENT</th>
<th>MP</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>#9</td>
<td>4</td>
<td>OA</td>
<td>D</td>
<td>3</td>
<td>3.OA.D.8</td>
<td>4,6</td>
<td></td>
</tr>
</tbody>
</table>

- Grapevines, $16
- Apple tree, $18
- Pear tree, $20
- Cherry tree, $22
f. Megan baked 28 sugar cookies and 24 chocolate chip cookies. Write the total number of cookies Megan baked in all.
Rubric: (1 point) the student writes the correct number of cookies.

<table>
<thead>
<tr>
<th>Item</th>
<th>Claim</th>
<th>Domain</th>
<th>Target</th>
<th>DOK</th>
<th>CCSS-MC</th>
<th>CCSS</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>1</td>
<td>OA</td>
<td>D</td>
<td>2</td>
<td>3.OA.D.8</td>
<td>N/A</td>
<td>52</td>
</tr>
</tbody>
</table>


Example: (Former NAEP question) (DOK 1)
The Ben Franklin Bride was 75 years old in 2001. In what year was the bride 50 years old?
1. 1951
2. 1976
3. 1984
4. 1986
Answer: 1. 1951

h. Example: (Former NAEP question) (DOK 2)
Bags of Healthy Snack Mix are packed into small and large cartons. The small cartons contain 12 bags each. The large cartons contain 18 bags each.
Meg claimed that she packed a total of 150 bags of Healthy Snack Mix into 2 small cartons and 7 large cartons.

Could Meg have packed the cartons the way she claimed?

___ Yes    ___ No

Show the computations you used to arrive at your answer.

Answer: Yes; (18 X 7) + (2 X 24) = 150

10. Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends. (3.OA.D.9) (DOK 1,2,3)

a. Example: Solution (DOK 3)
Below is a table showing addition of numbers from 1 through 5.

<table>
<thead>
<tr>
<th>+</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

a. In each column and each row of the table, even and odd numbers alternate. Explain why.

b. Explain why the diagonal, from top left to bottom right, contains the even numbers 2, 4, 6, 8, and 10.

c. Explain why all numbers in the other diagonal, from bottom left to top right, are 0s.

b. Example: Solution (DOK 3)
Below is a table showing how to add numbers from 1 to 3:

<table>
<thead>
<tr>
<th>+</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Cut out the table and fold it over the dotted line. Notice that the blue squares match up and so do the orange squares. Notice that the squares that match up have the same numbers in them. We say that the squares that match up when you fold along the line are "mirror images" of each other.

The table below shows how to add numbers from 1 to 9. Two squares are shaded blue and two are green:
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
</tbody>
</table>

a. Are the blue squares mirror images of each other? Explain why the numbers in the blue squares are equal.

b. Are the green squares mirror images of each other? Explain why the numbers in the green squares are equal.

c. Shade the rest of the mirror image squares with the same color. Why are the mirror image numbers always equal?
c. Example: Solution (DOK 3)

Below is a table showing all the ways to add the numbers from 1 to 9.

a. Each sum which is larger than 10 can be found by first making a 10. For example, to find $8 + 5$, we can write

\[
8 + 5 = 8 + (2 + 3) \\
= (8 + 2) + 3 \\
= 10 + 3 \\
= 13.
\]

Explain why this reasoning works and apply this method to find $7 + 8$. How can you visualize these equations using the table?

b. Adding 9 to another single digit number can also be done by first making a 10. For example

\[
3 + 9 = 3 + (10 - 1) \\
= (3 + 10) - 1 \\
= 13 - 1 \\
= 12.
\]

Explain why this reasoning works and apply this method to find $7 + 9$. How can you visualize these equations using the table?

<table>
<thead>
<tr>
<th>+</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
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<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
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<tr>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
</tbody>
</table>

d. Example: Solution (DOK 2)
The table shows products of the whole numbers 1 through 6.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
<td>36</td>
</tr>
</tbody>
</table>

a. Color all of the even products in the table.

b. Sometimes there are even numbers next to each other in the table. However, there are never odd numbers next to each other. Why is this true?

c. Imagine the same kind of table that shows all the ways of multiplying two numbers between 1 and 9. Would this still be true?

e. Example: What unknown numbers complete the pattern on the number line?

Write one answer in each response box.

<table>
<thead>
<tr>
<th>Item</th>
<th>Claim</th>
<th>Domain</th>
<th>Target</th>
<th>DOK</th>
<th>CONTENT</th>
<th>MP</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>#13</td>
<td>1</td>
<td>OA</td>
<td>D</td>
<td>2</td>
<td>3.OA.D.9</td>
<td>N/A</td>
<td>21, 39</td>
</tr>
</tbody>
</table>
f. Example: (Former NAEP question) (DOK 2)
Sam folds a piece of paper in half once. There are 2 sections.

\[ \text{[Diagram of a piece of paper folded in half once]} \]

Sam folds the paper in half again. There are 8 sections.

\[ \text{[Diagram of a piece of paper folded in half twice]} \]

Sam folds the paper in half two more times.

Which list shows the number of sections there are each time Sam folds the paper?

1. 2, 4, 8, 10, 12
2. 2, 4, 8, 12, 24
3. 2, 4, 8, 16, 24
4. 2, 4, 8, 16, 32

Answer: 4. 2, 4, 8, 16, 32

g. Example: (Former NAEP question) (DOK 1)
If \( n \) is any integer, which of the following expressions must be an odd integer?

1. \( N + 1 \)
2. \( 2n \)
3. \( 2n + 1 \)
4. \( 3n \)
5. \( 3n + 1 \)

Answer: 3. \( 2n + 1 \)

h. Part of a multiplication table is shown.
What two numbers correctly complete the pattern in the table?
Write your answers in the table.

<table>
<thead>
<tr>
<th>12</th>
<th>15</th>
<th>18</th>
<th>21</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td></td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>24</td>
<td>30</td>
<td>36</td>
<td>42</td>
</tr>
</tbody>
</table>

Rubric: (1 point) The student enters the correct numbers.

<table>
<thead>
<tr>
<th>Item</th>
<th>Claim</th>
<th>Domain</th>
<th>Target</th>
<th>DOK</th>
<th>CCSS-MC</th>
<th>CCSS-MP</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>#13</td>
<td>1</td>
<td>OA</td>
<td>D</td>
<td>2</td>
<td>3.OA.D.9</td>
<td>N/A</td>
<td>20 in the first row, 25 in the second row</td>
</tr>
</tbody>
</table>
Use place value understanding and properties of operations to perform multi-digit arithmetic.¹ (3.NBT.A)

a. Example: There are 425 boys and 510 girls in Hank’s school. How many more girls are there than boys?

<table>
<thead>
<tr>
<th>Item</th>
<th>Claim</th>
<th>Domain</th>
<th>Target</th>
<th>DOK</th>
<th>CONTENT</th>
<th>MP</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>#8</td>
<td>1</td>
<td>OA, NBT</td>
<td>D</td>
<td>2</td>
<td>3.OA.D, 3.NBT.A</td>
<td>N/A</td>
<td>85</td>
</tr>
</tbody>
</table>

1. Use place value understanding to round whole numbers to the nearest 10 or 100. (3.NBT.A.1) (DOK 1)
   b. Example: Solution (DOK 1)

   When rounding to the nearest ten:
   
   a. What is the smallest whole number that will round to 50?
   b. What is the largest whole number that will round to 50?
   c. How many different whole numbers will round to 50?

   When rounding to the nearest hundred:

   d. What is the smallest whole number that will round to 500?
   e. What is the largest whole number that will round to 500?
   f. How many different whole numbers will round to 500?

   c. Example: Solution (DOK 1)

¹ A range of algorithms may be used.
Plot 8, 32, and 79 on the number line.

a. Round each number to the nearest 10. How can you see this on the number line?

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

Answer:

Example: Solution (DOK 1)
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?

Answer:

e. Example: (Former NAEP question) (DOK 2)
The table shows the number of adults and children who went to the zoo. On what day was the number of adults who went to the zoo about the same as the number of children who went to the zoo?
ZOO ATTENDANCE

<table>
<thead>
<tr>
<th>Day</th>
<th>Adults</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday</td>
<td>757</td>
<td>649</td>
</tr>
<tr>
<td>Friday</td>
<td>774</td>
<td>742</td>
</tr>
<tr>
<td>Saturday</td>
<td>792</td>
<td>788</td>
</tr>
<tr>
<td>Sunday</td>
<td>801</td>
<td>726</td>
</tr>
</tbody>
</table>

1. Thursday
2. Friday
3. Saturday
4. Sunday

Answer: 3. Saturday

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

The weight of an object is 1,700 pounds, rounded to the nearest hundred. Of the following, which could be the actual weight of the object?

1. 1, 640
2. 1, 645
3. 1, 749
4. 1, 751

Answer: 3. 1, 749

2. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. (3.NBT.A.2) (DOK 1,2)
   a. Example: Solution (DOK 3)

   Your teacher was just awarded $1,000 to spend on materials for your classroom. She asked all 20 of her students in the class to help her decide how to spend the money. Think about which supplies will benefit the class the most.
<table>
<thead>
<tr>
<th>Supplies</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A box of 20 markers</td>
<td>$5</td>
</tr>
<tr>
<td>A box of 100 crayons</td>
<td>$8</td>
</tr>
<tr>
<td>A box of 60 pencils</td>
<td>$5</td>
</tr>
<tr>
<td>A box of 5,000 pieces of printer paper</td>
<td>$40</td>
</tr>
<tr>
<td>A package of 10 pads of lined paper</td>
<td>$15</td>
</tr>
<tr>
<td>A box of 50 pieces of construction paper</td>
<td>$32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Books and maps</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A set of 20 books about science</td>
<td>$250</td>
</tr>
<tr>
<td>A set of books about the 50 states</td>
<td>$400</td>
</tr>
<tr>
<td>A story book: (there are 80 to choose from)</td>
<td>$8</td>
</tr>
<tr>
<td>A map: there is one of your city, one for every state, one of the country, and one of the world to choose from</td>
<td>$45</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Puzzles and games</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Puzzles: (there are 30 to choose from)</td>
<td>$12</td>
</tr>
<tr>
<td>Board games: (there are 40 to choose from)</td>
<td>$15</td>
</tr>
<tr>
<td>Interactive computer games (math and reading)</td>
<td>$75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Special items</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A bean bag chair for the reading corner</td>
<td>$65</td>
</tr>
<tr>
<td>A class pet</td>
<td>$150</td>
</tr>
<tr>
<td>Three month's supply of food for a class pet</td>
<td>$55</td>
</tr>
<tr>
<td>A field trip to the zoo</td>
<td>$350</td>
</tr>
</tbody>
</table>

a. Write down the different items and how many of each you would choose. Find the total for each category.
   - Supplies
   - Books and maps
   - Puzzles and games
   - Special items

b. Create a bar graph to represent how you would spend the money. Scale the vertical axis by $100. Write all of the labels.

c. What was the total cost of all your choices? Did you have any money left over? If so, how much?

d. Compare your choices with a partner. How much more or less did you choose to spend on each category than your partner? How much more or less did you choose to spend in total than your partner?
b. Example: What unknown number makes this equation true?

\[ 904 - 256 = □ \]

<table>
<thead>
<tr>
<th>Item</th>
<th>Claim</th>
<th>Domain</th>
<th>Target</th>
<th>DOK</th>
<th>CONTENT</th>
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<td>1</td>
<td>3.NBT.A.2</td>
<td>N/A</td>
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</table>

c. Example: (Former NAEP question) (DOK 3)
The sum of three numbers is 173. If the smallest number is 23, could the largest number be 62?

___ yes     ___ no

Explain your answer in the space below.

Answer: No, because 173 – (23 + 62) = 85 and 85 is larger than 62.

d. What unknown number makes this equation true?

\[ □ = 881 - 72 \]

Rubric: (1 point) The student writes the correct number.

<table>
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<tr>
<th>Item</th>
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<td>1</td>
<td>3.NBT.A.2</td>
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<td>809</td>
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</table>

e. The table shows the number of books in four third-grade classrooms. One of the teachers is Tim’s teacher, and one of the teachers is Sue’s teacher.

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Number of Books</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Smith</td>
<td>136</td>
</tr>
<tr>
<td>Ms. Rose</td>
<td>148</td>
</tr>
<tr>
<td>Mr. Brown</td>
<td>172</td>
</tr>
<tr>
<td>Mrs. Lee</td>
<td>122</td>
</tr>
</tbody>
</table>

Tim’s teacher has 26 more books than Sue’s teacher.

Who is Tim’s teacher?
A. Mr. Smith  
B. Ms. Rose  
C. Mr. Brown  
D. Mrs. Lee

Rubric: (1 point) The student selects the correct teacher.

<table>
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<tr>
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<tr>
<td>#7</td>
<td>2</td>
<td>NBT</td>
<td>C</td>
<td>2</td>
<td>3.NBT.A.2</td>
<td>1,2</td>
<td>B</td>
</tr>
</tbody>
</table>

3. Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations. (3.NBT.A.3) (DOK 1,2)

a. Example: Solution (DOK 2)
There are 6 tables in Mrs. Potter’s art classroom. There are 4 students sitting at each table. Each student has a box of 10 colored pencils.

(A) How many colored pencils are at each table?

(B) How many colored pencils do Mrs. Potter’s students have in total?

b. Example: Jen has 5 stacks of quarters. Lee has 9 stacks of quarters. Each stack of quarters is worth $10.
   How much more money, in dollars, does Lee have than Jen?

<table>
<thead>
<tr>
<th>Item</th>
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<th>MP</th>
<th>Key</th>
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</thead>
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<tr>
<td>#27</td>
<td>2</td>
<td>OA, NBT</td>
<td>A</td>
<td>2</td>
<td>3.OA.D.8, 3.NBT.A.3</td>
<td>1, 2</td>
<td>40</td>
</tr>
</tbody>
</table>
Number and Operations—Fractions\(^1\)

Develop understanding of fractions as numbers. (3.NF.A)

1. Understand a fraction \(1/b\) as the quantity formed by 1 part when a whole is partitioned into \(b\) equal parts; understand a fraction \(a/b\) as the quantity formed by \(a\) parts of size \(1/b\). (3.NF.A.1) (DOK 1,2)
   a. Example: Solution (DOK 2)
      Mrs. Frances drew a picture on the board.

```
[Image: A green square divided into \(b\) equal parts, with one part shaded.]
```

Then she asked her students what fraction it represents.

- Emily said that the picture represents \(\frac{2}{6}\) Label the picture to show how Emily's answer can be correct.
- Raj said that the picture represents \(\frac{2}{3}\) Label the picture to show how Raj's answer can be correct.
- Alejandra said that the picture represents 2. Label the picture to show how Alejandra's answer can be correct.

b. Example: Solution (DOK 3)

---

\(^1\) Grade 3 expectations in this domain are limited to fractions with denominators 2, 3, 4, 6, and 8.
a. A small square is a square unit. What is the area of this rectangle? Explain.

b. What fraction of the area of each rectangle is shaded blue? Name the fraction in as many ways as you can. Explain your answers.

- A.  
- B.  
- C.  
- D.  
- E.  
- F.  
- G.  
- H.  

c. Shade $\frac{1}{4}$ of the area of the rectangle in a way that is different from the rectangles above.

-  

d. Shade $\frac{3}{4}$ of the area of the rectangle in a way that is different from the rectangles above.

-  

c. Example: [Former NAEP question](DOK 1)
What fraction of the figure is shaded?

Answer: $\frac{2}{5}$
d. Example: (Former NAEP question) (DOK 1)
What fraction of the group of umbrellas is closed?

![Umbrellas](image)

A. \( \frac{1}{3} \)
B. \( \frac{3}{7} \)
C. \( \frac{4}{7} \)
D. \( \frac{3}{4} \)

Answer: B. 3/7

e. Example: (Former NAEP question) (DOK 1)
How many fifths are equal to one whole?

\[ \frac{1}{5} \]

A. 5
B. 1
C. 4
D. 5

Answer: D. 5

f. Jamie drew this shape.

![Shape](image)

She says, "I divided the shape into 8 parts. I shaded 1 part. So \( \frac{1}{8} \) of the shape is shaded."

Is Jamie correct? Select the statement that explains why.
A. Yes, because there is 1 large piece shaded.
B. Yes, because the shape is divided into 8 parts.
C. No, because the 8 parts should be the same size.
D. No, because there should be 1 medium piece shaded.

Rubric: (1 point) The student selects the correct statement.
2. Understand a fraction as a number on the number line; represent fractions on a number line diagram.
   a. Represent a fraction $1/b$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into $b$ equal parts. Recognize that each part has size $1/b$ and that the endpoint of the part based at 0 locates the number $1/b$ on the number line.
   b. Represent a fraction $a/b$ on a number line diagram by marking off a lengths $1/b$ from 0. Recognize that the resulting interval has size $a/b$ and that its endpoint locates the number $a/b$ on the number line. (3.NF.A.2) (DOK 1,2)

1. Example: Solution (DOK 2)
   a. Mark and label the points $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, and $\frac{4}{4}$ on the number line. Be as exact as possible.

   ![Number Line Example 1](image1)

   b. Mark and label the point $\frac{2}{3}$ on the number line. Be as exact as possible.

   ![Number Line Example 2](image2)

   c. Mark and label the points $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ on the number line. Be as exact as possible.

   ![Number Line Example 3](image3)

2. Example: Solution (DOK 2)
   a. Locate 1 on the number line. Label the point. Be as exact as possible.

   ![Number Line Example 4](image4)

   b. Locate 1 on the number line. Label the point. Be as exact as possible.

3. Example: Solution (DOK 1)
Label the point where $\frac{2}{3}$ belongs on the number line. Be as exact as possible.

![Number line with marked points](Image)

4. Example: **Solution** (DOK 1)

Which number is closest to $\frac{1}{2}$?

![Number line with marked points](Image)

a. $\frac{1}{8}$

b. $\frac{3}{8}$

c. $\frac{7}{8}$

d. $\frac{9}{8}$

5. Example: **Solution** (DOK 3)

Which is closer to 1 on the number line, $\frac{4}{5}$ or $\frac{5}{4}$? Explain.

6. Example: **Solution** (DOK 2)

a. Mark and label points on the number line for $\frac{1}{2}$, $\frac{2}{2}$, $\frac{3}{2}$, $\frac{4}{2}$, $\frac{5}{2}$, and $\frac{6}{2}$.

![Number line with marked points](Image)

b. Mark and label a point on the number line for $\frac{11}{3}$. Be as exact as possible.

![Number line with marked points](Image)

7. Example: **Solution** (DOK 2)
The number line below shows two numbers, 0 and $\frac{5}{3}$.

Where is 1 on this number line?

Example: Solution (DOK 2)
The number line below shows two numbers, 0 and 1.

Where is $\frac{1}{4}$ on this number line?

Example: Solution (DOK 2)
The number line below shows two numbers, 0 and 1.

Where is $\frac{7}{4}$ on this number line?

10. Example: Write each fraction in the correct location on the number line.

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<tr>
<td>#15</td>
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<td>NF</td>
<td>F</td>
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<td>3.NF.A.2, 3.NF.A.3c</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

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

On the number line, what number does $P$ represent?
3. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.
   a. Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line.
   b. Recognize and generate simple equivalent fractions, e.g., \( \frac{1}{2} = \frac{2}{4}, \frac{4}{6} = \frac{2}{3} \). Explain why the fractions are equivalent, e.g., by using a visual fraction model.
   c. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form \( \frac{3}{1} \); recognize that \( \frac{6}{1} = 6 \); locate \( \frac{4}{4} \) and 1 at the same point of a number line diagram.
   d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols \( >, =, \) or \( < \), and justify the conclusions, e.g., by using a visual fraction model. (3.NF.A.3) (DOK 1,2,3)
      a. Example: Solution (DOK 3)
         Arrive the fractions in order from least to greatest. Explain your answer with a picture.
         a. \( \frac{1}{6}, \frac{1}{7}, \frac{1}{3} \)
         b. \( \frac{2}{6}, \frac{2}{7}, \frac{2}{3} \)
         c. \( \frac{5}{6}, \frac{3}{6}, \frac{1}{6} \)
         d. \( \frac{5}{12}, \frac{8}{12}, \frac{4}{12} \)
      b. Example: Solution (DOK 3)
Jon and Charlie plan to run together. They are arguing about how far to run. Charlie says,

*I run \( \frac{3}{6} \) of a mile each day.*

Jon says,

*I can only run \( \frac{1}{3} \) of a mile.*

If Charlie runs \( \frac{3}{6} \) of a mile and Jon runs \( \frac{1}{3} \) of a mile, explain why it is silly for them to argue. Draw a picture or a number line to support your reasoning.

c. Example: Solution (DOK 2)

Compare the fractions below. Use the symbols \( > \), \( = \), or \( < \) to record your comparisons. Draw a picture to illustrate your answer.

a. \( \frac{2}{6} \) and \( \frac{5}{6} \)

b. \( \frac{1}{2} \) and \( \frac{1}{3} \)

c. \( \frac{3}{6} \) and \( \frac{4}{8} \)

d. Example: Solution (DOK 2)
Bryce drew this picture:

Then he said,

*This shows that \( \frac{1}{4} \) is greater than \( \frac{1}{2} \).*

a. What was his mistake? Draw a picture that shows why \( \frac{1}{2} \) is greater than \( \frac{1}{4} \).

b. Which of these comparison of \( \frac{1}{4} \) with \( \frac{1}{2} \) are true?
   i. \( \frac{1}{4} > \frac{1}{2} \)
   ii. \( \frac{1}{4} < \frac{1}{2} \)
   iii. \( \frac{1}{4} = \frac{1}{2} \)
   iv. \( \frac{1}{2} > \frac{1}{4} \)
   v. \( \frac{1}{2} < \frac{1}{4} \)

e. Example: **Solution** (DOK 2)
a. Choose each statement that is true.
   i. $\frac{3}{4}$ is greater than $\frac{5}{4}$.
   ii. $\frac{5}{4}$ is greater than $\frac{3}{4}$.
   iii. $\frac{3}{4} > \frac{5}{4}$.
   iv. $\frac{3}{4} < \frac{5}{4}$.
   v. $\frac{5}{4} > \frac{3}{4}$.
   vi. $\frac{5}{4} < \frac{3}{4}$.
   vii. None of these.

b. $\frac{3}{4}$ and $\frac{5}{4}$ are shown on the number line. Which is correct?
   i. 
   ![Number line with points at 0, \frac{3}{4}, and \frac{5}{4}]
   
   ii. 
   ![Number line with points at 0, \frac{3}{4}, and \frac{5}{4}]
   
   iii. Neither of these.
f. Example: **Solution** (DOK 2)

a. Choose each statement that is true.
   i. \( \frac{9}{8} \) is greater than \( \frac{9}{4} \).
   ii. \( \frac{9}{4} \) is greater than \( \frac{9}{8} \).
   iii. \( \frac{9}{8} > \frac{9}{4} \).
   iv. \( \frac{9}{8} < \frac{9}{4} \).
   v. \( \frac{9}{4} > \frac{9}{8} \).
   vi. \( \frac{9}{4} < \frac{9}{8} \).
   vii. None of these.

b. \( \frac{9}{8} \) and \( \frac{9}{4} \) are shown on the number line. Which is correct?
   i. 
   ![Number line with points at \( \frac{9}{8}, \frac{9}{4} \).]
   ii. 
   ![Number line with points at \( \frac{9}{8}, \frac{9}{4} \).]
   iii. Neither of these.

g. Example: **Solution** (Video online) (DOK 2)

a. Who correctly compares the numbers 2/3 and 2/5?
   i. Ben said that 2/3 is greater than 2/5.
   ii. Lee said that 2/3 is equal to 2/5.
   iii. Mia said that 2/3 is less than 2/5.

b. Compare 2/3 and 2/5 using symbols:

\[
\frac{2}{3} \quad \nabla \quad \frac{2}{5}
\]

c. Choose the two pictures that best compare 2/3 and 2/5.
h. Example: **Solution** (DOK 2)
   Alec and Felix are brothers who go to different schools. The school day is just as long at Felix' school as at Alec's school. At Felix' school, there are 6 class periods of the same length each day. Alec's day is broken into 3 class periods of equal length. One day, it snowed a lot so both of their schools started late. Felix only had four classes and Alec only had two. Alec claims his school day was shorter than Felix' was because he had only two classes on that day. Is he right?

i. Example: **Solution** (DOK 3)
a. A small square is a square unit. What is the area of this rectangle? Explain.

b. What fraction of the area of each rectangle is shaded blue? Name the fraction in as many ways as you can. Explain your answers.

A. 
B. 

C. 
D. 

E. 
F. 

G. 
H. 

c. Shade $\frac{1}{2}$ of the area of rectangle in a way that is different from the rectangles above.

d. Shade $\frac{3}{4}$ of the area of the rectangle in a way that is different from the rectangles above.
j. Example: Solution (DOK 2)
This activity is designed for pairs of students. They will require a set of cards (which are supplied as an attached resource, after the commentary). The goal is to compare the two fractions appearing on each card, determine if they are equivalent and, if not, which is larger. Instructions for the activity are as follows:

a. Students go through the following steps with the fraction cards:
   i. The pair of students select a card.
   ii. Each student individually decides whether the fractions are equal and, if not, which is greater. Then they show each other their choice.
   iii. If the partners agree, they take turns explaining their reasoning. If they disagree, they discuss until reaching a consensus.
   iv. Repeat 1 through 3 with a new card.

b. After 10 rounds, each pair records observations about what methods they used to compare the fractions.

k. Example: Use this model to solve the problem.
   Shade 1/3 of the whole model.

<table>
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<td>2</td>
<td>3.NF.A.3b</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

l. Example: Robert says,
“When comparing two fractions with a numerator of 1, the fraction with the bigger denominator is greater.”
Write each fraction in the correct location on the number line to find out if Robert’s statement is true.
m. Example: Write each fraction in the correct location on the number line.

n. Example: Use this number line to solve the problem.

Choose **all** the number lines that show a number equal to the number shown by point \( P \).
o. Example: (Former NAEP question) (DOK 1)
These three fractions are equivalent. Give two more fractions that are equivalent to these.

Answer: Any other fraction equivalent to ½: 3/6, 6/12, etc.

p. Example: (Former NAEP question) (DOK 3)
Mark says \( \frac{1}{4} \) of his candy bar is smaller than \( \frac{1}{5} \) of the same candy bar.

Is Mark right?  ☐ Yes  ☐ No

Draw a picture or use words to explain why you think Mark is right or wrong.

Answer: No (When you divide a candy bar into 4 pieces, one piece of that bar is going to be larger than if you divide the candy bar up into 5 pieces and take one of those pieces.)

A recipe requires \( \frac{1}{3} \) cups of sugar. Which of the following ways describes how the measuring cups shown can be used to measure \( \frac{1}{2} \) cups of sugar accurately?

A. Use the \( \frac{1}{2} \) cup three times.

B. Use the \( \frac{1}{3} \) cup three times.

C. Use the \( \frac{1}{2} \) cup twice and the \( \frac{1}{3} \) cup once.

D. Use the \( \frac{1}{3} \) cup twice and the \( \frac{1}{2} \) cup once.

E. Use the \( \frac{1}{4} \) cup once, the \( \frac{1}{3} \) cup once, and the \( \frac{1}{2} \) cup once.

Answer: C. Use the \( \frac{1}{2} \) cup twice and the \( \frac{1}{3} \) cup once
What fraction of the figure above is shaded?

A. \( \frac{1}{4} \)
B. \( \frac{3}{10} \)
C. \( \frac{1}{3} \)
D. \( \frac{7}{7} \)
E. \( \frac{7}{10} \)

Answer: B. 3/10

s. What number goes in the box to make the equation true?

\[ \frac{\Box}{1} = 5 \]

Rubric: (1 point) The student enters a correct number.
Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects. (3.MD.A)

1. Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram. (3.MD.A.1) (DOK 1,2)
   a. Example: Solution (DOK 2)
      a. It usually takes Dajuana 45 minutes to do her homework. If she starts her homework at 5:30 PM, what time will she finish?
      b. One day Dajuana started her homework at 6:45 PM and finished her homework at 7:20 PM. How long did Dajuana spend on her homework?
      c. Another day, Dajuana finished her homework at 5:05 PM after spending 40 minutes on her homework. What time did Dajuana start her homework?

   b. Example: Use this clock to answer the question.

   ![Clock Image]

   Select the time, to the nearest minute, shown on the clock.
   1. 4:10
   2. 4:49
   3. 5:10
   4. 5:59

   c. Example: (Former NAEP question) (DOK 2)
      The early show and the late show for a movie last the same amount of time. The early show begins at 3:15 P.M. and ends at 4:27 P.M. The late show begins at 7:30 P.M. At what time does the late show end?

      Show your work.

      Answer: 8:42 P.M. (4:27 – 3:15 = 1 hour and 12 minutes, 7:30 + 1 hour and 12 minutes = 8:42)
d. Example: (Former NAEP question) (DOK 1)

The time is now 10:18 P.M. In how many minutes will it be 11:00 P.M.?

1. 12
2. 18
3. 22
4. 42
5. 82

Answer: 4. 42

e. Look at the time on this clock.

![Clock Image]

Select the time, to the nearest minute, shown on the clock.

1. 7:42
2. 8:33
3. 9:33
4. 6:42

Rubric: (1 point) The student writes the correct time.

<table>
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<td>G</td>
<td>1</td>
<td>3.MD.A.1</td>
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<td>4</td>
</tr>
</tbody>
</table>

2. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).¹ Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.² (3.MD.A.2) (DOK 1,2)

   a. Example: Solution (DOK 2)

¹ Excludes compound units such as cm³ and finding the geometric volume of a container.
² Excludes multiplicative comparison problems (problems involving notions of “times as much”; see Glossary, Table 2).
Students will need various items, a balance scale, a large set of cubes such as unifix or snap cubes, and a recording sheet. They choose an item to measure. Using the balance scale, they put the item on one side of the balance scale. Then they put enough cubes on the other side of the scale to make it balance. They remove the cubes, count them, and record the result. For example, if a small book balances with 12 cubes, they should write, “The book has the same mass as 12 cubes.” They continue same routine three more times with different items.

b. Example: Jeff has 6 markers. He estimates that the total mass of the markers is 54 grams.

Which statement could Jeff have used to make this estimate?
1. Three markers have a mass of about 35 grams.
2. Three markers have a mass of about 18 grams.
3. Each marker has an equal mass of about 9 grams.
4. Each marker has an equal mass of about 7 grams.

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<td>C</td>
<td>2</td>
<td>3.MD.A.2</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

c. Example: A pencil has a mass of 25 grams. An apple has a mass that is 75 grams more than the pencil. What is the mass of the apple, in grams?

<table>
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</tbody>
</table>

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

Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word
problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale to represent the problem.

What is being measured?
1. The amount of water in the cup
2. The height of the water in the cup
3. The weight of the cup of water
4. The temperature of the water

Answer: 3. The weight of the cup of water

b. Example: (Former NAEP question) (DOK 1)
Which unit would you use to tell the temperature outside?
1. Degree
2. Gram
3. Liter
4. Meter

Answer: 1. Degree

c. Example: (Former NAEP question) (DOK 1)
Which of the following is a unit of volume?
1. Acre
2. Gram
3. Liter
4. Meter
5. Ton

Answer: 3. Liter

d. Example: (Former NAEP question) (DOK 2)
Both figures below show the same scale. The marks on the scale have no labels except the zero point.
The weight of the cheese is \( \frac{1}{2} \) pound. What is the total weight of the two apples?

Total weight of the two apples = ___ pounds.

Answer: 1 \( \frac{3}{4} \) pounds

e. Example: Paul made a number line to show the times he started reading and finished reading.

Paul read for 45 minutes.
Which number line shows 4:00 p.m. in the correct place on Paul's number line?

Rubric: (1 point) The student identifies the correct number line.
Represent and interpret data. (3.MD.B)

3. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets. (3.MD.B.3) (DOK 1,2)
   a. Example: Solution (DOK 2)

   Your teacher was just awarded $1,000 to spend on materials for your classroom. She asked all 20 of her students in the class to help her decide how to spend the money. Think about which supplies will benefit the class the most.

<table>
<thead>
<tr>
<th>Supplies</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A box of 20 markers</td>
<td>$5</td>
</tr>
<tr>
<td>A box of 100 crayons</td>
<td>$8</td>
</tr>
<tr>
<td>A box of 60 pencils</td>
<td>$5</td>
</tr>
<tr>
<td>A box of 5,000 pieces of printer paper</td>
<td>$40</td>
</tr>
<tr>
<td>A package of 10 pads of lined paper</td>
<td>$15</td>
</tr>
<tr>
<td>A box of 50 pieces of construction paper</td>
<td>$32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Books and maps</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A set of 20 books about science</td>
<td>$250</td>
</tr>
<tr>
<td>A set of books about the 50 states</td>
<td>$400</td>
</tr>
<tr>
<td>A story book (there are 80 to choose from)</td>
<td>$8</td>
</tr>
<tr>
<td>A map: there is one of your city, one for every state, one of the country, and one of the world to choose from</td>
<td>$45</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Puzzles and games</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Puzzles (there are 30 to choose from)</td>
<td>$12</td>
</tr>
<tr>
<td>Board games (there are 40 to choose from)</td>
<td>$15</td>
</tr>
<tr>
<td>Interactive computer games (math and reading)</td>
<td>$75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Special items</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A bean bag chair for the reading corner</td>
<td>$65</td>
</tr>
<tr>
<td>A class pet</td>
<td>$150</td>
</tr>
<tr>
<td>Three month's supply of food for a class pet</td>
<td>$55</td>
</tr>
<tr>
<td>A field trip to the zoo</td>
<td>$350</td>
</tr>
</tbody>
</table>
a. Write down the different items and how many of each you would choose. Find the total for each category.
   - Supplies
   - Books and maps
   - Puzzles and games
   - Special items

b. Create a bar graph to represent how you would spend the money. Scale the vertical axis by $100. Write all of the labels.

c. What was the total cost of all your choices? Did you have any money left over? If so, how much?

d. Compare your choices with a partner. How much more or less did you choose to spend on each category than your partner? How much more or less did you choose to spend in total than your partner?

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

**Summer Reading**

<table>
<thead>
<tr>
<th>Month</th>
<th>Books</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>📚📚📚 cruis 📚📚📚</td>
</tr>
<tr>
<td>July</td>
<td>📚📚 cruis</td>
</tr>
<tr>
<td>August</td>
<td>📚📚📚📚 cruis 📚📚📚📚</td>
</tr>
</tbody>
</table>

= 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.
c. Example: Students vote for their favorite school subjects. Use the bar graph to answer the question.

```
#5 1  MD  H  2  3.MD.B.3, 4.OA.B.4, 4.NF.B.4b  N/A  3
```

d. Example: (Former NAEP question) (DOK 2)
The graph below shows students’ favorite fruits. Use these clues to label the bars with the correct fruit.

- Twice as many students chose apples as grapes.
- Five more students chose peaches than apples.
- Ten more students chose bananas than peaches.

Write the correct fruit on the lines above.

Answer: Peaches, bananas, grapes, apples

e. Example: (Former NAEP question) (DOK 2)
Fred planted 8 trees.
Yolanda planted 12 trees.

Make a pictograph of the information above. Use  to represent 2 trees

Answer: Fred: draw 4 trees, Yolanda: draw 6 trees

f. Example: (Former NAEP question) (DOK 2)
In the school sale Bob sold 10 boxes of fruit, Kyla sold 20 boxes, and Chris sold 15 boxes.
Complete the bar graph below to show how many boxes each student sold.
Example: (Former NAEP question) (DOK 2)
The pictograph shows how all the 4th graders at Smith School get to school. According to the pictograph, how many 4th graders attend Smith School?
4. Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. \(3\cdot\text{MD.B.4}\) (DOK 2)

a. Example: Tracy has a broken ruler, but she can use it to measure the length of her pencil. What is the length, in inches, of the pencil shown?

1. 8 inches
2. 7 ¾ inches
3. 5 inches
4. 4 ¾ inches
Geometric measurement: understand concepts of area and relate area to multiplication and to addition. (3.MD.C)

5. Recognize area as an attribute of plane figures and understand concepts of area measurement.
   a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.
   b. A plane figure which can be covered without gaps or overlaps by \( n \) unit squares is said to have an area of \( n \) square units. (3.MD.C.5) (DOK 1,2)
   c. Example: City planners want to build a garden by the city library.
      - There are 2 possible spaces for the garden.
      - The planners draw models of the spaces on a grid.
      - Each unit length on a model equals a length of 1 foot

How much more area does space A have than space B?
   A. 5 square feet
   B. 25 square feet
   C. 30 square feet
   D. 60 square feet

Rubric: (1 point) The student selects the correct number of square feet.

<table>
<thead>
<tr>
<th>Item</th>
<th>Claim</th>
<th>Domain</th>
<th>Target</th>
<th>DOK</th>
<th>CCSS-MC</th>
<th>CCSS-MP</th>
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</tr>
</thead>
<tbody>
<tr>
<td>#17</td>
<td>1</td>
<td>MD</td>
<td>I</td>
<td>2</td>
<td>3.MD.C</td>
<td>4, 6</td>
<td>A</td>
</tr>
</tbody>
</table>
6. Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units). *(3.MD.C.6) (DOK 1,2)*
   a. Example: Solution (DOK 3)
      a. A small square is a square unit. What is the area of this rectangle? Explain.

```
+---+---+---+---+
|   |   |   |   |
|   |   |   |   |
|   |   |   |   |
+---+---+---+---+
```

b. What fraction of the area of each rectangle is shaded blue? Name the fraction in as many ways as you can. Explain your answers.

- A.
- B.
- C.
- D.
- E.
- F.
- G.
- H.
c. Shade \( \frac{1}{2} \) of the area of the rectangle in a way that is different from the rectangles above.

\[ \text{Diamond shape} \]

d. Shade \( \frac{2}{3} \) of the area of the rectangle in a way that is different from the rectangles above.

\[ \text{Square} \]

b. Example: Solution (DOK 2)

Find the area of each colored figure.

a. 

\[ \text{Green shape} \]

b. 

\[ \text{Yellow shape} \]
c. Example: (Former NAEP question) (DOK 2)
A map of City Park is shown above. The area of the whole park is 490 square units. The Bike Trail and the Picnic Place together occupy how many square units of the park’s area?

1. 70
2. 80
3. 150
4. 220

d. Example: (Former NAEP question) (DOK 1)
Which figure has the greatest area?
1. A
2. B
3. C
4. D

7. Relate area to the operations of multiplication and addition.
   a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.
   b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.
   c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths $a$ and $b + c$ is the sum of $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning.
   d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems. (3.MD.C.7) (DOK 1,2)

Example: Solution (DOK 2)

Find the area of each colored figure.

a.

b.
2. Example: **Solution** (DOK 2)
   There are many ways to find the area of this figure.
   
   ![Diagram](image1)

   a. Try to find as many ways as you can to split this figure into exactly 3 rectangles. Be sure that none of the rectangles overlap and the 3 rectangles cover the entire figure.

   b. For every example you found in part a, write an expression that represents the area as the sum of the three rectangles.

   c. Find the total area of this figure.

3. Example: **Solution** (DOK 2)
India is remodeling her bathroom. She plans to cover the bathroom floor with tiles that are each 1 square foot. Her bathroom is 5 feet wide and 8 feet long. India needs to stay within a strict budget and must purchase the exact number of tiles needed.

How many tiles should India buy? Use the space below to illustrate your answer.
4. Example: Solution (DOK 3)
   Part I.

   a. How many circles are there in all? Write down a number sentence that shows how you thought about it.

   ![Circle Diagram]

   b. Alonso said he figured out how many shaded circles there were first and then how many unshaded circles there were second. Once he knew how many of each, he added them together to find the total. Write a number sentence Alonso could have used that shows his reasoning.

   c. Jennifer said, “I just saw 3 rows of 8 circles.” Write a number sentence that Jennifer could have used that shows her reasoning.

   Part II.

   a. The area model below shows the floor plan for a storage closet. The storage closet will have a tiled floor with grey tiles on the left and white tiles on the right. How many tiles are needed for the storage closet in all? Write down a number sentence that shows how you thought about it.

   ![Tile Diagram]

   b. Think back to how Alonso figured out how many circles there were in Part I. Use Alonso’s same strategy here to find out how many tiles are needed. Write a number sentence with Alonso’s reasoning.

   c. Think back to how Jennifer figured out how many circles there were in Part I. Use Jennifer's same strategy here to find out how many tiles are needed. Write a number sentence with Jennifer's reasoning.

5. Example: Tasha is doing an art project with square tiles. She needs to figure out how many tiles she will need. This picture shows her design. Tasha thinks:
Tasha says, “I need \((9 \times 3) + (3 \times 9) = 27 + 27 = 54\) tiles to make the design.”

Which statement explains why Tasha is not correct?

- b. \(27 + 27\) does not equal 54
- c. \((3 \times 9)\) does not equal \((9 \times 3)\).
- d. Tasha multiplied 9 \(\times\) 3 incorrectly.
- e. Tasha included the 9 squares in the middle twice.

<table>
<thead>
<tr>
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<th>DOK</th>
<th>CONTENT</th>
<th>MP</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>#21</td>
<td>3</td>
<td>OA, MD</td>
<td>E</td>
<td>3</td>
<td>3.OA.B.5, 3.MD.C.7a</td>
<td>1, 6</td>
<td>d</td>
</tr>
</tbody>
</table>

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

The square has a perimeter of 12 units.

What is the area of the square?

- a. 6 square units
- b. 8 square units
- c. 9 square units
- d. 12 square units

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

Which is the best estimate for the area of the figure?
a. Less than 10 square feet  
b. More than 10 square feet but less than 15 square feet  
c. More than 15 square feet but less than 25 square feet  
d. More than 25 square feet

Answer: c. More than 15 square feet but less than 25 square feet

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

You will need pieces labeled $R$, $T$, and $X$ to answer this question.

The figure above is made of one piece labeled $T$ and two pieces labeled $X$. This figure has the same total area as...

a. One piece labeled $R$  
b. Two pieces labeled $X$  
c. Three pieces labeled $X$
d. One piece labeled R and one piece labeled T

Answer: a. One piece labeled R

9. Example: (Former NAEP question) (DOK 1)
How many square tiles, 5 inches on a side, does it take to cover a rectangular area that is 50 inches wide and 100 inches long?

Answer: 200 square tiles

10. Example: Juan draws a polygon with a perimeter of 36 units. He covers the area of the polygon with tiles that are each 1 square unit.

Part A: Write an equation that could be used to find the value of \( n \).
Part B: Write the number of tiles Juan used to cover the polygon.

<table>
<thead>
<tr>
<th>Item</th>
<th>Claim</th>
<th>Domain</th>
<th>Target</th>
<th>DOK</th>
<th>CONTENT</th>
<th>MP</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>#16</td>
<td>4</td>
<td>MD</td>
<td>C</td>
<td>3</td>
<td>3.MD.D.8, 3.MD.C.7b,d</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Part A: \( 5 + 4 = n \) or \( n = 36 - 9 - 5 - 2 - 4 - 7 \) (or equivalent equation)
Part B: 73

11. Example: This figure is made by joining two rectangles.

Write the area, in square feet, of the figure.
Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures. (3.MD.D)

12. Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters. (3.MD.D.8) (DOK 1,2)

   a. Example: Juan draws a polygon with a perimeter of 36 units. He covers the area of the polygon with tiles that are each 1 square unit.

   Part A: Write an equation that could be used to find the value of \( n \).

   Part B: Write the number of tiles Juan used to cover the polygon.

   ![Diagram of polygon with labeled sides and an equation for Part A]

   \[ n \text{ units} \]

   - Part A: Write an equation that could be used to find the value of \( n \).
     \[ 5 + 4 = n \text{ or } n = 36 - 9 - 5 - 2 - 4 - 7 \] (or equivalent equation)

   - Part B: Write the number of tiles Juan used to cover the polygon.
     \[ n = 36 - 9 - 5 - 2 - 4 - 7 \]

   b. Example: A city park is in the shape of a rectangle. The park is 120 feet wide and 55 feet long.
What is the perimeter, in feet, of the city park?

<table>
<thead>
<tr>
<th>Item</th>
<th>Claim</th>
<th>Domain</th>
<th>Target</th>
<th>DOK</th>
<th>CONTENT</th>
<th>MP</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3</td>
<td>1</td>
<td>MD</td>
<td>J</td>
<td>2</td>
<td>3.MD.D.8</td>
<td>N/A</td>
<td>350</td>
</tr>
</tbody>
</table>
c. Example: [Former NAEP question] (DOK 1)

![Grid Diagram]

Which rectangle below has the same perimeter (distance around) as the rectangle above?

A.  

B.  

C.  

D.  

Answer: A

d. Example: [Former NAEP question] (DOK 3)

A stop sign has 8 sides of equal length. Ryan knows that the length of each side is 10 inches. Explain how Ryan can find the perimeter (distance around) of the sign.

What is the perimeter of the sign? Answer: ___ inches

Answer: 80 inches

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

Of the following, which is the best estimate for the area of a typical classroom floor?

1. 700 feet
2. 700 square feet
3. 700 cubic feet
4. 700 yards
5. 700 square yards
Answer: 2. 700 square feet

f. Example: (Former NAEP question) (DOK 1)
What is the distance all the way around a square that has a side length of 10 inches?
1. 10 inches
2. 20 inches
3. 40 inches
4. 100 inches
Answer: 3. 40 inches

g. Example: (Former NAEP Question) (DOK 1)
Which figure is NOT a polygon?

Answer: B

f. The side lengths of a shape are shown.
Write the perimeter, in feet, of the shape.
Rubric: (1 point) The student enters the correct perimeter of the shape.

<table>
<thead>
<tr>
<th>Item</th>
<th>Claim</th>
<th>Domain</th>
<th>Target</th>
<th>DOK</th>
<th>CCSS-MC</th>
<th>CCSS-MP</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>#8</td>
<td>1</td>
<td>MD</td>
<td>J</td>
<td>1</td>
<td>3.MD.D.8</td>
<td>N/A</td>
<td>60</td>
</tr>
</tbody>
</table>

Geometry 3.6

Reason with shapes and their attributes. (3.G.A)

1. Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories. (3.G.A.1) (DOK 1,2)
   a. Example: Circle all of the shapes that are quadrilaterals.
Example: Maya says that a rhombus cannot also be a rectangle. Show Maya that her statement is **not** true. Draw a rhombus that is also a rectangle.
c. Example: (Former NAEP question) (DOK 2)
This question requires additional materials:

You will need two pieces labeled X to answer this question.
Use the pieces to make a shape that has these properties.
- It has four sides
- No pieces overlap
- No two sides are parallel

In the space below, trace the shape.
Draw the line to show where the two pieces meet.

Answer:
d. Example: (Former NAEP question) (DOK 2)
   When asked to classify the figure below, here is what four students said.
   Ken: “It’s a parallelogram.”
   Lynn: “It’s a square or a rhombus.”
   Marianne: “It’s a polygon.”
   Rosa: “I think that it’s both a quadrilateral and a rectangle.”

![Figure](image)

Which student or students correctly classified the figure?
1. Lynn only
2. Ken and Marianne only
3. Lynn and Rosa only
4. Ken, Lynn, Marianne, and Rosa
   Answer: 4. Ken, Lynn, Marianne, and Rosa

---

2. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape. (3.G.A.2) (DOK 1,2)*
   a. Example: Solution (DOK 3)
For each picture, decide whether one half of the circle is shaded or not. Explain how you know.

a.

b.

c.

d.
b. Example: Solution (DOK 2)
For each of the pictures, explain how you can see that half of the square is shaded:

a.

b.

C.
c. Example: **Solution** (DOK 3)

a. A small square is a square unit. What is the area of this rectangle? Explain.

b. What fraction of the area of each rectangle is shaded blue? Name the fraction in as many ways as you can. Explain your answers.
c. Shade \( \frac{1}{2} \) of the area of rectangle in a way that is different from the rectangles above.

\[
\begin{array}{|c|c|}
\hline
& \\
\hline
& \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|}
\hline
& \\
\hline
& \\
\hline
\end{array}
\]

d. Shade \( \frac{2}{3} \) of the area of the rectangle in a way that is different from the rectangles above.

\[
\begin{array}{|c|c|}
\hline
& \\
\hline
& \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|}
\hline
& \\
\hline
& \\
\hline
\end{array}
\]
Performance Task Example:

Jaleen has a lemonade stand. The bar graph below shows the number of lemonade cups sold in each of four weeks in July.

![July Lemonade Sales](image)

Use the **July Lemonade Sales** bar graph to complete this task.

1. The bar graph shows how many cups of lemonade Jaleen sold in July.

Complete the table to show how many cups Jaleen sold each week.

<table>
<thead>
<tr>
<th>July Lemonade Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Week</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

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

* 72, 42, 54, and 50.

For this item, a partial-credit response (1 point) includes
• 72 for week 1, and all other bars within 1 of the true value.

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

[Scoring for this item takes into account that grade 3 requires students to read a scaled bar graph.]

2. **How many total cups of lemonade did Jaleen sell in July?**

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

• 218

OR

• a total sum that is correct based on the student’s responses to item 1575.

For this item, a no-credit response (0 points) includes none of the features of a full-credit response.
3. Jaleen also sold lemonade for 4 weeks in August. She compares her weekly sales in July to her weekly sales in August.

- For week 1, she sold 22 fewer cups in August than in July.
- For week 2, she sold 18 more cups in August than in July.
- For week 3, she sold 26 more cups in August than in July.
- For week 4, she sold 25 fewer cups in August than in July.

Complete the table to show how many cups Jaleen sold each week in August.

<table>
<thead>
<tr>
<th>August Lemonade Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

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

- 50, 60, 80, and 25

OR

- four correct responses based on the student’s responses to item 1575.

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

- 2 or 3 correct entries

OR

- 2 or 3 entries that are correct based on the student’s responses to item 1575.

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

[This rubric takes into account that a student may refer either to Item 1575 or to the original bar graph in the stimulus.]

4. Use the August Lemonade Sales from Item 3 to complete this task.

Create a picture graph that shows the number of cups of lemonade Jaleen sold each week in August.

In the graph you may use whole and half pictures for each cup.

- First click on the key to show the scale that you will use for your graph.
- Then click on the cups to create the graph.

For this item, a full-credit response (2 points) includes:
• Student creates a graph that, when combined with the scale, shows 50 cups for week 1, 60 cups for week 2, 80 cups for week 3, and 25 cups for week 4 OR
• Student creates a graph that, when combined with the selected scale, correctly represents all 4 weeks from the table in the student’s response to item 1577.

For this item, a partial-credit response (1 point) includes:
• Student creates a graph that, when combined with the scale, shows 2 or 3 of the following: 50 cups for week 1, 60 cups for week 2, 80 cups for week 3, and 25 cups for week 4 OR
• Student creates a graph that, when combined with the selected scale, correctly represents 2 or 3 weeks from the table in the student’s response to item 1577.

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

[This culminating item should prompt students to go back and check for errors as it will signal that something may be wrong with earlier work.]