Warm-Up

Review: 3NS2.4	CST: 3NS2.4
1) Create a model to solve this problem. $\begin{array}{r} 7 \\ \times 8 \\ \hline \end{array}$	**34** **A company has 6 big trucks. Each truck has 18 wheels. How many wheels is this in all?** **A** 24 **B** 96 **C** 108 **D** 116 *Use decomposition(break-apart) to solve.
CST: 3NS2.4	**CST: 4NS3.2**
36 **Third-grade students went to a concert in 8 buses. Each bus took 45 students. How many students went to the concert?** **A** 320 **B** 360 **C** 380 **D** 3240 *Which answer is a partial product? *What are the factors for this partial product?	**32** $528 \times 49 =$ **A** 577 **B** 25,872 **C** 26,400 **D** 26,872 *Solve two ways.

Multiplying two and three digit numbers using the Generic Rectangle

Objective: Teach students several multiplication methods of two and three digit numbers using the Generic Rectangle.

Materials: Warm-ups, scissors, 3 Rectangle worksheet, Graph paper, Note paper.

Warm-up:

In this lesson a basic math fact will be used to model semi-concretely how to decompose a math problem.

You have a paper in front of you with three rectangles on it. Cut out all three.
Choose one rectangle. What are the dimensions, or factors, of the rectangle?
$\left[7 \times 8 \text{ or } 8 \times 7\right]$

These are the factors from our warm-up #1.What is the area or product of the rectangle?
[56]

How did you determine the area? You have one minute to discuss with your neighbor.
(take student answers on this) [Multiplied the dimensions, or factors]

Today we are going to see what happens when we decompose or break-apart factors.
Turn one rectangle so the base is 8 and the height is 7. (demo this)

The vertical lines represent columns and the horizontal lines are rows.
How many columns are there? [8]

How many rows? [7]

Take your scissors and cut one column off an end. Now you have two rectangles. What are the dimensions, or factors, of the larger rectangle? $\left[7 \times 7\right]$

What is the area of the larger rectangle? [49]

Write the equation $7 \times 7 = 49$ on the larger rectangle. What are the dimensions, or factors, of the smaller rectangle? $\left[7 \times 1\right]$

What is the area of the smaller rectangle? [7]

Write the equation $7 \times 1 = 7$ on the smaller rectangle. Take an uncut rectangle. Place the two smaller rectangles together so they fit on the whole uncut rectangle. What is the area of the two smaller rectangles together? [56]

Has the area of the rectangle changed because it was cut into 2 pieces? [no]

If our original equation was $7 \times 8 = 56$, then discuss with your desk partner what our new equation would look like now that it has been broken apart and write this in your notes. I will give you two minutes to write down the new equations. (After 2 minutes, share student work. Below is a good example to share.)

Example:

$$(7 \times 7) + (7 \times 1) = 56$$

$$49 + 7 = 56$$

$$56 = 56$$

You can break apart one factor and multiply each part with the other factor to get partial products which when added, equal the whole product

Take an uncut rectangle. Turn it so the base is 8 and the height is 7. Cut three rows off all together on the bottom. With your partner label each rectangle with an equation showing its factors and product. Then write a new equation for $7 \times 8 = 56$ in your notes now that it is broken apart into the new pieces. (Share student work. Below is a good example to share.) Put these aside

Example:

$$(8 \times 4) + (8 \times 3) = 56$$

$$32 + 24 = 56$$

$$56 = 56$$

You can break apart factors to make partial products and still get the same whole product

Now take out the piece of graph paper. On one of the rectangles with the dimensions 6×18, which are our factors from problem # 34 on our warm-up, divide the rectangle into two parts and shade one part using your pencil. Which factor did you break-apart? Take several answers. So, there are many ways to break up the factors. If I broke-apart the 18 using expanded notation, what would I write down? [10 + 8]

Write the equation 10 + 8 – 18 on the bottom of the graph paper. On the second rectangle divide the rectangle into two parts based upon expanded notation. Break up the side that has 18 into 10 and 8. Label each part with the equation you would use to solve for partial product.

Which equation did you write for the larger area? $\left[6 \times 10 = 60\right]$

Which equation did you write for the smaller area? $\left[6 \times 8 = 48\right]$

What would you add together to find the whole area? $\left[60 + 48\right]$

With your partner write an equation to show using decomposition and expanded notation to find the product of 6×18. (Share student work. Below is a good example to share.)

Example:

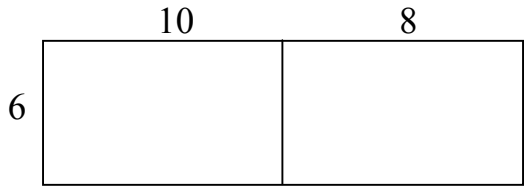
$$(6 \times 10) + (6 \times 8) = 108$$

$$60 + 48 = 108$$

$$108 = 108$$

You can break apart factors to make partial products and still get the same whole product

On your note paper draw a rectangle, divide it into two columns.



Across the top write 18 in expanded form with the 10 above the first box and the 8 above the second box. Then write 6 to the left of the first box. How is this similar to our rectangle we broke apart on the graph paper? Discuss with your partner. (Share student responses. Below is a good example to share.)

Example: It is in 2 parts, it uses expanded notation.

How can I solve this? Discuss with your partner. (Share student responses. Below is a good example to share.)

Example: Multiply $(6 \times 10) + (6 \times 8)$ for the partial products from each box.

This method is called a Generic Rectangle. You break apart your number using expanded notation. Then multiply to find the partial products and then add the partial product to find the whole product. Now you try to use a Generic Rectangle to find the product for #36 on our warm-up 8×45.

	40	5
8	320	40

$320 + 40 = 360$

(Share student responses.)

Let's look at #32 on our warm-up. What is 528 written in expanded notation?
$[500 + 20 + 8]$

What is 49 decomposed using expanded notation? $[40 + 9]$

My new dimensions, or factors, are $500 + 20 + 8$ and $40 + 9$. Draw a large box in your notes and label the dimensions above. Make a column or row for each of the plus signs. Why are there 6 boxes? [You have 3 factors by 2 factors, a 3 by 2 box would have 6 squares.]

	500	+	20	+	8
40					
+					
9					

Label each box with the equation you would use to find the partial product for that square.
How do you find the total product for 528 and 49?

	500	+ 20	+ 8
40	500 x 40 = 20,000	20 x 40 = 800	8 x 40 = 320
+			
9	500 x 9 = 4,500	20 x 9 = 180	9 x 8 = 72

20,000
4,500
800
180
320
+ 72
25,872

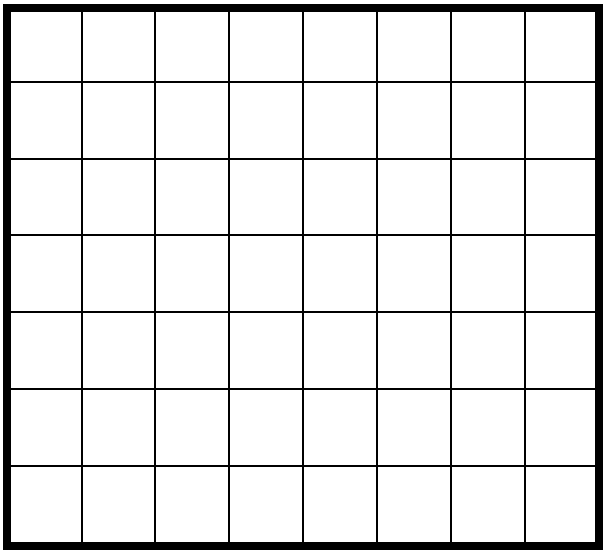
Add the partial products.
What is the answer? [25,872]

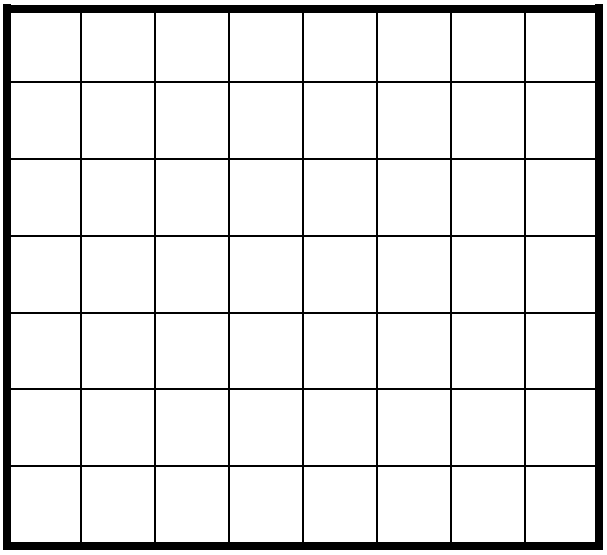
You Try:

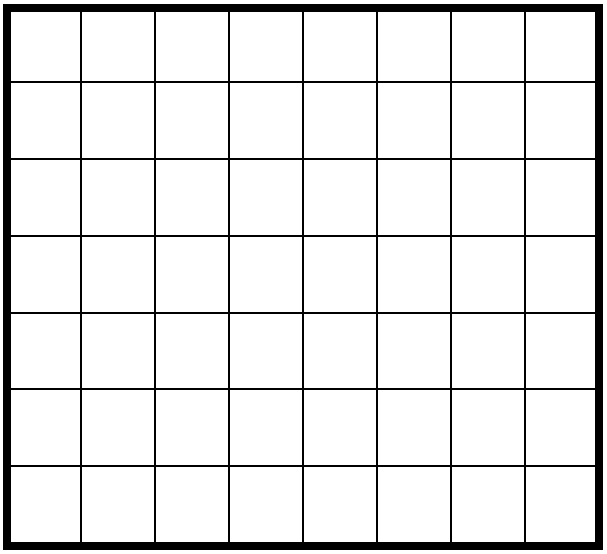
637
× 51

	600	+ 30	+ 7
50	600 x 50 = 30,000	30 x 50 = 1500	7 x 50 = 350
+			
1	600 x 1 = 600	30 x 1 = 30	7 x 1 = 7

30,000
1,500
600
350
30
+ 7
32,487







Graph Paper