SECTION 1

Standards and Activities for Grade 3

Operations and Algebraic Thinking: 3.OA.1

"Represent and solve problems involving multiplication and division."

1. "Interpret products of whole numbers, e.g., interpret 5×7 as the total number of objects in 5 groups of 7 objects each."

BACKGROUND

When items in equal-sized groups are combined, multiplication can be used to find the total number of items. For example, hamburger rolls are sold in packages of 8 rolls. If 3 bags are purchased, you can multiply to find the total number of rolls. Three packages (groups) of 8 rolls can be expressed as 3×8. The product is 24 rolls. Note also that $8 \times 3 = 24$, but in this case there are 8 groups of 3 items per group.

ACTIVITY: COMBINING GROUPS

Working in pairs or groups of three, students will generate ways that groups of items can be represented in real-world situations. They will then draw an illustration of the groups and write a description and a related multiplication sentence.

MATERIALS

Drawing paper; crayons; colored pencils for each pair or group of students.

PROCEDURE

1. Ask your students to think about the ways things are grouped so that each group has the same number of items. Present the example of the hamburger rolls that was provided in the Background section. You may suggest other examples, such as sports (the number of starting players per team), board games (4 cards per person), shopping (6 cupcakes per package), school (5 books per student), and so on. Encourage your students to brainstorm other possible groups.
2. Explain that students are to select an equal-sized group and then decide the number of groups they wish to represent. They are to draw a picture that illustrates their groups. For example, if they chose the packages of hamburger rolls, as noted in the Background section, they would draw 3 packages of hamburger rolls with 8 rolls per package.
3. Explain that after they complete their drawings, they are to write a description of their groups and a multiplication sentence.

CLOSURE

Discuss and display students' drawings, descriptions, and multiplication sentences.

Operations and Algebraic Thinking: 3.OA.2

"Represent and solve problems involving multiplication and division."

2. "Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 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."

BACKGROUND

Division is the process of separating a quantity into equal groups. It is the inverse (opposite) of multiplication, which is the process of combining equal groups.

ACTIVITY: BREAKING INTO GROUPS

Working in pairs or groups of three, students will find the number of groups that can be formed from a class of 30 students. They will represent their groups on graph paper.

MATERIALS

Two to three sheets of graph paper; 30 counters for each pair or group of students.

PROCEDURE

1. Present this situation to your class: Mr. Smith has a class of 30 students. How many different-sized groups can he form?
2. Explain that because Mr. Smith's class has 30 students, 1 counter represents 1 student.
3. Instruct your students to divide their counters into equal groups to represent the students of Mr. Smith's class. They must find how many groups are possible and then sketch the groups on graph paper. Finally, have students write division sentences that represent their sketches.

CLOSURE

Discuss your students' answers.

ANSWERS

1 group of 30; 2 groups of 15; 3 groups of 10; 5 groups of 6; 6 groups of 5; 10 groups of 3; 15 groups of 2; 30 "groups" of 1

Operations and Algebraic Thinking: 3.OA.3

"Represent and solve problems involving multiplication and division."

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."

BACKGROUND

Diagrams and equations may be used with the operations of multiplication and division to solve word problems. Letters are commonly used to represent unknown numbers in equations.

ACTIVITY: IT'S A MATCH

Working in groups, students will match word problems with equations, diagrams, and answers.

MATERIALS

Scissors; one copy of reproducibles, "Matchings, I" and "Matchings, II," for each group of students.

PROCEDURE

1. Explain that word problems involving multiplication and division can be solved by using equations or diagrams. In equations, symbols may be used to represent unknown numbers. For example, in the problem $3 \times 5 = n$, n represents the product of 3×5, which is 15.
2. Distribute copies of the reproducibles. Explain that together the reproducibles contain 24 boxes that have word problems (boxes 1–8), equations or diagrams (boxes 9–16), and answers (boxes 17–24).
3. Explain that students are to cut out each box.
4. Instruct students to start with problem 1. They should find the equation or diagram that matches the problem. Next they should find the answer that matches the problem. Students should continue in the same manner, matching equations, diagrams, and answers for problems 2, 3, and so on. They should place each set of correct "matchings" in separate piles.

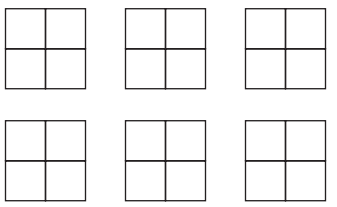
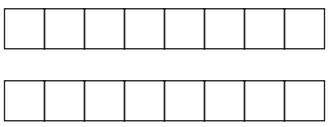
CLOSURE

Discuss students' results.

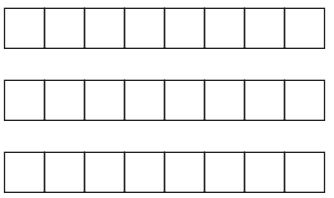
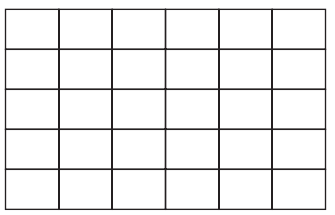
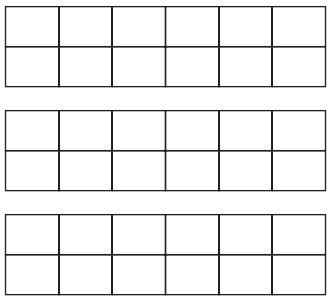
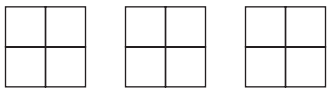
ANSWERS

The card number of the problem, equation or diagram, and answer are listed in order:
1, 12, 23; 2, 13, 18; 3, 15, 19; 4, 14, 17; 5, 10, 20; 6, 11, 24; 7, 16, 22; 8, 9, 21

MATCHINGS, I

1. Mike played video games for 20 hours last week. This was twice as long as he is allowed to play in one week. How long is he allowed to play?	9. $2 \times 24 = n$	17. $n = 5$
2. 24 students in the chorus are to stand on a stage. There are 8 students in a row. How many rows are needed?	10. 	18. $n = 3$
3. Sam bought 3 cartons of eggs. Each carton had 12 eggs. How many eggs did he buy?	11. 	19. $n = 36$
4. There are 30 desks in a classroom. 6 desks are in each row. How many rows of desks are there?	12. $2 \times n = 20$ and $20 \div 2 = n$	20. $n = 6$

MATCHINGS, II

5. 24 students are going on a trip. Parents will be driving them. There is room for 4 students in each car. How many cars are needed?	13. 	21. $n = 48$
6. Mike's family filled 2 rows of seats in the stadium. Each row has 8 seats. How many of Mike's family attended the game?	14. 	22. $n = 4$
7. 12 cookies are to be placed in 3 boxes. How many cookies are in each box?	15. 	23. $n = 10$
8. Jane earned \$24. A pair of shoes that she wants costs twice what she earned. What is the cost of the shoes?	16. 	24. $n = 16$

Operations and Algebraic Thinking: 3.OA.4

"Represent and solve problems involving multiplication and division."

4. "Determine the unknown whole number in a multiplication or division equation relating three whole numbers."

BACKGROUND

To find the missing number in a multiplication or division equation, students should know their basic facts. For example, knowing that $4 \times 3 = 12$ is necessary to find the missing number in equations such as $12 \div ? = 3$ and $12 \div ? = 4$.

ACTIVITY: EQUATION TIC-TAC-TOE

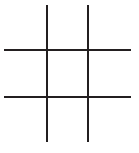
In a twist on the traditional game of tic-tac-toe, students will complete tic-tac-toe boards by randomly choosing and writing nine numbers from 1 to 50 on their boards. After the boards are completed, the teacher presents an equation to the class. If the answer to the equation is on a student's board, the student writes an X over it. The first person who gets three Xs in a row or along a diagonal wins. If no student gets three Xs in a row or along a diagonal, the student who has the most Xs after completing all of the equations is the winner.

MATERIALS

One sheet of unlined paper for each student.

PROCEDURE

1. Explain that students will play equation tic-tac-toe, but note that this is a little different from the standard game of tic-tac-toe. In this game, each student has his or her own board and everyone plays against everyone else at the same time.
2. Distribute the paper. (If you are considering playing more than one round, you might have your students fold their papers in half from top to bottom. Using the front and back of the paper results in four regions, each of which can easily accommodate one tic-tac-toe board. It is likely that you will need to create more equations to play more games.) Instruct your students to draw a tic-tac-toe board on (each region of) their papers as shown.



3. Explain to your students that they are to select any nine numbers from the numbers 1 through 50 and write one number in each space on the tic-tac-toe board. Note that they cannot use any number more than once.
4. Explain that you will present an equation. Students who have the answer on their boards should place an X over the number. There are two ways to win. The first student to get three Xs in a row or along a diagonal wins. If all of the equations have been presented, and no one has three Xs in a row, the student with the most Xs on his or her board is the winner.
5. Begin the game. Present the first equation from the Equation Bank, and continue until someone wins or all of the equations have been used.

CLOSURE

Review the answers after each game to verify the winner. Create equations of your own to play additional games.

Equation Bank

Problem	Answer	Problem	Answer	Problem	Answer
1. $5 \times 5 = ?$	25	11. $? \div 4 = 4$	16	21. $6 \times 4 = ?$	24
2. $8 \times 6 = ?$	48	12. $72 \div 8 = ?$	9	22. $9 \times 5 = ?$	45
3. $? \div 5 = 10$	50	13. $4 \times 7 = ?$	28	23. $? \div 6 = 6$	36
4. $8 \times 4 = ?$	32	14. $? \div 9 = 3$	27	24. $4 \times 5 = ?$	20
5. $? \div 3 = 4$	12	15. $56 \div 7 = ?$	8	25. $? \div 10 = 4$	40
6. $54 \div 9 = ?$	6	16. $16 \div 8 = ?$	2	26. $63 \div 9 = ?$	7
7. $2 \times 9 = ?$	18	17. $3 \times 7 = ?$	21	27. $30 \div 6 = ?$	5
8. $3 \times 10 = ?$	30	18. $36 \div 9 = ?$	4	28. $7 \times 5 = ?$	35
9. $24 \div 8 = ?$	3	19. $2 \times 5 = ?$	10	29. $2 \times 7 = ?$	14
10. $? \div 3 = 5$	15	20. $7 \times 6 = ?$	42	30. $? \div 7 = 7$	49

Operations and Algebraic Thinking: 3.OA.5

"Understand properties of multiplication and the relationship between multiplication and division."

5. "Apply properties of operations as strategies to multiply and divide."

BACKGROUND

Applying mathematical properties can help students compute by changing the order of factors, grouping factors, and expressing a factor as the sum of two numbers.

- The commutative property of multiplication, $a \times b = b \times a$, states that the order of multiplying two factors does not affect their product.
- The associative property of multiplication, $a \times (b \times c) = (a \times b) \times c$, states that the order of grouping factors does not affect their product.
- The distributive property, $a \times (b + c) = a \times b + a \times c$, states that the product of a factor and a sum is equal to multiplying each addend in the sum by the factor and then adding the products.

Although students need not know the names of these properties to complete this activity, an intuitive grasp of the properties will be helpful.

ACTIVITY: APPLYING PROPERTIES

Working in pairs or groups of three, students will apply properties of operations to complete math equations.

MATERIALS

Scissors; one copy of reproducible, "Fact Cards," for each pair or group of students.

PROCEDURE

1. Hand out copies of the reproducible. Explain to your students that the reproducible contains 20 fact cards. Each card is equivalent to 1 of 4 different values.
2. Explain that students are to cut out the cards. They are then to place each card with the other cards that have the same value. (*Note:* They should finish with four sets of cards, though not all sets will have the same number of cards.)

CLOSURE

Check students' results. Ask your students to share strategies they used to arrange their cards correctly. Emphasize that problems can often be solved in different ways.

ANSWERS

Cards that equal 60: 1, 6, 14, 17, 18, and 20.
Cards that equal 40: 2, 7, 9, 15, and 19.
Cards that equal 27: 3, 12, and 16.
Cards that equal 24: 4, 5, 8, 10, 11, and 13.

FACT CARDS

1. $6 \times (2 \times 5)$	2. 4×10	3. 9×3	4. $2 \times (8 + 4)$
5. 8×3	6. $6 \times (3 + 7)$	7. $(4 \times 2) \times 5$	8. 4×6
9. 8×5	10. $4 \times (5 + 1)$	11. $(3 \times 2) \times 4$	12. $3 \times (7 + 2)$
13. 6×4	14. $6 \times (7 + 3)$	15. $(2 \times 4) \times 5$	16. 3×9
17. $4 \times (8 + 7)$	18. $3 \times (10 + 10)$	19. $4 \times (8 + 2)$	20. 6×10

Operations and Algebraic Thinking: 3.OA.6

"Understand properties of multiplication and the relationship between multiplication and division."

6. "Understand division as an unknown-factor problem."

BACKGROUND

Since division and multiplication are inverse operations, every division problem has a related multiplication problem.

For example, $18 \div 3 = ?$ can be posed as "3 times what number is 18?" Students can solve this problem by finding the missing factor of 18. $3 \times ? = 18$ The missing factor is 6.

ACTIVITY: NUMBER SCRAMBLE

Working in pairs or groups of three, students will be given a division problem. They will find the number that completes a multiplication sentence and then find the missing factor.

MATERIALS

Scissors; glue sticks; one copy of reproducibles, "Multiplication, Division, and Factors, I" and "Multiplication, Division, and Factors, II," for each pair or group of students.

PROCEDURE

1. Hand out copies of the reproducibles. Note that "Multiplication, Division, and Factors, I" contains six rows (1 through 6) and that "Multiplication, Division, and Factors, II" contains four rows (7–10). Each row is divided into three parts. The first part contains a division problem. The second part contains a related multiplication sentence that students must complete. The third part contains the answer to the multiplication sentence, which students must provide. Following row 10 is a Number Bank.
2. Explain that students are to cut out the numbers in the Number Bank. They are to glue the correct numbers in the boxes to complete the multiplication sentences. They are also to glue the correct numbers in the boxes for the answers to the multiplication sentences. Note that each multiplication sentence is related to the division problem in its row.

CLOSURE

Discuss students' results. While still working in pairs or groups, for more practice, ask your students to write a division problem for their partners. Their partner should then write a related multiplication sentence.

ANSWERS

The missing numbers in each row follow: (**1**) 5, 5, 25; (**2**) 6, 4, 24; (**3**) 3, 2, 6; (**4**) 3, 3, 9; (**5**) 2, 4, 8; (**6**) 8, 5, 40; (**7**) 3, 9, 27; (**8**) 5, 6, 30; (**9**) 8, 3, 24; (**10**) 6, 9, 54

MULTIPLICATION, DIVISION, AND FACTORS, I

Division	Multiplication Sentence	Answer
1. 25 ÷ 5	☐ times ☐ is	☐
2. 24 ÷ 6	☐ times ☐ is	☐
3. 6 ÷ 3	☐ times ☐ is	☐
4. 9 ÷ 3	☐ times ☐ is	☐
5. 8 ÷ 2	☐ times ☐ is	☐
6. 40 ÷ 8	☐ times ☐ is	☐

MULTIPLICATION, DIVISION, AND FACTORS, II

Division	Multiplication Sentence					Answer
7. 27 ÷ 3		times		is		
8. 30 ÷ 5		times		is		
9. 24 ÷ 8		times		is		
10. 54 ÷ 6		times		is		

Number Bank					
2	2	3	3	3	3
3	4	4	5	5	5
5	6	6	6	6	8
8	8	9	9	9	24
24	25	27	30	40	54

Operations and Algebraic Thinking: 3.OA.7

"Multiply and divide within 100."

> 7. "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 that $40 \div 5 = 8$) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers."

BACKGROUND

The first step to mastering multiplication and division is to understand how these operations are related. The next step is to be able to multiply and divide quickly and accurately all products of two one-digit numbers. This is achieved through practice and memorization.

ACTIVITY: MULTIPLICATION AND DIVISION BINGO

Students will create a math bingo board by placing numbers from a Number Bank in each square on the board. The teacher will call out multiplication and division problems. If the answer is on the student's board, the student will cover the square with a counter. The first student to cover the squares in a row, column, or diagonal is the winner.

MATERIALS

24 1-inch diameter (or smaller) counters; reproducible, "Multiplication and Division Bingo," for each student. Optional: One copy of reproducible, "Problem Bank for Multiplication and Division Bingo," for the teacher.

PROCEDURE

1. Hand out copies of the bingo boards. Explain that there is a Number Bank below the board.
2. Explain that students should randomly fill in each square on their board with a number from the Number Bank. They should not fill in the free space with a number. As they fill in a number, suggest that they cross out the number in the Number Bank so that they will not use the same number twice. Note that some numbers will not be used.
3. Explain the rules of the game. You will call out a multiplication or division problem from the "Problem Bank for Multiplication and Division Bingo." (*Note:* The answers are written in parentheses after the problems.) Students who find the answer to the problem on their boards should place a counter on the number. (*Note:* Having students use counters to

place on numbers allows you to use the same bingo board for additional games.) After presenting a problem, place a check beside the problems you use on the Problem Bank so that you do not use the problem again. Continue calling out problems until a student gets bingo.

4. Check the answers the student has covered on his bingo board to make sure he is correct.

CLOSURE

Announce the correct answers and review any problems that students found confusing.

MULTIPLICATION AND DIVISION BINGO

		Free Space		

Number Bank

1	2	3	4	5	6	7
8	9	10	12	14	15	16
18	20	21	24	25	27	28
30	32	35	36	40	42	45
48	49	50	54	56	60	63
64	70	72	80	81	90	100

PROBLEM BANK FOR MULTIPLICATION AND DIVISION BINGO

6×4 (24)	4×8 (32)	9×9 (81)
$24 \div 3$ (8)	7×6 (42)	$60 \div 10$ (6)
2×5 (10)	9×10 (90)	6×3 (18)
9×8 (72)	$18 \div 9$ (2)	8×7 (56)
1×1 (1)	6×9 (54)	10×3 (30)
7×3 (21)	8×5 (40)	$9 \div 3$ (3)
8×6 (48)	7×7 (49)	6×10 (60)
$7 \div 1$ (7)	$36 \div 4$ (9)	6×2 (12)
2×8 (16)	8×8 (64)	5×5 (25)
$8 \div 2$ (4)	$30 \div 6$ (5)	7×10 (70)
5×9 (45)	10×10 (100)	6×6 (36)
4×5 (20)	3×5 (15)	9×3 (27)
9×7 (63)	5×10 (50)	7×5 (35)
7×2 (14)	7×4 (28)	8×10 (80)

Operations and Algebraic Thinking: 3.OA.8

"Solve problems involving the four operations, and identify and explain patterns in arithmetic."

8. "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."

BACKGROUND

Solving two-step word problems requires several steps:

1. Read the problem carefully.
2. Identify what you are to find.
3. Decide what information to use.
4. Write an equation using a letter to stand for the unknown quantity.
5. Solve the equation.
6. Check to see if your answer makes sense.

ACTIVITY: WHICH EQUATION?

Working in pairs or groups of three, students will choose an equation that can be used to solve word problems. They will then solve the problem.

MATERIALS

Reproducible, "Two-Step Word Problems," for each pair or group of students.

PROCEDURE

1. Review the steps for writing and solving two-step word problems that were presented in the Background of this activity.
2. Hand out copies of the reproducible. Explain that it contains five word problems, each of which is followed by two equations. Students are to select the equation that can be used to solve the problem. They must then solve the problem.
3. Depending on the abilities of your students, you might find it helpful to do the first problem together as a class.

4. Emphasize that after students have selected the correct equation and solved a problem, they must consider whether their answer makes sense by using estimation or mental math. For example, imagine an answer to a problem that the cost of a school lunch is \$175. This is unlikely. A probable mistake here is omission of a decimal point that would make a correct (and reasonable) answer of \$1.75.

CLOSURE

Discuss the answers to the problems, including students' assessments of the reasonableness of their answers. Ask how they determined if an answer made sense.

ANSWERS

The correct equations are listed, followed by their solution. (**1**) $27 \div 9 + 4 = n$; $n = 7$; (**2**) $5 \times 3 - 14 = n$; $n = 1$; (**3**) $6 \times n = 54 - 12$; $n = 7$ (**4**) $7 \times 4 + 6 = n$; $n = 34$; (**5**) $6 \times 4 - 20 = n$; $n = 4$

Name _____ Date _____

TWO-STEP WORD PROBLEMS

Directions: Choose the equation, or equations, that describe each problem. Solve the problem. Decide if your answer is reasonable.

1. Mason has 27 new coins to add to his collection. He will put them in a coin album. Each page holds 9 coins. He already has 4 full pages of coins. After he puts the new coins in his album, how many full pages will he have? *n* stands for the total number of pages.

   $27 \div 9 = 4 - n$ $\qquad$ $27 \div 9 + 4 = n$

2. Mrs. Sanchez plans to hand out markers to 5 groups of students. She wants each group to have 3 markers. She has 14 markers. How many more markers does she need? *n* stands for the number of additional markers.

   $5 \times 3 - 14 = n$ $\qquad$ $14 = 5 \times 3 + n$

3. Audrey is paid $6 a week for walking Ruffles, Mrs. Hanson's dog. Audrey needs $54 to buy her brother a birthday present. She has already earned $12. How many more weeks must she walk Ruffles so that she has enough money to buy the gift? *n* stands for the number of weeks she must work.

   $54 \div 6 = 12 - n$ $\qquad$ $6 \times n = 54 - 12$

4. Sal is decorating 8 cupcakes. He places 6 candies on one of the cupcakes. He places 4 candies on the other 7 cupcakes. How many candies will he need? *n* stands for the number of candies he needs.

   $4 \times n + 6 = 34$ $\qquad$ $7 \times 4 + 6 = n$

5. Carla is taking 4 packages of soda to a family picnic. Each package has 6 cans. 20 people are at the picnic. Each person drinks one can of soda. How many cans will be left over? *n* stands for the number of soda cans left over.

   $6 \times 4 - 20 = n$ $\qquad$ $20 \times 4 + 6 = n$

Operations and Algebraic Thinking: 3.OA.9

"Solve problems involving the four operations, and identify and explain patterns in arithmetic."

9. "Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations."

BACKGROUND

Patterns abound in mathematics. Multiples present students with a variety of patterns. Some are noted below:

- All multiples of 2, 4, 6, 8, and 10 are even.
- Every multiple of 4, 6, 8, and 10 is a multiple of 2.
- Every multiple of 6 and 9 is a multiple of 3.
- Every multiple of 10 is a multiple of 5.

ACTIVITY: COLOR THE MULTIPLES

Students will color the multiples of a number assigned to them on a multiplication table. They will describe a pattern they see and explain it using properties of operations.

MATERIALS

Colored pencils; crayons; reproducible, "Multiplication Table," for each student.

PROCEDURE

1. Assign each student a number from 2 to 10. (More than one student may work with the same number.)
2. Distribute copies of the reproducible. Explain that students who have "2" are to color the multiples of 2 on their multiplication table. Students who have "3" are to color the multiples of 3 on their multiplication table. Other students are to similarly color the multiples of their numbers on the multiplication table.
3. Explain that when students are done coloring their multiples, they are to explain a pattern that they find.

CLOSURE

Ask for volunteers to share the numbers they colored. Discuss what patterns they found. Note any different patterns for the same numbers.

ANSWERS

The patterns students find may vary; some include the following: All multiples of 2 are even numbers. Multiples of 3 may be odd or even. All multiples of 4 are even numbers. All multiples of 5 end in 0 or 5. All multiples of 6 are even numbers. Multiples of 7 may be odd or even. All multiples of 8 are even numbers. Multiples of 9 may be odd or even. All multiples of 10 end in 0.

Name _____ Date _____

MULTIPLICATION TABLE

X	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

Number and Operations in Base Ten: 3.NBT.1

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

1. "Use place value understanding to round whole numbers to the nearest 10 or 100."

BACKGROUND

Rounding is an important skill in mathematics. To round numbers, students must understand place value.

When rounding to the nearest 10, students must look to the digit in the ones place. If the digit is 5 or more, students must round up to the nearest 10. If the digit is 4 or less, they must round down to the nearest 10. For example, 25 is rounded to 30, but 24 is rounded to 20.

When rounding to the nearest 100, students must look to the digit in the tens place. If the digit is 5 or more, they must round up to the nearest 100. If the digit is 4 or less, they must round down to the nearest 100. For example, 855 is rounded to 900, but 845 is rounded to 800.

ACTIVITY: IT'S AROUND ...

Working in pairs or groups of three, students will round numbers to the nearest 10 and nearest 100.

MATERIALS

Reproducible, "Rounding Numbers," for each pair or group of students.

PROCEDURE

1. Distribute copies of the reproducible. Explain that there are two large boxes on the right side of the page. The first contains the numbers 0, 10, 20, 30, 40, 50, and 60. The second contains the numbers 100, 200, 300, 400, 500, 600, and 700. Students will be rounding to these numbers.
2. Explain that the numbers in the box on the upper left of the page are to be used with the numbers in the box immediately to their right. Students are to consider each number in the box on the upper left, and write it beside the number in the box on the right that it can be rounded to. For example, the numbers 49 and 53 (in the box on the upper left) can both be rounded to the number 50 (in the box directly to the right). Students are to write these numbers in the space beside 50 in the box on the right.

3. Explain that the numbers in the box on the lower left of the page are to be used with the numbers in the box immediately to their right. Again, students are to consider each number in the box on the lower left, and write it beside the number in the box on the right that it can be rounded to.

CLOSURE

Correct the work as a class. Review any numbers students had difficulty rounding.

ANSWERS

0: 4; **10:** 5, 7, 11, 14; **20:** 15, 19, 24; **30:** 25, 31; **40:** 35, 44; **50:** 49, 53; **60:** 59, 62; **100:** 79, 120; **200:** 150, 189, 199, 201; **300:** 305, 349; **400:** 370, 410, 449; **500:** 499; **600:** 554, 628; **700:** 705, 745

Name _____ Date _____

ROUNDING NUMBERS

Look at each number in the small box below. Write each number in the large box beside the number it can be rounded to.

24	5	53	25
35	44	19	31
59	62	49	4
11	7	14	15

0	
10	
20	
30	
40	
50	
60	

Look at each number in the small box below. Write each number in the large box beside the number it can be rounded to.

120	449	628	189
745	499	150	554
79	199	705	305
349	201	370	410

100	
200	
300	
400	
500	
600	
700	

Number and Operations in Base Ten: 3.NBT.2

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

2. "Fluently add and subtract within 1,000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction."

BACKGROUND

Addition and subtraction problems involving two- and three-digit numbers can be classified in two groups: those problems that do not require regrouping and those that do. You may find it helpful to demonstrate and reinforce the meaning of addition and subtraction, especially the concept of regrouping, through modeling with base-10 blocks.

ACTIVITY 1: HELPING ZERO FIND A PLACE

The teacher will read the story *A Place for Zero: A Math Adventure* to the class. Students are to listen to the story, and then write a letter to Zero, explaining how he is important to the other digits.

MATERIALS

One copy of *A Place for Zero: A Math Adventure* by Angeline Sparagna LoPresti (Charlesbridge Publishing, 2003) for the teacher.

PROCEDURE

1. Read the story *A Place for Zero: A Math Adventure* to your students. The story is about Zero, who feels different from his other digit friends because he believes he has nothing to add.
2. After reading the story, discuss why Zero feels that he is different.
3. Ask your students to imagine that they are a digit, one of Zero's friends. They are to write a letter to Zero, explaining why he is important not only to them but also to addition and subtraction.

CLOSURE

Ask for volunteers to read their letters to Zero. You may also want to display the letters of your students.

ACTIVITY 2: FINDING SUMS AND DIFFERENCES

Students will add or subtract two- and three-digit numbers within 1,000.

MATERIALS

Reproducible, "Problem Grid"; a copy of an appropriate problem group (see Preparation) for each student; scissors; reproducible, "Problem Groups," for the teacher.

PREPARATION

The reproducible, "Problem Groups," is divided into three parts: Group 1, Group 2, and Group 3. Group 1 contains addition and subtraction problems that do not require regrouping. Group 2 contains addition and subtraction problems that require regrouping. Group 3 contains a variety of addition and subtraction problems, some that require regrouping and some that do not. Make a copy of the reproducible, select the skills you want your students to work with, and cut out the appropriate problems, which may be Group 1, Group 2, or Group 3. Make enough copies of this group so that each student will receive a copy.

PROCEDURE

1. Hand out the copies of the "Problem Grid" to your students. Also hand out the copies of the problem group you selected.
2. Explain that each row on the "Problem Grid" has an answer. Following the answer are four blank squares.
3. Explain that students should find each sum or difference on their problem group. They are then to write the problem number and the problem in the square in each row that contains the answer to the problem. Note that different problems will have the same answer. Also note that not all squares on the "Problem Grid" will be filled.

CLOSURE

Review students' results and discuss any problems that your students found troublesome.

ANSWERS

Groups, answers, and problem numbers are provided. Group 1: **241:** 5, 8, 15; **526:** 6, 10, 13; **854:** 3, 4, 7; **371:** 1, 9 12, 14; **604:** 2, 11; Group 2: **241:** 11, 14; **526:** 4, 7, 10, 15; **854:** 1, 9, 12, 13; **371:** 2, 5; **604:** 3, 6, 8; Group 3: **241:** 5, 11, 15; **526:** 2, 4, 8, 13; **854:** 1, 7, 14; **371:** 3, 9; **604:** 6, 10, 12

Name _____ Date _____

PROBLEM GRID

Answer	Problems			
241				
526				
854				
371				
604				

PROBLEM GROUPS

Group 1

1. 599 – 228	2. 503 + 101	3. 976 – 122	4. 430 + 424	5. 211 + 30
6. 501 + 25	7. 421 + 433	8. 767 – 526	9. 995 – 624	10. 668 – 142
11. 905 – 301	12. 240 + 131	13. 206 + 320	14. 872 – 501	15. 130 + 111

Group 2

1. 359 + 495	2. 627 – 256	3. 409 + 195	4. 945 – 419	5. 189 + 182
6. 901 – 297	7. 309 + 217	8. 478 + 126	9. 369 + 485	10. 923 – 397
11. 608 – 367	12. 961 – 107	13. 960 – 106	14. 114 + 127	15. 552 – 26

Group 3

1. 343 + 511	2. 114 + 412	3. 209 + 162	4. 804 – 278	5. 328 – 87
6. 909 – 305	7. 981 – 127	8. 404 + 122	9. 486 – 115	10. 206 + 398
11. 567 – 326	12. 299 + 305	13. 923 – 397	14. 976 – 122	15. 118 + 123

Number and Operations in Base Ten: 3.NBT.3

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

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."

BACKGROUND

Knowledge of the products of two one-digit numbers makes multiplication of multiples of 10 by one-digit whole numbers a simple process.

For example, 3×20 can easily be found if students know that $3 \times 2 = 6$. They can use a shortcut to find the product by adding a zero in the ones place. Be sure, however, that your students understand why the shortcut can be used. For example, modeling problems such as 3 groups of 20 and finding the sum can help them understand why $3 \times 20 = 60$.

ACTIVITY: WHAT DOES IT EQUAL?

Students will work individually or in pairs for this activity. They will be given a slip of paper that contains a product and a multiplication problem. They will identify the product, based on the problem.

MATERIALS

One copy of reproducible, "Products and Problems," for the class and one copy for the teacher; scissors for the teacher.

PREPARATION

After making two copies of the reproducible, cut out each two-part box from one copy so that you have a total of 21 slips of paper. (Each student or pair of students will receive one slip.) Keep the other copy of the reproducible to refer to during the activity. Note that the slips are arranged in order, each providing the correct answer to the multiplication problem written on the preceding slip. The first answer, "It equals 80," is the answer to the last problem on the reproducible.

PROCEDURE

1. Before passing out the 21 slips of paper to your students, mix the slips up.
2. Hand out one slip of paper to each student (or a slip to a pair of students). For a small class, you may give some students two slips. You must distribute all 21 slips.
3. To start, choose a student to read the problem written on the right side of his or her slip. If necessary, have the student read the problem twice. All students should check their slips to see if the slips contain the product. Because of the way the slips are designed, only one will contain the correct product. The student who has the slip with the correct product should say "It equals … " and then provide the answer. If the student is correct, he then reads the question written on the right side of his slip. If he is incorrect, point out his error. Another student should then provide the correct product from the left side of her own slip.
4. Continue the process until the student who read the first question has the correct response to the last question.

CLOSURE

Discuss the activity. Ask your students to explain how knowing the basic multiplication facts helped them multiply whole numbers by multiples of 10.

PRODUCTS AND PROBLEMS

It equals	What does
80	9 × 40 equal?

It equals	What does
360	3 × 80 equal?

It equals	What does
240	2 × 50 equal?

It equals	What does
100	80 × 4 equal?

It equals	What does
320	2 × 30 equal?

It equals	What does
60	70 × 2 equal?

It equals	What does
140	6 × 50 equal?

It equals	What does
300	9 × 30 equal?

It equals	What does
270	6 × 30 equal?

It equals	What does
180	7 × 60 equal?

It equals	What does
420	5 × 80 equal?

It equals	What does
400	9 × 60 equal?

It equals	What does
540	7 × 90 equal?

It equals	What does
630	6 × 80 equal?

It equals	What does
480	4 × 10 equal?

It equals	What does
40	7 × 80 equal?

It equals	What does
560	5 × 70 equal?

It equals	What does
350	8 × 90 equal?

It equals	What does
720	3 × 40 equal?

It equals	What does
120	7 × 40 equal?

It equals	What does
280	8 × 10 equal?

Number and Operations—Fractions: 3.NF.1

"Develop understanding of fractions as numbers."

1. "Understand a fraction $\frac{1}{b}$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction $\frac{a}{b}$ as the quantity formed by a parts of size $\frac{1}{b}$."

BACKGROUND

If a quantity is divided into the same number, n, of equal parts, each part is $\frac{1}{n}$ of the total. For example, if a quantity is divided into 4 equal parts, each part is $\frac{1}{4}$ of the original.

ACTIVITY: MAKING FRACTION BARS

Students will make fraction bars, showing what part each fraction bar is of 1 whole. Because this Domain is limited to fractions with denominators of 2, 3, 4, 6, and 8, students will make fraction bars representing 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, and $\frac{1}{8}$.

MATERIALS

Scissors; rulers; unlined $8\frac{1}{2}$-by-11-inch paper for each student.

PROCEDURE

1. Explain to your students that they are to cut six 1-inch-by-10-inch strips of paper from their unlined paper. (Demonstrate what students should do.) A practical way to do this is to cut off a 1-inch-by-$8\frac{1}{2}$-inch strip from the top of the paper, leaving an $8\frac{1}{2}$-inch-by-10-inch piece of paper. Next, students should cut a $2\frac{1}{2}$-inch-by-10-inch strip off one of the sides of the paper, leaving a 6-inch-by-10-inch piece of paper. Students should discard the strips of paper they cut off. (*Note:* Depending on the abilities of your students, you may prefer to use a paper cutter and hand out precut 6-inch-by-10-inch sheets and then allow students to cut the paper into the necessary strips.)
2. Instruct your students to place their paper so that it measures 10 inches along the top and 6 inches along the side. They should mark points at 1-inch intervals along each side, and then draw lines connecting each pair of points. Next they should cut along each line, resulting in six 1-inch-by-10-inch strips.
3. Tell your students to label one strip *1 whole*.

4. Instruct them to take another strip. They should fold it in half, open the strip, and then write $\frac{1}{2}$ on each part of the strip.
5. Instruct your students to take another strip. They should fold this strip in half, then fold it in half again. After opening the strip, they should label each part $\frac{1}{4}$.
6. Instruct your students to take another strip. They should fold this strip in half, fold it in half again, and fold it in half once more. After opening the strip, they should label each part $\frac{1}{8}$.
7. Instruct them to take another strip. They are to fold this strip in thirds. After opening the strip, they should label each part $\frac{1}{3}$.
8. Instruct your students to take the final strip. They are to fold this strip in thirds, then fold it in half. After opening the strip, they should label each part $\frac{1}{6}$.
9. Using these strips, ask your students questions such as the following:
   - What strips represent $\frac{2}{3}$? (Answer: Two parts of the $\frac{1}{3}$ strip or four parts of the $\frac{1}{6}$ strip)
   - What strips represent $\frac{1}{4}$? (Answer: One part of the $\frac{1}{4}$ strip or two parts of the $\frac{1}{8}$ strip)
   - What strips represent 1 whole? (Answer: Two $\frac{1}{2}$, three $\frac{1}{3}$, four $\frac{1}{4}$, six $\frac{1}{6}$, or eight $\frac{1}{8}$ parts or one *1 whole* strip)

CLOSURE

Ask your students to explain how fraction bars help them to understand fractions.

Number and Operations—Fractions: 3.NF.2

"Develop understanding of fractions as numbers."

2. "Understand a fraction as a number on the number line; represent fractions on a number line diagram.

a. "Represent a fraction $\frac{1}{b}$ 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 $\frac{1}{b}$ and that the endpoint of the part based at 0 locates the number $\frac{1}{b}$ on the number line.

b. "Represent a fraction $\frac{a}{b}$ on a number line diagram by marking off a lengths $\frac{1}{b}$ from 0. Recognize that the resulting interval has size $\frac{a}{b}$ and that its endpoint locates the number $\frac{a}{b}$ on the number line."

BACKGROUND

Every fraction can be represented on a number line by marking off equal parts (represented by the denominator of the fraction) and counting off the number of equal parts (represented by the numerator of the fraction).

For example, to locate $\frac{3}{4}$ on a number line, divide the portion of the number line from 0 to 1 into 4 equal intervals. Then, from 0, count 3 of these intervals and place a dot on the line. Note that the fourth interval is $\frac{4}{4}$, which is the same as 1.

ACTIVITY: PLACING FRACTIONS ON THE NUMBER LINE

Working at a Web site, students will move a cursor along a virtual number line to represent fractions.

MATERIALS

Computers with Internet access for students; computer and digital projector for the teacher.

PROCEDURE

1. Instruct your students to go to www.mathisfun.com/numbers/fraction-number-line.html where they will find a virtual number line that ranges from 0 to 1.
2. Demonstrate how students can locate fractions on the number line. Start at 0 and move the cursor along the number line at the top, stopping at 1 whole. The values of fractions will be displayed. Point out the intervals on the number line and how they correspond

to the values of the fractions. Note that the vertical line that highlights the fraction also highlights equivalent fractions.

3. Instruct your students to locate $\frac{1}{4}$, $\frac{1}{2}$, $\frac{4}{6}$, and $\frac{7}{8}$ on the number line. Give them a chance to locate the fractions, then locate them yourself so that students can see if they are correct.

CLOSURE

Discuss the activity. Ask questions such as the following: What other values are the same as $\frac{1}{2}$? $\left(\text{Answer: } \frac{2}{4}, \frac{3}{6}, \frac{4}{8}\right)$ What other values are the same as $\frac{4}{6}$? $\left(\text{Answer: } \frac{2}{3}\right)$ (*Note:* The previous answers are limited to halves, thirds, fourths, sixths, and eighths, which are the focus of fractions in third grade.) Students should realize that fractions and their equivalent values can be located on the number line.

Number and Operations—Fractions: 3.NF.3

"Develop understanding of fractions as numbers."

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.
- **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."

BACKGROUND

Fractions may be expressed in many forms. Two common forms are equivalent fractions (fractions that have the same value) and whole numbers (which can be written as a fraction with 1 as the denominator).

If two fractions have the same numerator, the fraction that has the larger denominator has the smaller value. For example, $\frac{1}{3}$ is less than $\frac{1}{2}$. Given two pies of equal size, cut one into thirds and the other into halves. It is clear that a piece that is $\frac{1}{3}$ of the original pie is smaller than a piece that is $\frac{1}{2}$ of the original pie.

If two fractions have the same denominator and different numerators, the fraction with the larger numerator has the larger value. The fraction with the larger numerator represents more of the equal parts. For example, $\frac{7}{8}$ has a greater value than $\frac{5}{8}$, because 7 parts, each part being $\frac{1}{8}$, are larger than 5 parts, each being $\frac{1}{8}$.

ACTIVITY 1: SQUARES AND FRACTIONS

Working in pairs or groups of three, students will cut out four squares and arrange them so that equivalent values correspond to form a large square.

MATERIALS

Scissors; reproducible, "Four Squares," for each pair or group of students.

PROCEDURE

1. Review equivalent fractions and whole numbers expressed as fractions. For example, $\frac{1}{2} = \frac{2}{4}$ and $3 = \frac{3}{1}$.
2. Hand out copies of the reproducible and explain that students will see four squares, each of which contains fractions and a whole number.
3. Instruct your students to cut out each square.
4. Explain that they should arrange the squares so that the sides that have equivalent fractions are next to each other. Note that the numbers on the squares may not be turned upside down. Remind students that whole numbers may be written as fractions.

CLOSURE

Discuss the positions of the squares with your students.

ANSWERS

Two possible arrangements are shown below.

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

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

ACTIVITY 2: BALANCING FRACTIONS

Working at a Web site, students will virtually drag fraction bars to a scale to determine their relative size.

MATERIALS

Computers with Internet access for students; computer and digital projector for the teacher.

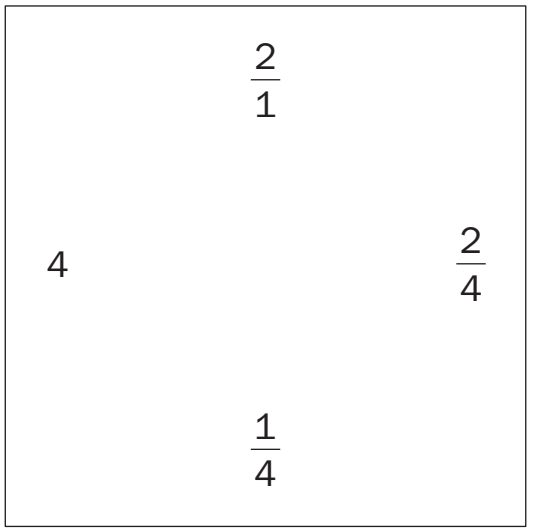
PROCEDURE

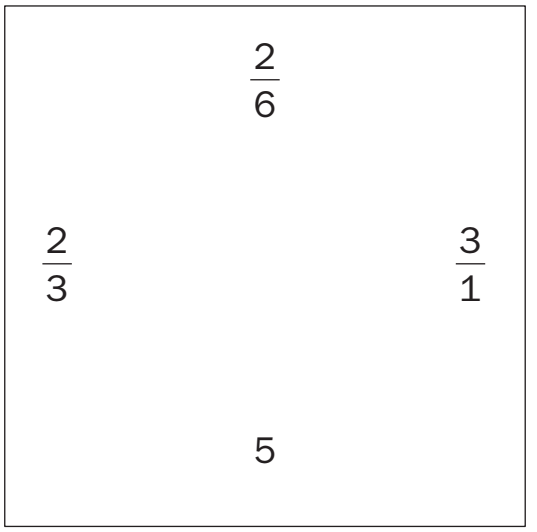
1. Instruct your students to go to http://mathplayground.com/Scale_Fractions.html. Explain that they will use a virtual balance scale to compare fractions.
2. Demonstrate how to compare fractions using the virtual balance. For example, drag $\frac{1}{2}$ to the left side of the scale and $\frac{1}{3}$ to the right. The ">" is displayed on the scale because $\frac{1}{2} > \frac{1}{3}$. Next, click "Reset." Drag five $\frac{1}{8}$ pieces to the left side of the scale and seven $\frac{1}{8}$ pieces to the right side to show that $\frac{5}{8} < \frac{7}{8}$.
3. Instruct your students to drag other fractions to the scale and write at least five comparisons. They should record their comparisons so that they can share their results with the class at the conclusion of the activity.

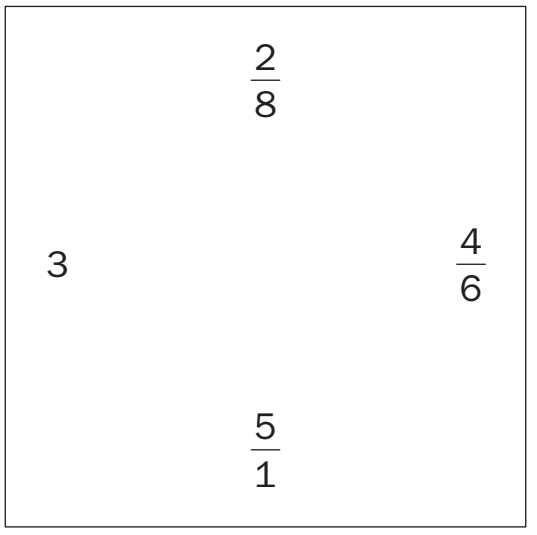
CLOSURE

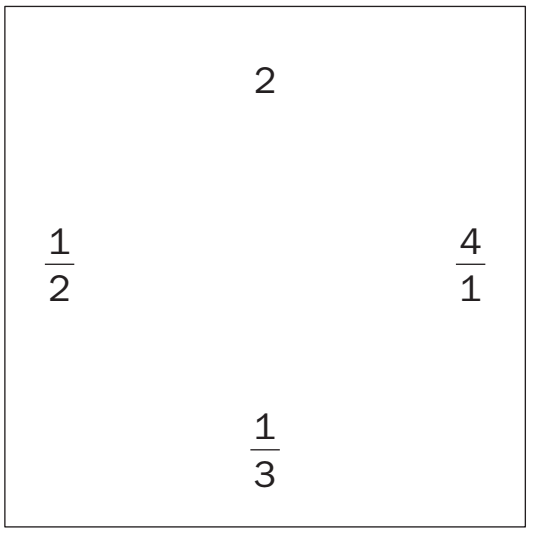
Discuss the comparisons that students made. Discuss any patterns students noticed. For example, they should notice that when the denominators are the same, the larger numerator represents the larger fraction.

FOUR SQUARES









Measurement and Data: 3.MD.1

"Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects."

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."

BACKGROUND

Telling time is an essential skill. By looking at a circular clock students can tell what time it is, what time it will be later, or what time it was a few moments ago. For example, if it is 2:15, students may count by fives to find the time in 20 minutes—2:20, 2:25, 2:30, 2:35.

ACTIVITY 1: TIME TO READ

You will read *Telling Time with Big Mama Cat* by Dan Harper to your class. Students will determine what the time is as you read about the events in the story.

MATERIALS

A copy of the book *Telling Time with Big Mama Cat* by Dan Harper (HMH Books, 1998) for the teacher.

PROCEDURE

1. Explain that you will read a story about Big Mama Cat and time. Start by showing the fold-out clock at the front of the book. Adjust the hands so that they coincide with the start of the story.
2. Read aloud. Pause as you say a time and then show the time on the clock.
3. Ask your students questions at different points in the story. For example: What time is it now?
4. Continue this procedure until you are finished reading.

CLOSURE

Note the actual time in class. Ask students: What time will it be in 10 minutes? 15 minutes? 20 minutes? 30 minutes? 45 minutes? 1 hour and a half? Include more examples if you feel it is necessary.

ACTIVITY 2: WHAT TIME IS IT?

Working at a Web site, students will find the correct time on virtual clocks.

MATERIALS

Computers with Internet access for students; computer and digital project for the teacher.

PROCEDURE

1. Instruct your students to go to http://nlvm.usu.edu/en/. They should click in the grades "3–5" column on the "Measurement" row and then scroll down and click on "Time—What Time Will It Be?" Explain that students will see two clocks and a question regarding time. The clocks have the same time. Students are to answer the question by changing the time on the second clock. (*Note:* The clocks will be either analog or digital and will randomly change with new problems.)
2. Explain that they should show the new time on the round clock by moving the hands on the second clock, or on the digital clock by clicking on the arrows below the second clock. Demonstrate how to increase or decrease the time on the clocks.
3. Explain that after students have changed the time on the second clock, they should click on "Check Answer" to see if they are right. If they are, they should click on "New Problem." If they are wrong, they should try again to find the correct time.
4. Instruct students to try several problems on their own.

CLOSURE

Ask additional questions for which students must find the correct time. For example: If a movie starts at 7:15, and you are 10 minutes late, what time did you arrive at the theater? If it is 12:35, and you have a music lesson in 45 minutes, what time is your lesson?

Measurement and Data: 3.MD.2

"Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects."

2. "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."

BACKGROUND

Common units of the metric system are grams (g) and kilograms (kg) for measuring mass, which is the amount of matter in an object, and liters (L) for measuring capacity, which is the amount a container can hold. Following are some general descriptions:

- A gram is a very small mass, about 0.035 ounce. Objects such as a paper clip or thumbtack weigh about 1 gram.
- A kilogram is equal to 1,000 grams, about 2.2 pounds. A typical textbook or a pair of sneakers weighs about a kilogram.
- A liter is equal to 1,000 milliliters, about 1.06 quarts. A glass of water is about $\frac{1}{4}$ of a liter. A common type of soda bottle contains 1 liter of soda.

ACTIVITY 1: MAKE A METRIC MONSTER

This is likely to be a two- or three-day activity. Working in groups of three or four, students will create a metric monster (figure) from common items found in the classroom or at home.

MATERIALS

A metric scale; glue sticks; scissors; construction paper; items such as boxes (for example, empty cereal boxes), cylinders (empty paper towel rolls), circles (paper plates), and also pencils, erasers, notecards, spools of threads—any items that students can estimate and weigh; reproducible, "Recording the Metric Monster Mass," for each group of students; digital camera for the teacher to photograph the metric monsters.

PREPARATION

In the days before the actual activity, encourage students to bring items from home that they will use to build their metric monsters; you may also collect a variety of items ahead of time.

(*Note:* Items should be nonbreakable, safe, and easy to manage in the classroom; for example, discourage students from bringing in glass containers.)

PROCEDURE

Day 1

1. Explain the activity to your students: They will be creating a Metric Monster out of common materials.
2. Encourage them to brainstorm what kinds of items they might use to create their Metric Monster. Students should then decide what items they need and what items each student will bring to class. (*Note:* You may want to give students a few days to bring items into class before moving on to Day 2 of the activity.)

Day 2

1. Explain that kilograms and grams are units of measurement used for measuring mass in the metric system. Mass is the amount of matter in an object. Ask your students if they can name some objects that might be measured in kilograms and grams. Offer some examples, such as those provided in the Background.
2. Hand out copies of the reproducible and explain that it contains spaces to record each item students use in making their Metric Monster. It also contains spaces for the estimated mass of each item, the actual mass of each item, and the difference between them.
3. Make sure that students have enough materials. If necessary, provide some that you brought to class.
4. Instruct students to record the name of each item they use for their Metric Monster in the first column on the reproducible. They are to estimate the weight of each item in grams or kilograms and record the estimated mass in the second column. Next they should weigh each item and record its actual mass in the third column. Finally, they are to find the difference in the values of the estimated and actual mass and record the difference in the fourth column.
5. Encourage students to create their Metric Monsters. Take pictures of their monsters and print them. (*Note:* Be sure to follow the guidelines of your school for taking pictures in class.)

Day 3

1. Distribute the pictures of students' Metric Monsters.
2. Instruct students to attach the pictures to their sheet, "Recording the Metric Monster Mass."

CLOSURE

Discuss the mass of your students' monsters. Ask questions such as the following: How did your estimates of the mass of various items compare to the actual mass of the items? Did the accuracy of your estimates improve as you found the actual mass? Why might this have been? Which monster had the greatest mass? Which had the least? How does the mass of the Metric Monster of one group compare to the mass of another group's Metric Monster? Display the "Recording the Metric Monster Mass" sheets and photos.

ACTIVITY 2: A LOT OF WATER

The teacher presents five containers partially filled with water to the class. Students will estimate the amount of water in each container. The teacher and student volunteers will verify the results by finding the capacity. Students will then write and solve word problems based on the results.

MATERIALS

Unlined paper for each student; a dark nonpermanent marker; five clear containers of various shapes and sizes, such as a milk container, water bottle, soda bottle, vase, and glass; three 1-liter beakers for the teacher.

PREPARATION

Label the containers 1 through 5 with the nonpermanent marker. Use the marker to draw a line on each container to indicate the amount of water you will pour into the container. Then fill each container to the line.

PROCEDURE

1. Explain that liters are the basic unit for measuring capacity in the metric system. Capacity is the amount a container can hold. Ask your students if they can name some items that might be measured in liters. Offer some examples, such as those provided in the Background.
2. Explain to your students that you have five containers filled with water.
3. Ask students to decide how much water, in liters, is in each container. On their sheet of unlined paper, they should sketch each container with its water level so that they have a representation of its contents. They should then record their estimates for container 1, container 2, and so on beneath their sketches.
4. After your students have recorded their estimates, find the capacity of container 1 by pouring the contents into the liter beakers. Have a student volunteer come up, read the volume, and write the amount on the board, along with the container number.

5. Ask your students to compare their estimates with the actual measurement. They should write the actual measurement next to their estimate.
6. Empty the beaker either by pouring the contents into a sink or back into its original container.
7. Follow this same procedure (Steps 3 to 5) for the next four containers.
8. Instruct your students to refer to their sketches, estimates, and the actual measurements, and write a one-step word problem involving either addition, subtraction, multiplication, or division.

CLOSURE

Ask your students how their estimates compared to the actual measurements. Who was closest? Ask for volunteers to share their problems with the class so that other students may solve the problems. Discuss the problems and their answers.

Name _____ Date _____

RECORDING THE METRIC MONSTER MASS

Item	Estimated Mass	Actual Mass	Difference
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Total Mass _____

Measurement and Data: 3.MD.3

"Represent and interpret data."

> 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."

BACKGROUND

Picture graphs and bar graphs are two very common methods of displaying data. A picture graph is a graph that uses pictures or symbols to display data. A bar graph is a graph that uses horizontal or vertical bars to display data.

ACTIVITY: PICTURE GRAPHS AND BAR GRAPHS

This activity begins with the teacher gathering data by conducting a poll of the class. Working in pairs or groups of three, students will create scaled picture graphs and bar graphs to represent the data. They will also solve problems based on the graphs.

MATERIALS

Unlined white paper; rulers; markers; crayons; colored pencils for each pair or group of students.

PREPARATION

Conduct a poll of favorites of your students. You might ask students what their favorite flavor of ice cream is (for example, chocolate, vanilla, strawberry, cherry, other); their favorite sport (baseball, football, soccer, basketball, hockey, other); their favorite type of school lunch (pizza, hamburger, hot dog, taco, pasta, other). Of course, you may choose other topics, but whichever topic you choose, limit the possible choices to 5 or 6.

PROCEDURE

1. Conduct the poll and write the data on the board.
2. Explain that picture graphs display data as pictures or symbols. Each picture or symbol represents a specific quantity, which is shown in a legend on the graph. Show your students examples of picture graphs in their math or other texts. You may also find many examples online by searching for "picture graphs." Discuss the graphs and point out how they are constructed.

3. Explain that a bar graph displays data using vertical or horizontal bars. The scale of a bar graph typically represents numerical data. Note that the data is labeled and the bars are separated by a space. Show your students examples of bar graphs in their math or other texts. You may also find many examples online by searching for "bar graphs." Discuss the graphs and point out how they are constructed.
4. Instruct your students to construct a picture graph and a bar graph, using the data obtained in the poll you conducted at the beginning of the activity. Suggest that they choose a simple picture to represent data for their picture graph and create a legend showing the value of each picture. For their bar graph they should create a scale to represent the data, and be sure to label each bar. They should construct their graphs neatly and accurately, and include a title for each graph.
5. After students have constructed their graphs, ask them questions based on comparisons of the data, especially questions that focus on "how many more," and "how much less."

CLOSURE

Ask your students to summarize the steps for constructing picture graphs and bar graphs:

- Obtain data.
- Determine a scale or legend, depending on the graph.
- Draw the graph.
- Show and label the data accurately.
- Include a scale or legend that shows the value of the data on the graph.
- Title the graph.

You may also want to display students' graphs.

Measurement and Data: 3.MD.4

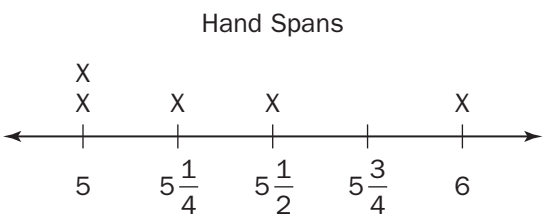
"Represent and interpret data."

> 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."

BACKGROUND

A line plot, also known as a dot plot, displays data along a number line. Each value of the data is marked with a symbol noting the frequency.

For example, suppose that you wish to draw a line plot, showing the hand span of five students in inches: $5\frac{1}{4}$, $5\frac{1}{2}$, 5, 5, 6. The line plot appears below.



Note that an "X" is placed above the value each time the value appears.

ACTIVITY: HAND SPANS

Working in pairs or groups of three, students will measure their hand spans and draw a line plot that shows the hand spans of the students in class.

MATERIALS

Rulers with a $\frac{1}{4}$-inch scale; reproducible, "Hand Span Data Sheet," for each pair or group of students.

PROCEDURE

1. Explain that students will measure their hand span—the distance between the tip of the pinkie finger and the tip of the thumb when the hand is open, palm down.
2. Demonstrate a hand span by placing your hand palm down on the board, marking the tip of your pinkie and the tip of your thumb. Then measure the distance between these two points to the nearest quarter inch.

3. Instruct your students to find their hand span and record its length to the nearest quarter inch. If necessary, the student's partner can help measure.
4. Distribute copies of the reproducible. Note that it contains a table (broken into three parts) with rows numbered 1–30 and a horizontal line at the bottom that will serve as the line plot.
5. Call the name of the first student in your grade book. Ask for his or her hand span. Students will record this distance in Row 1 on the reproducible. You may find it helpful to write the data on the board.
6. Continue until all the names of your students have been called and everyone has announced his or her hand span. The number of completed rows in the table should be the same as the number of students in class.
7. Explain how to construct the line plot.
   - Find the smallest and largest hand spans.
   - Place a small vertical line near the left arrow on the horizontal line at the bottom of the reproducible to represent the smallest hand span.
   - Using a ruler and starting with the smallest value, mark the number line at $\frac{1}{4}$-inch intervals, stopping at the number representing the largest hand span.
   - Place an X every time a value is given.

CLOSURE

Discuss the line plots. Ask your students question such as: What was the most common hand span in the class? What was the least common? Is a line plot a good tool for displaying data? Why?

Name _____ Date _____

HAND SPAN DATA SHEET

Student	Hand Span	Student	Hand Span	Student	Hand Span
1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

Hand Spans

Measurement and Data: 3.MD.5

"Geometric measurement: understand concepts of area and relate area to multiplication and to addition."

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."

BACKGROUND

The area of plane figures can be measured by covering the figure with square units. Covering a plane figure with square units can help students recognize area.

ACTIVITY: COVERING THE AREA

Working in groups, students will cover a 1-foot square with 1-inch square tiles.

MATERIALS

About 150 1-inch square tiles; large construction paper (12 inches by 18 inches); rulers with a 1-inch scale; scissors for each group of students.

PROCEDURE

1. Explain that area is the number of square units needed to cover a surface. For this activity students will cover a surface with square units to find the area of the surface.
2. Instruct your students to use their rulers to accurately measure a square with sides of 1 foot (12 inches) on their paper. If they are using paper that is 12 inches by 18 inches, they can do this by taking the paper lengthwise and measuring 6 inches along one side. Tell them to mark a point 6 inches from the short edge at the top of the sheet and a point 6 inches from the short edge at the bottom. Drawing a straight line connecting these two points should result in a 1-foot square on their paper. Demonstrate how they should do this.
3. After students have drawn their square, instruct them to cut along the line that they drew. They should now have a 1-foot square.

4. Explain that they are now to use their 1-inch square tiles to cover the area of their 1-foot square. Each tile should be placed so that its edges neatly fit against the other tiles around it. The tiles should completely cover the 1-foot square without leaving any gaps or overlaps.

CLOSURE

Discuss your students' covered squares. How many 1-inch squares were required to cover the 1-foot square? Emphasize that the 1-foot square is covered with 144 1-inch squares, meaning it has an area of 144 square inches.

Measurement and Data: 3.MD.6

"Geometric measurement: understand concepts of area and relate area to multiplication and to addition."

6. "Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units.)"

BACKGROUND

The area of a plane figure can easily be measured by counting square units. The number of square units equals the area of the figure.

ACTIVITY 1: MEASURING AREAS

Students will measure the area of flat surfaces by counting unit squares.

MATERIALS

Scissors; rulers with centimeter and inch units; reproducibles, "5-Inch Square" and "10-Centimeter Square," for each student.

PROCEDURE

1. Hand out copies of the reproducibles. Explain that students are to cut out the 5-inch square and 10-centimeter square.
2. Explain that they are to measure each square with their rulers and decide how the surface of the paper can be divided into square units.
3. Explain that after students have determined what square units each large square can be divided into, they should use rulers to draw square units on the paper. Next they should count the total number of square units needed to cover the surface of each square without any gaps or overlaps.

CLOSURE

Discuss students' results. The square with sides of 5 inches can be divided into 1-inch square units and has an area of 25 square units. The square with sides of 10 centimeters can be divided into 1-centimeter square units and has an area of 100 square centimeters.

ACTIVITY 2: MEASURING AREAS WITH APPROPRIATE TOOLS

Working in small groups, students will measure areas with unit squares.

MATERIALS

Meter sticks; yard sticks; 1-foot rulers with inch and centimeter scales for each group; masking tape for the teacher.

PREPARATION

Before students enter the classroom, measure various rectangles and squares on the classroom floor and mark the corners of the figures with masking tape, for example a 2-meter-by-1-meter rectangle, a 2-yard square, and a 4-foot square. Also designate the surfaces of various objects such as desks, tables, bulletin boards, books, windowsills, and the door to the classroom for measurement. Be sure to find the areas of these figures prior to the activity.

PROCEDURE

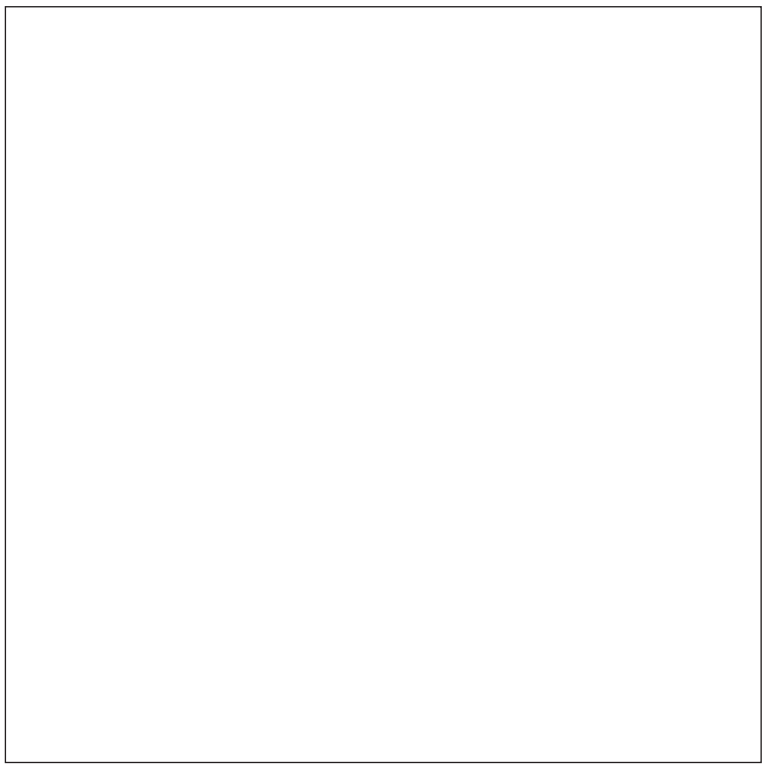
1. Explain to your students that they will be using meter sticks, yard sticks, and rulers to find the areas of various figures. Remind them that areas are measured in square units.
2. Show your students the figures that they will be measuring. Tell them that they will need to use the appropriate tool—a meter stick, yard stick, or ruler (in inches or centimeters)—to find as closely as possible the number of unit squares that will cover each particular figure, without any gaps or overlaps.
3. Instruct groups to designate a recorder who will write down the number of square units needed to cover each figure.
4. To avoid congestion and idle "waiting around," have groups work at different parts of the classroom, measuring different figures.
5. Remind students that they should try to be as accurate as possible in measuring and then counting the number of unit squares they find in each figure.

CLOSURE

Discuss your students' results. Which group's results were closest to the actual area of each figure? What, if any, problems did students have in measuring the figures? How did they resolve the problems? Emphasize that the area of a plane figure can always be found by counting the unit squares that cover the area completely.

5-INCH SQUARE

10-CENTIMETER SQUARE



Measurement and Data: 3.MD.7

"Geometric measurement: understand concepts of area and relate area to multiplication and to addition."

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.

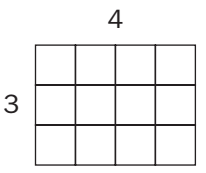
   c. "Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and $b + c$ is the sum of $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning.

   d. "Recognize area as additive. Find areas of rectilinear figures by decomposing them into nonoverlapping rectangles and adding the areas of the nonoverlapping parts, applying this technique to solve real-world problems."

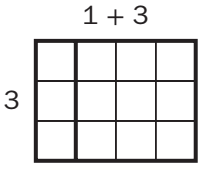
BACKGROUND

The area of a rectangle can be found by counting the number of tiles that cover it with no part of the tiles overlapping. Think of a rectangle as being a grid, consisting of rows and columns.

In the example below, because the rectangle has 3 rows with 4 squares in each row, the area is 3×4 or 12 square units.



The way to express the area of a rectangle can vary. The rectangle above may be decomposed into two rectangles as pictured below. The 4 columns can be redrawn as $1 + 3$, resulting in a 1-by-3 rectangle and a 3-by-3 rectangle. (*Note:* To avoid confusion with terminology, a square is a special type of rectangle.)



The area of the previous rectangle can be found by using the distributive property: $3 \times (1 + 3) = 3 \times 1 + 3 \times 3$. The sum of nonoverlapping parts can be used to find the total area, showing that area is additive.

ACTIVITY 1: TILING AND FINDING AREA

Students will tile a 3-inch-by-5-inch index card, and then find the area by multiplying the lengths of its sides. They will solve a real-world problem by multiplying the sides of a rectangle to find area.

MATERIALS

One 3-inch-by-5-inch index card; about 20 1-inch square color tiles for each student.

PROCEDURE

1. Explain that students will find the area of an index card by tiling (covering it with 1-inch squares).
2. Explain that students should cover the index card with the 1-inch squares completely, without leaving any gaps or having overlapping squares. After they have completed their tiling, ask: How many 1-inch squares were needed to cover the index card? (Students should have found 15.) Note that this is the area of the index card.
3. Tell your students to find the area of the index card by multiplying its length times its width. $A = l \times w$ ($A = 5 \times 3 = 15$ square inches)
4. Ask your students to compare the areas by tiling and multiplying. (Both are 15 square inches.)
5. Now pose this problem: Mrs. Williams is planning to change her kitchen floor. She needs to buy 1-foot square tiles to cover the floor, which is 9 feet by 10 feet. What is the area of the floor? (90 square feet) How many tiles does she need? (90)

CLOSURE

Ask your students questions such as the following: Does multiplying the length times the width of a rectangle always result in the area of a rectangle? (Students should realize this is true, because the width represents the number of rows, and the length represents the number of squares in each row. The product shows the number of squares needed to tile the rectangle, which is the number of square units.) Is finding the area of a rectangle by multiplying its length by its width easier than counting tiles? Ask your students to explain their answers.

ACTIVITY 2: DECOMPOSING AREAS

Working in pairs or groups of three, students will decompose area models to represent the distributive property.

MATERIALS

Graph paper; reproducible, "The Area of the Sums," for each pair or group of students.

PROCEDURE

1. Explain that rectangles can be decomposed (separated) into smaller rectangles. The area of the original rectangle is equal to the sum of the areas of smaller rectangles.
2. Distribute copies of the reproducible. Explain that at the top is a rectangle whose area is 6 square units. Below it are two different ways to decompose the rectangle into two smaller rectangles. (*Note:* If students point out that in the first example the original rectangle is decomposed into a rectangle and a square, remind them that a square is a special type of rectangle.)
3. Instruct your students to draw a rectangle that has two rows, each with five squares, on their graph paper.
4. Instruct them to decompose this rectangle into two smaller rectangles and find the area of each pair. There are three ways to do this. They should find all three.

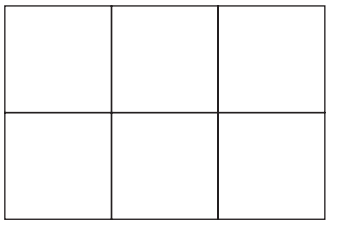
CLOSURE

Discuss the ways the rectangle can be decomposed. Ask your students: Do you think the sum of the areas of the smaller rectangles will always equal the area of the original rectangle? Why?

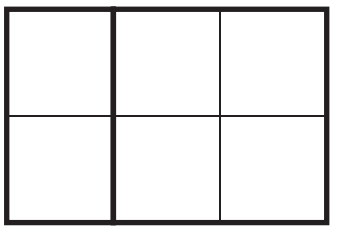
ANSWERS

There are three ways to decompose the rectangle: a 2-by-1 and a 2-by-4 rectangle; a 2-by-2 and a 2-by-3 rectangle; a pair of 1-by-5 rectangles.

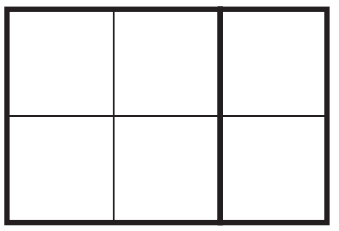
THE AREA OF THE SUMS



6 Square Units

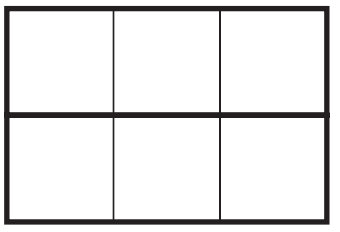


is the same as



2 Square Units + 4 Square Units

4 Square Units + 2 Square Units



3 Square Units + 3 Square Units

Measurement and Data: 3.MD.8

"Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures."

8. "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."

BACKGROUND

While the area of a polygon (a closed plane figure whose sides are line segments) is the number of square units needed to cover the flat surface, the perimeter of a polygon is the distance around the figure.

Two rectangles may have the same area but different perimeters. For example, a 4-by-5 rectangle and a 2-by-10 rectangle both have an area of 20 square units, but the perimeters are 18 units and 24 units respectively.

Two rectangles may have the same perimeters but different areas. For example, a 1-by-6 rectangle and a 3-by-4 rectangle both have a perimeter of 14 units, but their areas are 6 square units and 12 square units respectively.

ACTIVITY 1: AREA AND FINDING PERIMETER

Working in pairs or groups of three, students will create rectangles with a given area and then find the perimeters.

MATERIALS

About 15 1-inch square color tiles; rulers; unlined paper; reproducible, "Areas and Perimeters of Rectangles," for each pair or group of students.

PROCEDURE

1. Explain that rectangles may have the same area but different perimeters. Sketch a 4-by-5 rectangle and a 2-by-10 rectangle on the board. Both have an area of 20 square units, but their perimeters are 18 units and 24 units.
2. Hand out copies of the reproducible. Explain that it contains instructions for creating rectangles that have a given area.
3. Explain that students are to first use their tiles to create the rectangles, working with one rectangle at a time. After they create a rectangle, they are to draw it on their unlined paper,

label each side, and find its perimeter. Be sure that students understand that a 1-by-2 rectangle, for example, is the same as a 2-by-1 rectangle. It is only positioned differently. In cases where there is more than one possible rectangle, students should provide drawings and perimeters for all of them. (If necessary, remind your students that a square is a special kind of rectangle.)

CLOSURE

Discuss students' sketches and perimeters. Ask: How did you find the perimeters of the rectangles when given the areas?

ANSWERS

The dimensions of the rectangles and their perimeters are listed in order. (**1**) 1 by 1, 4. (**2**) 1 by 2, 6. (**3**) 1 by 4, 10; 2 by 2, 8. (**4**) 1 by 5, 12. (**5**) 1 by 8, 18; 2 by 4, 12. (**6**) 1 by 9, 20; 3 by 3, 12. (**7**) 1 by 10, 22; 2 by 5, 14. (**8**) 1 by 12, 26; 2 by 6, 16; 3 by 4, 14

ACTIVITY 2: PERIMETER AND FINDING AREA

Working in pairs or groups of three, students will create rectangles with a given perimeter and then find the areas of the rectangles they created.

MATERIALS

About 20 1-inch square color tiles; rulers; unlined paper; reproducible, "Perimeters and Areas of Rectangles," for each pair or group of students.

PROCEDURE

1. Explain that rectangles may have the same perimeter but different areas. Sketch a 1-by-6 rectangle and a 3-by-4 rectangle on the board. Both have perimeters of 14 units but their areas are 6 square units and 12 square units.
2. Hand out copies of the reproducible. Explain that it contains instructions for creating rectangles that have a given perimeter.
3. Explain that students are to use their tiles to create rectangles that have the given perimeters, working with one rectangle at a time. After they create a rectangle, they are to draw it on their unlined paper, label its sides, and find its area. Be sure that students understand that a 1-by-2 rectangle, for example, is the same as a 2-by-1 rectangle. It is only positioned differently. In cases where there is more than one possible rectangle, students should provide drawings and areas for all of them. (If necessary, remind your students that a square is a special kind of rectangle.)

CLOSURE

Discuss students' sketches and areas. Ask: How did you find the dimensions of the rectangles when given the perimeters?

ANSWERS

The dimensions of the rectangles and the areas are listed in order. (**1**) 1 by 1, 1. (**2**) 1 by 2, 2. (**3**) 1 by 4, 4; 2 by 3, 6. (**4**) 1 by 5, 5; 2 by 4, 8; 3 by 3, 9. (**5**) 1 by 7, 7; 2 by 6, 12; 3 by 5, 15; 4 by 4, 16

ACTIVITY 3: DESIGNING A VEGETABLE GARDEN

Working in small groups, students will design a vegetable garden with a given perimeter. They will then find the area of their garden.

MATERIALS

Graph paper; rulers for each group.

PROCEDURE

1. Explain that students are to design a vegetable garden. Because small animals, such as rabbits, like vegetables, students will need to place a wire fence around their garden. They have 50 feet of wire fence.
2. Explain that students should design a rectangular garden with a perimeter of 50 feet. They should consider and sketch several possible plans before choosing the one they want.
3. Explain that after students have agreed on a design for their garden, they should draw the plan on their graph paper. Suggest a scale of 1 unit on their graph paper equaling 1 foot of the garden. They are to label the lengths of the garden's sides (which must total 50), and then find the area of the garden.

CLOSURE

Have students share their garden designs with other groups. It is likely that the designs will vary. Discuss that although the perimeters of the gardens equal 50, the areas will vary, according to each garden's dimensions. Which garden had the largest area? Which had the smallest? Why?

AREAS AND PERIMETERS OF RECTANGLES

Directions: Use square tiles to make the rectangles below. After you make each rectangle, draw it on a separate piece of paper. Then write the lengths of each side and find the perimeter.

1. Create a rectangle that has an area of 1 square unit.

2. Create a rectangle that has an area of 2 square units.

3. Create two rectangles that each has an area of 4 square units.

4. Create a rectangle that has an area of 5 square units.

5. Create two rectangles that each has an area of 8 square units.

6. Create two rectangles that each has an area of 9 square units.

7. Create two rectangles that each has an area of 10 square units.

8. Create three rectangles that each has an area of 12 square units.

PERIMETERS AND AREAS OF RECTANGLES

Directions: Use square tiles to make the rectangles below. After you make each rectangle, draw it on a separate piece of paper. Then write the lengths of each side and find the area.

1. Create a rectangle that has a perimeter of 4 units.

2. Create a rectangle that has a perimeter of 6 units.

3. Create two rectangles that each has a perimeter of 10 units.

4. Create three rectangles that each has a perimeter of 12 units.

5. Create four rectangles that each has a perimeter of 16 units.

Geometry: 3.G.1

"Reason with shapes and their attributes."

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 no not belong to any of these subcategories."

BACKGROUND

Quadrilaterals (four-sided figures) have three subgroups: trapeziums, which have no parallel sides, parallelograms, which have two pairs of parallel and congruent sides, and trapezoids, which have only one pair of parallel sides.

Parallelograms have two subgroups: rhombuses, which have four congruent sides, and rectangles, which have two pairs of parallel sides, two pairs of congruent sides, and four right angles. A square, having four congruent sides and four right angles, is a rhombus *and* a rectangle.

Parallelogram serves both as an umbrella term over an entire category (as just described) and as a specific example within that category, namely, a quadrilateral with two pairs of parallel and congruent sides but no right angles. Likewise *rhombus* can refer either to a category of parallelogram that has four congruent sides that might or might not have right angles, or to a specific type of parallelogram with four congruent sides but no right angles.

ACTIVITY: CLASSIFYING QUADRILATERALS

Working in small groups, students will identify which quadrilateral does not belong in a set of three. They are to explain why they believe the figure selected does not belong and then draw a figure that does belong with the other two in the set.

MATERIALS

Scissors; glue sticks; rulers; unlined paper; reproducible, "Which One Does Not Belong?" for each group of students.

PROCEDURE

1. Explain that quadrilaterals can be classified in many ways: by the number of parallel sides, by the number of congruent sides, by the number of right angles, and by their perimeter and area.

2. If necessary, review the meanings of the following terms: parallel, congruent, right angle, perimeter, and area. Also, if necessary, provide examples of parallelograms, trapezoids, rhombuses, rectangles, and squares.
3. Hand out copies of the reproducible and explain that there are three figures in each row. Two belong in each set of three because they share some of the same features, but one does not. Students are to identify which figure does not belong with the other two and provide a reason why.
4. Use the first row as an example. Ask your students which figure does not belong with the other two. Students should say the square because it has four right angles.
5. Explain that once students have identified a figure that does not belong, they should write the number of the row and their reasons why the figure does not belong on a separate sheet of paper. They are to then draw a figure on unlined paper that belongs with the other two, cut the figure out, and glue it over the figure on the reproducible that does not belong. Using the first row as an example again, students should draw a rhombus that is not a square, cut it out, and glue it over the square so that every figure in the row has four congruent sides and no right angles. Instruct your students to follow this procedure for every row on the reproducible.

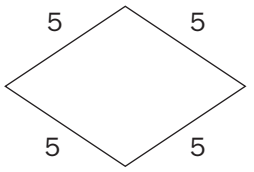
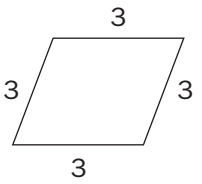
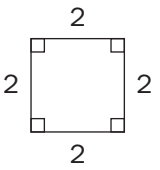
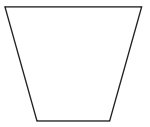
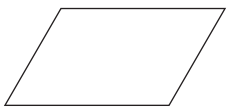
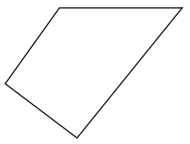
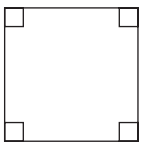
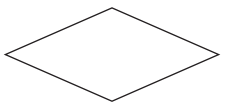
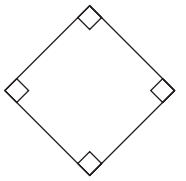
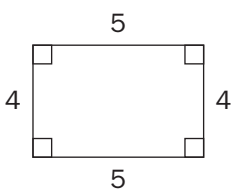
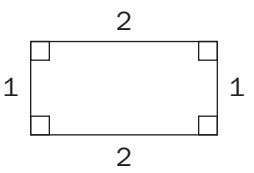
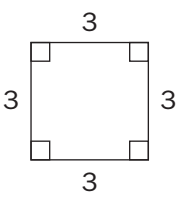
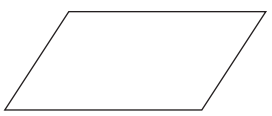
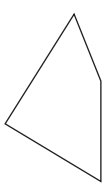
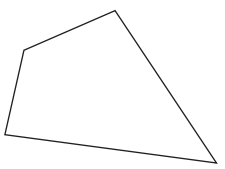
CLOSURE

Discuss the answers and share your students' correct responses.

Answers: The answer is provided for each problem, followed by placement and description of the sketch. (**1**) Figure two, the parallelogram, does not belong because it has two pairs of parallel sides while the other figures are trapezoids, which have one pair of parallel sides. A trapezoid should be placed over the second figure. (**2**) Figure two, the rhombus, does not belong because it has no right angles while the other figures have four right angles. A square should be placed over the second figure. (**3**) Figure three, the square, does not belong because it has four congruent sides while the other two figures have two pairs of congruent sides. A rectangle that is not a square should be placed over the third figure. (**4**) Figure one, the parallelogram, does not belong because it has two pairs of parallel sides while the other two figures are quadrilaterals that have no parallel sides. A quadrilateral with no parallel sides should be placed over the first figure.

Name _____ Date _____

WHICH ONE DOES NOT BELONG?

Example			
1.			
2.			
3.			
4.			

Geometry: 3.G.2

"Reason with shapes and their attributes."

2. "Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole."

BACKGROUND

Geometric figures can be partitioned into parts with equal areas. For example, a 2-by-2 square can be divided into four 1-by-1 squares. The area of each small square is $\frac{1}{4}$ of the area of the 2-by-2 square. The 2-by-2 square can also be partitioned into two 1-by-2 rectangles. The area of each rectangle is $\frac{1}{2}$ of the area of the square.

ACTIVITY: DECOMPOSING FIGURES

Working in pairs or groups of three, students will assemble parts of a geometric figure into the original figure. They will represent the area of each part as a unit fraction of the larger figure.

MATERIALS

Scissors; reproducibles, "Parts of Figures, I," "Parts of Figures, II," and "Geometric Figures," for each pair or group of students.

PROCEDURE

1. Distribute copies of the reproducibles. Explain that on "Parts of Figures, I" and "Parts of Figures, II" each group of figures in each box can be assembled to form one of the figures (a triangle, hexagon, square, or rectangle) contained on "Geometric Figures."
2. Explain that students should start with the figures in the first box. They should cut out the triangles and assemble them to form a figure shown on "Geometric Figures." After students have assembled the small figures, on a separate sheet of paper they should write the number of the box of the small figures, the fraction of the area each small figure makes up of the larger figure, and the name of the larger figure.
3. Instruct students to follow the same procedure for the figures in the other boxes.

CLOSURE

Discuss your student's results. Emphasize the unit fractions as parts of their wholes.

ANSWERS

(**1**) The area of each part is $\frac{1}{4}$ of the area of the triangle. (**2**) The area of each part is $\frac{1}{4}$ of the area of the hexagon. (**3**) The area of each part is $\frac{1}{2}$ of the area of the hexagon. (**4**) The area of each part is $\frac{1}{2}$ of the area of the rectangle. (**5**) The area of each part is $\frac{1}{3}$ of the area of the rectangle. (**6**) The area of each part is $\frac{1}{8}$ of the area of the square. (**7**) The area of each part is $\frac{1}{4}$ of the area of the square. (**8**) The area of each part is $\frac{1}{2}$ of the area of the square.

PARTS OF FIGURES, I

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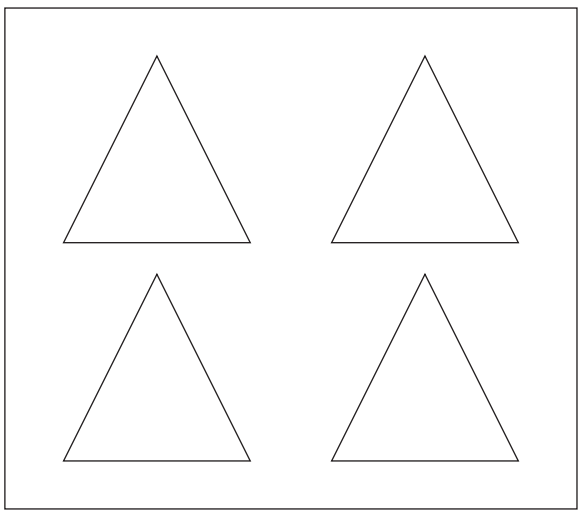

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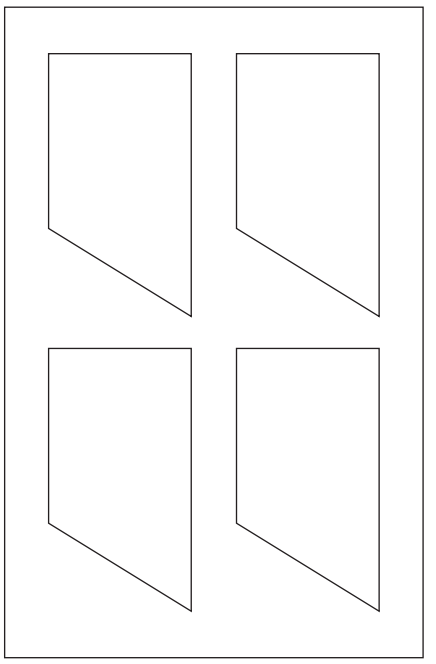

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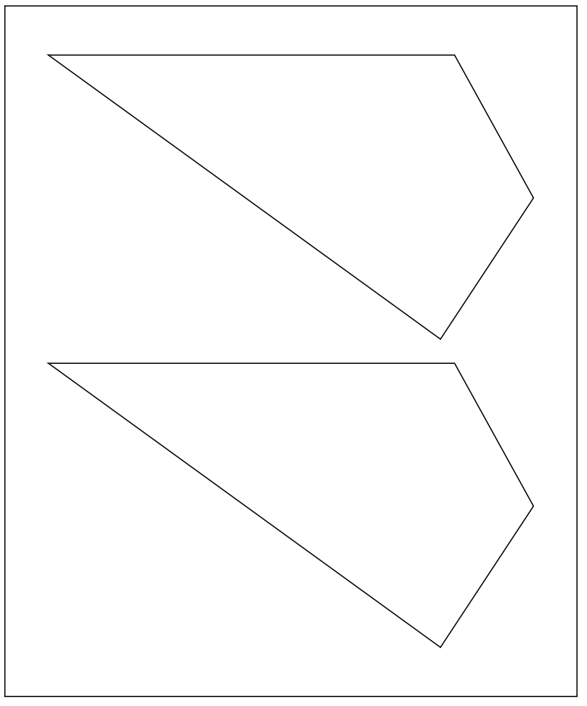

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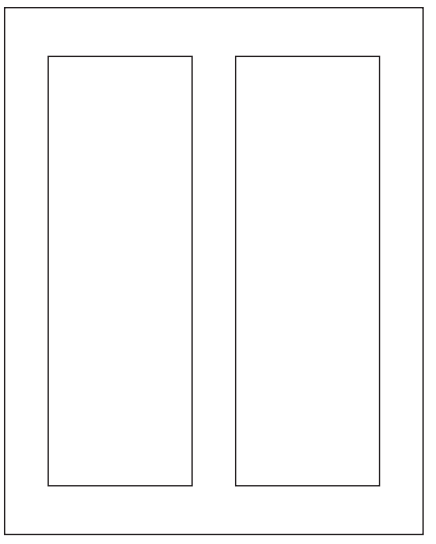

PARTS OF FIGURES, II

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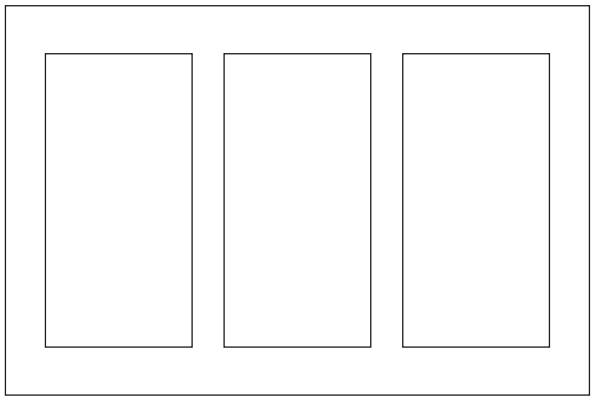

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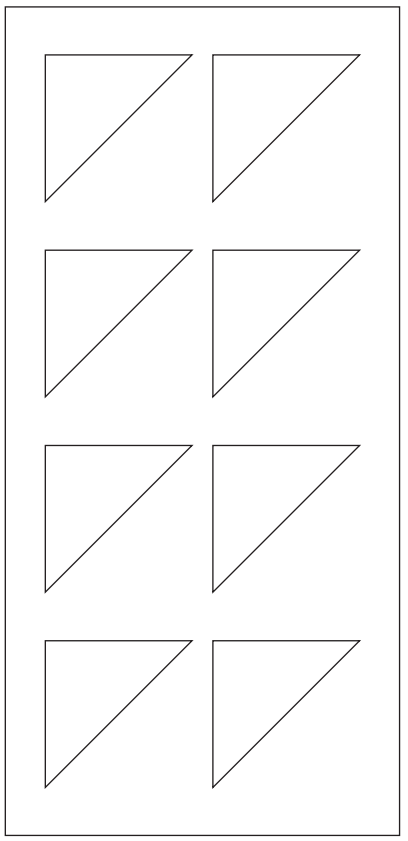

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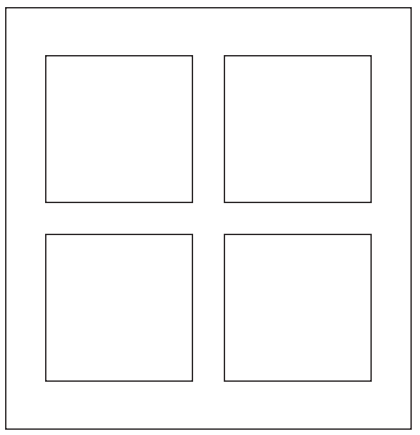

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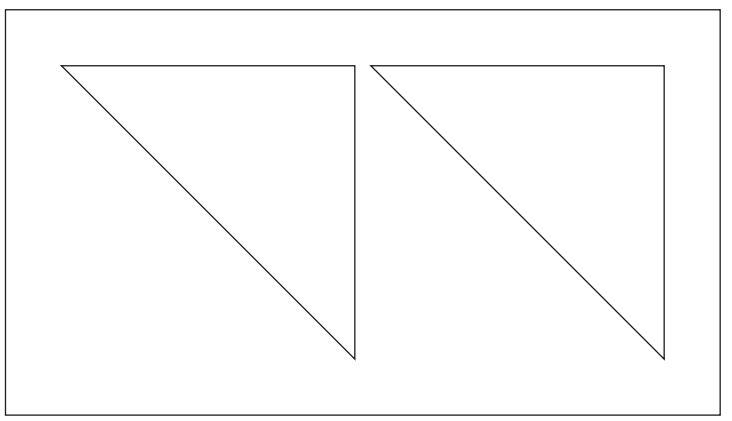

GEOMETRIC FIGURES