**Sticker Stumper**

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| In this lesson students explore the relationship between the dimensions of a rectangular sheet of stickers to the total amount of stickers on a sheet.  |

**NC Mathematics Standard(s):**

**Operations and Algebraic Thinking**

**NC.3.OA.1** For products of whole numbers with two factors up to and including 10:

* Interpret the factors as representing the number of equal groups and the number of objects in each group.
* Illustrate and explain strategies including arrays, repeated addition, decomposing a factor, and applying the commutative and associative properties.

**Additional/Supporting Standards:**

 **Operations and Algebraic Thinking**

**NC.3.OA.3** Represent, interpret, and solve one-step problems involving multiplication and division.

* Solve multiplication word problems with factors up to and including 10. Represent the problem using arrays, pictures, and/or equations with a symbol for the unknown number to represent the problem.
* Solve division word problems with a divisor and quotient up to and including 10. Represent the problem using arrays, pictures, and/or equations with a symbol for the unknown number to represent the problem.

**NC.3.OA.6** Solve an unknown-factor problem, by using division strategies and/or changing it to a multiplication problem.

 **Measurement and Data**

**NC.3.MD.7** Relate area to the operations of multiplication and addition.

• 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.

• Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving problems, and represent whole-number products as rectangular areas in mathematical reasoning.

• Use tiles and/or arrays to illustrate and explain that the area of a rectangle can be found by partitioning it into two smaller rectangles, and that the area of the large rectangle is the sum of the two smaller rectangles.

**Standards for Mathematical Practice:**

SMP 1.Make sense of problems and persevere in solving them.

SMP 3. Construct viable arguments and critique the reasoning of others.

SMP 6. Attend to precision.

**Student Outcomes:**

* I can find the area of a rectangle by multiplying the length and width of the rectangle.
* I can communicate my strategies to find the area of rectangles and compare areas.

**Math Language:**

Array, Dimensions, Length, Width, Multiply, Sides, Rows, Columns

**Materials/Advance Preparation**:

* Sticker Stumper sheet (1 per student)
* Centimeter Grid Paper (1 per student)
* Colored pencils or crayons
* Notebook paper (1 sheet per student)

**Launch:**

1. Introducing Sticker Stumper (2-3 minutes)

 Ask students:

* “Do you like stickers?”
* “Now or when you were younger, what were your favorite kinds of stickers?”
* “How are stickers usually packaged?”

The goal is to have students discuss the idea that stickers come in groups and often these groups are printed and packaged on sheets of stickers.

You are owners of the Stuck on Stickers factory. Your factory makes sticker sheets for customers according to their requirements. You have two new sticker orders that need to be filled. Working in pairs, you will use grid paper to show how the orders will be filled.

**Explore:**

1. Sticker Stumper Activity (5-7 minutes)

Make sure students each have a copy of the Sticker Stumper activity.

Students work through the activity to answer questions 1 and 2.

As students are working make observations about strategies that students are using.

If students struggle support them by asking questions such as:

* What information do you know from the problem?
* If you know the size of the rectangle how can you draw a picture of it?

**Discuss:**

1. Discussion of Sticker Stumper (8-10 minutes)

The discussion of student solutions after the completion of Order 2 provides students with the opportunity to share and listen to multiple solution strategies. The discussion also leads students toward the connection between factors and dimensions.

Possible questions:

* + How are Orders 1 and 2 different? (Order 1 gave the dimensions and we had to find the number of stickers, Order 2 gave the number of stickers and we had to find the dimensions.)
	+ What do you notice about the relationship of the dimensions of the rectangles and the number of stickers in Order 1? (Multiply the columns and rows to find the number of stickers.)
	+ What do you notice about the total number of stickers and the lengths of the sides of the rectangles in Order 2? (The lengths of the sides are factors of the total number of stickers.)
	+ Are there more possibilities for Order 2? How can we find them?

The goal of the discussion is for students to hear about various strategies for determining the number of stickers on each sheet.

**Additional Activities (40-45 minutes):**

Possible activities include:

 More Sticker Situations - See the activity sheet attached. Students will need grid paper for this. These focus on two-step situations (NC.3.OA.8).

Exploring Tile Rectangles

Provide 24, 30, or 36 plastic square tiles and grid paper. Have students make as many rectangles using all tiles. Students should record all of the possible dimensions of the rectangles that they create.

Journal Prompt

Have students draw arrays for the following dimensions 4x3, 8x3 and 8x6. Ask students to determine the size of each array. Ask students, “how many 4x3 arrays will fit inside of an 8x3 array?” Ask students “how many 8x3 arrays will fit inside of an 8x6 array?” Ask students “how many 4x3 arrays will fit inside of an 8x6 array?”

**Evaluation of Student Understanding**

Informal Evaluation:

Observe students during the tasks. What do you notice about their understanding of multiplication? Remember to ask students, “How are you using the information to help you solve the problem?”

Formal Evaluation/Exit Ticket:

Student work on the Sticker Stumper activity sheet can be collected. If you would like to give an additional task you may pose the following task:
 Taylor has a sheet of stickers with 8 rows and 7 stickers in each row. Kiera has a sheet of stickers that has 9 rows with 6 stickers in each row. Who has more stickers? How many more?

**Meeting the Needs of the Range of Learners**

**Intervention:**

Provide struggling students with paper to draw pictures (sets or arrays) or counters to make groups will support their work in finding the various multiplication combinations.

**Extension:** Students could be given more tasks that involve two-steps, such as determining the stickers on a sheet then determining how many they would have if they gave away some. For example, *how many stickers would I have if I had 7 rows of 6 stickers and gave away 26 stickers?*

**Possible Misconceptions/Suggestions:**

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| **Possible Misconceptions** | **Suggestions** |
| Students may add the number of stickers in each row to the number of rows instead of multiply them.  | Have students count the number of stickers on smaller sheets and then have them use the strategy of repeated addition to determine the number of stickers on a sheet.  |
| Students may not be able to come up with the number of stickers on a sheet in an efficient way and they may need to count them all or use repeated addition. | The use of repeated addition is appropriate and an acceptable strategy. Continue to support students’ development of seeing equal groups and understanding that they could use repeated addition or other multiplication strategies such as breaking a factor apart to determine the answer.  |

**Possible Solutions:**

Exit ticket

 Taylor: 56, Kiera: 54. Taylor has 2 more than Kiera.

Sticker Stumper

Order Number 1: a. 40, b. 24, c. 20.
Order Number 2:

a. 36: 1 row of 36, 2 rows of 18, 3 rows of 12, 4 rows of 9, 6 rows of 6, 9 rows of 4, 12 rows of 3, 18 rows of 2, and 36 rows of 1.

b. 12: 1 row of 12, 2 rows of 6, 3 rows of 4, 4 rows of 3, 6 rows of 2, and 12 rows of 1

c. 24: 1 row of 24, 2 rows of 12, 3 rows of 8, 4 rows of 6, 6 rows of 4, 8 rows of 3, and 12 rows of 1.

More Sticker Situations

1 ) 44, 2) 36, 3) 13, 4) 23, 5) 7, 6), 9, 7) 8, 8) 1 row of 16, 2 rows of 8, 4 rows of 4, 8 rows of 2, 16 rows of 1.

Exploring Tile Rectangles

 24: 1 row of 24, 2 rows of 12, 3 rows of 8, 4 rows of 6, 6 rows of 4, 8 rows of 3, 12 rows of 2, 24 rows of 1.

 30: 1 row of 30, 2 rows of 15, 3 rows of 10, 5 rows of 6, 6 rows of 5, 10 rows of 3, 15 rows of 2, 30 rows of 1

36: 1 row of 36, 2 rows of 18, 3 rows of 12, 4 rows of 9, 6 rows of 6, 9 rows of 4, 12 rows of 3, 18 rows of 2, and 36 rows of 1.

Journal Prompt

 4x3 = 12, 8x3 = 24, 8x6 = 48
 2 4x3 rectangles will fit inside of an 8x3 rectangle
 2 8x3 rectangles will fit inside of an 8x6 rectangle

 4 4x3 rectangles will fit inside of a 8x6 rectangle

#### Sticker Stumper

Order Specifications:

* All sticker sheets must be rectangular.
* All dimensions must be whole units.
* All stickers must be arranged in rows and columns with no spaces or overlaps.
* Pictures of each sheet should be drawn on grid paper.

1. Order Number 1.

Happy Face Designs sent an order for the stickers it wants. How many stickers will fit on each sheet?

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| Item | Length | Width | Number of Stickers |
| a. Sticker Sheet | 10 stickers | 4 stickers |  |
| b. Sticker Sheet | 8 stickers | 3 stickers |  |
| c. Sticker Sheet | 5 stickers | 4 stickers |  |

1. Order Number 2.

The Hearts and Flowers Company sent an order for the number of stickers per sheet it wants to sell. What will be the length and Width of each sticker sheet?

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| Item | Length | Width | Number of Stickers |
| a. Sticker Sheet |  |  | 36 stickers |
| b. Sticker Sheet |  |  | 12 stickers |
| c. Sticker Sheet |  |  | 24 stickers |

1. The Hearts and Flowers Company wants your factory to design more than one sheet for their total number of stickers. Choose Sticker Sheet a, b, or c. Use the grid paper to show your plan for the sticker sheets.
2. Choose one Sticker Sheet from Order 1 and one Sticker Sheet from order two. In your Math Journal, show how you found the answers using words, numbers, and pictures.

Grid Paper

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More Sticker Situations

Part 1. Each of the following children want to collect 100 stickers. How many more does each need?

1. Lenard has a sheet with 8 rows and 7 stickers in each row.
2. Bridget had 28 stickers. Then she got a sheet with 4 rows and 9 stickers in each row.
3. Kendrick has 59 stickers. Then he got a sheet with 7 rows and 4 stickers in each row.
4. Beatrice has a sheet with 5 rows and 9 stickers and another sheet with 8 rows and 4 stickers in each row.

Part 2. Find the numbers that are missing for the situations below.

1. Susan has 35 stickers on a sheet that has 5 rows with an equal number of stickers in each row. How many stickers are in each row?
2. Tim has 54 stickers on a sheet that has 6 rows with an equal number of stickers in each row. How many stickers are in each row before?
3. Taylor has 64 stickers on a sheet that has 8 rows with an equal number of stickers in each row. How many stickers are in each row?
4. Vera has 16 stickers on a sheet. They are in rows with an equal number in each row. Find out 3 possible arrangements for her stickers.