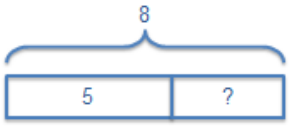
What are Tape Diagrams?

Tape diagrams, also called bar models, are pictorial representations of relationships between quantities used to solve word problems.

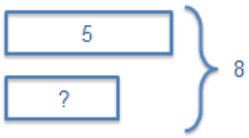
At the heart of a tape diagram is the idea of forming units. In fact, forming units to solve word problems is one of the most powerful ideas in the common core and is particularly helpful for understanding fraction arithmetic. The tape diagram also provides an essential bridge to algebra.

Like any tool, it is best introduced with simple examples and in small manageable steps so that students have time to reflect on the relationships they are drawing. For most students, structure is important.

Types of Tape Diagrams



Part/Whole

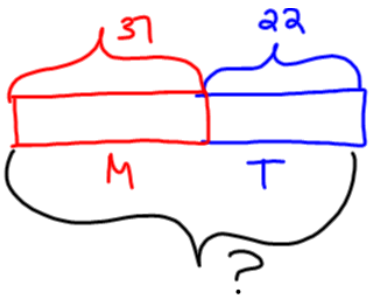


Comparison

Use of tape diagrams, provides visualization of relationships between quantities thereby promoting conceptual understanding

Example A:

Michelle reads for 37 minutes on Monday. She reads for 22 minutes on Tuesday. How many minutes does she read in all?

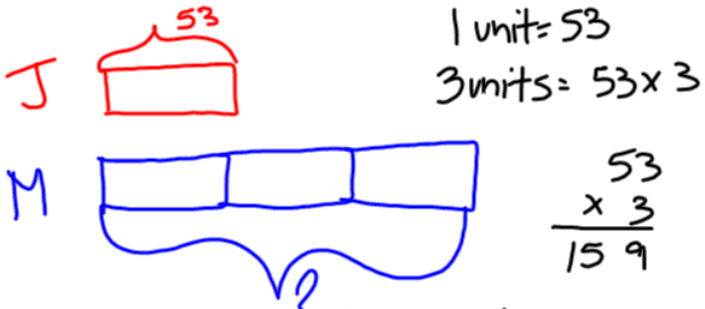


$$\begin{array}{r} 37 \\ +\,22 \\ \hline 59 \end{array}$$

Michelle read for 59 minutes in all.

<u>Example B</u>:

Jan has 53 stickers in her collections. Her older, sister, Marsha, has 3 times as many stickers in her collections. How many stickers does Marsha have?



1 unit = 53

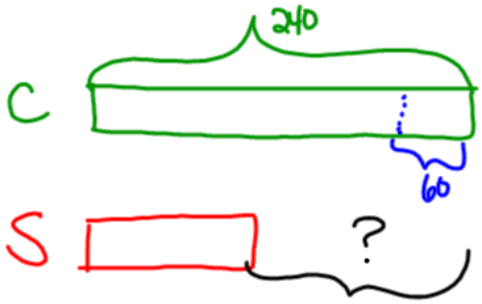
3 units = 53 x 3

$$\begin{array}{r} 53 \\ \times\ 3 \\ \hline 159 \end{array}$$

Marsha has 159 stickers.

Example C:

A copper wire was 240 m long. After 60 m was cut off, it was double the length of a steel wire. How much longer was the copper wire than the steel wire at first?



240 - 60 = 180

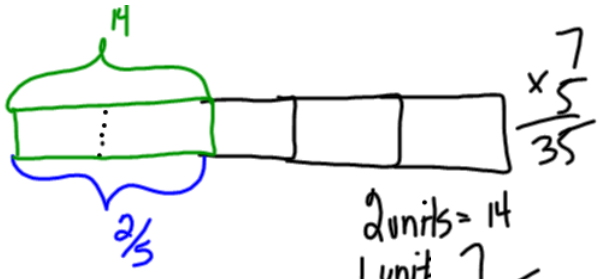
180 ÷ 2 = 90

240 - 90 = 150

The copper wire was 150 meters longer than the steel wire at first.

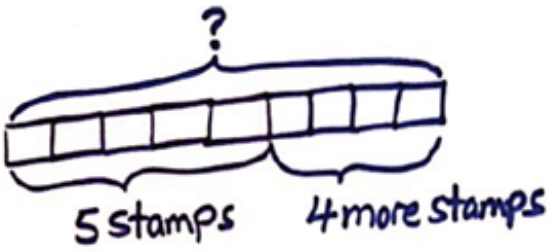
Example D:

Matthew has 14 blue marbles. His blue marbles make up two-fifths of his total number of marbles. How many marbles does Matthew have?



Matthew has 35 marbles.

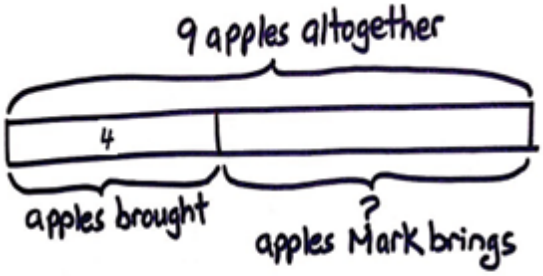
<u>Example 1</u>:
Sara has 5 stamps. Mark brings her 4 more stamps.
How many stamps does Sara have now?



5+4=9 stamps
Sara has 9 stamps now.

<u>Example 2</u>:

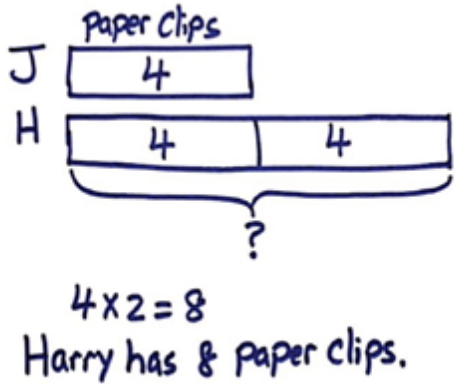
Sara brought 4 apples to school. After Mark brings her some more apples, she has 9 apples altogether. How many apples did Mark bring her?



$9 - 4 = 5$

Mark brought Sara 5 apples.

<u>Example 3</u>:
Jose has 4 paper clips. Harry has twice as many paper clips as Jose. How many paper clips does Harry have?

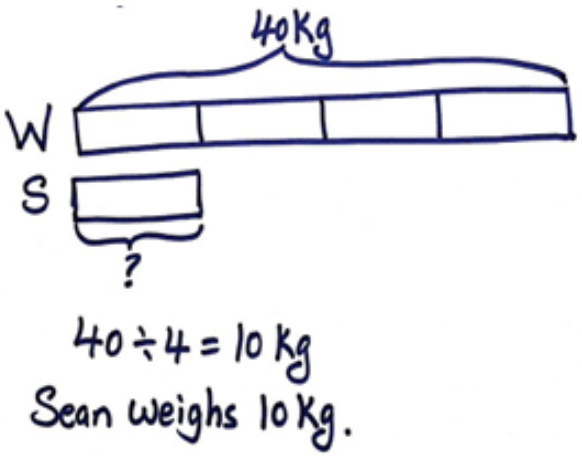


$4 \times 2 = 8$

Harry has 8 paper clips.

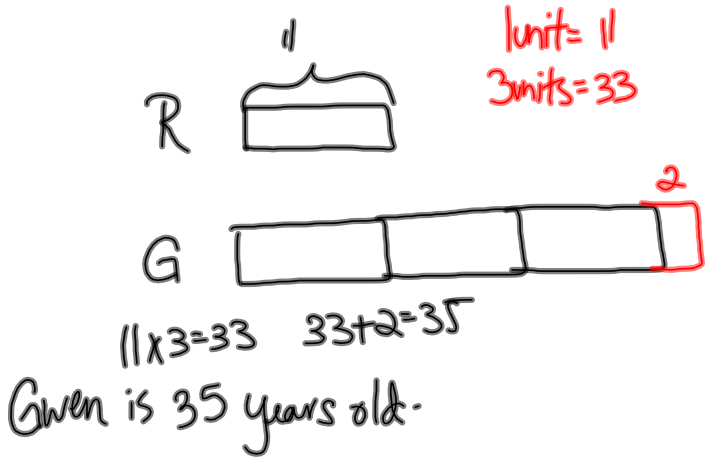
Example 4:

William's weight is 40 kg. He is 4 times as heavy as his youngest brought Sean. What is Sean's weight?



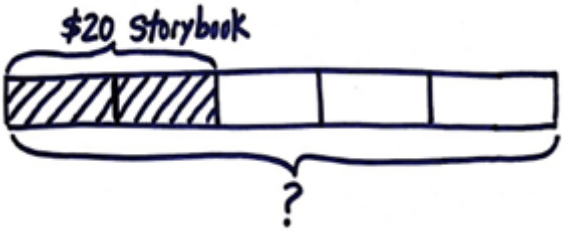
Example 5:

Robin is 11 years old. Her mother, Gwen, is 2 years more than 3 times Robin's age. How old is Gwen?



Example 6:

David spent 2/5 of his money on a storybook. The storybook cost $20. How much did he have at first?



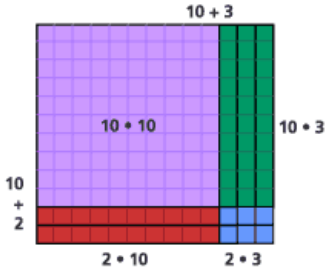
$20 ÷ 2 = $10

$10 × 5 = $50

David had $50 at first.

Array and Area Models

Area model is a model for multiplication problems, in which the length and width of a rectangle represent the factors. Area models provide a visual representation of the algorithms we use to perform multiplication and division. These models help children see how the algorithms relate to what is actually happening as a number is increased or decreased proportionately.



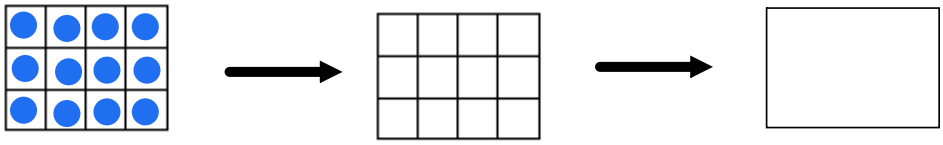
13
• 12
6 = 2 • 3
20 = 2 • 10
30 = 10 • 3
100 = 10 • 10
156

Array and Area Models

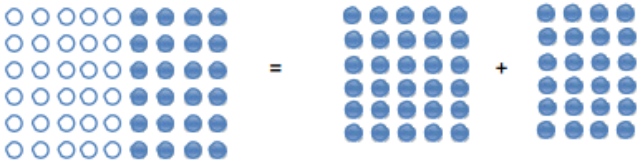
In Grade 2, students start to count objects in equal groups and write equations to represent the sum. This strategy is a foundation for multiplication because students should make a connection between repeated addition and multiplication.

Array and Area Models

In Grade 3, students start to put those objects in grids. Students will move from the using concrete objects (dots) to just a grid to just an open array that represents a certain amount of square units.



Student also start to use the distributive property to represent whole quantities in different ways. This understanding of part/whole relationships is critical in understanding the connection between multiplication and division.



The 6 groups of 5 is 30 and the 6 groups of 4 is 24. Students can write 6 x 9 as 6 x 5 + 6 x 4.

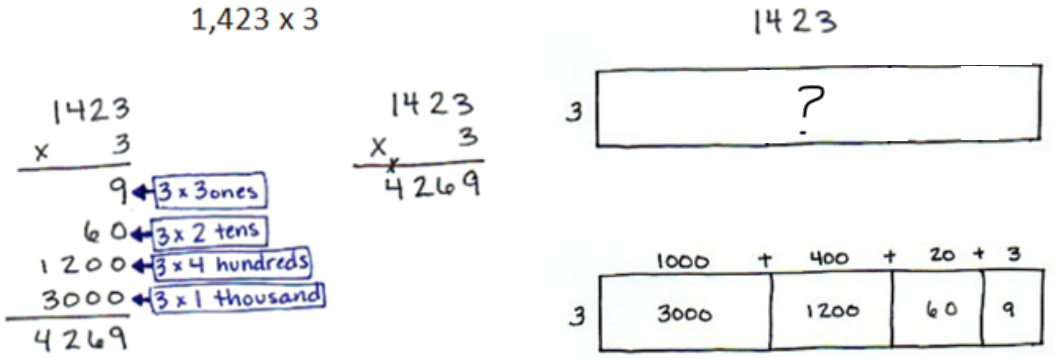
Area Model

Grade 4: Multiplication

3 x 1,423

Students decompose numbers into base ten units in order to find products of single-digit by multi-digit numbers.

In Multiplication, both parts (factors) are known and whole is unknown.

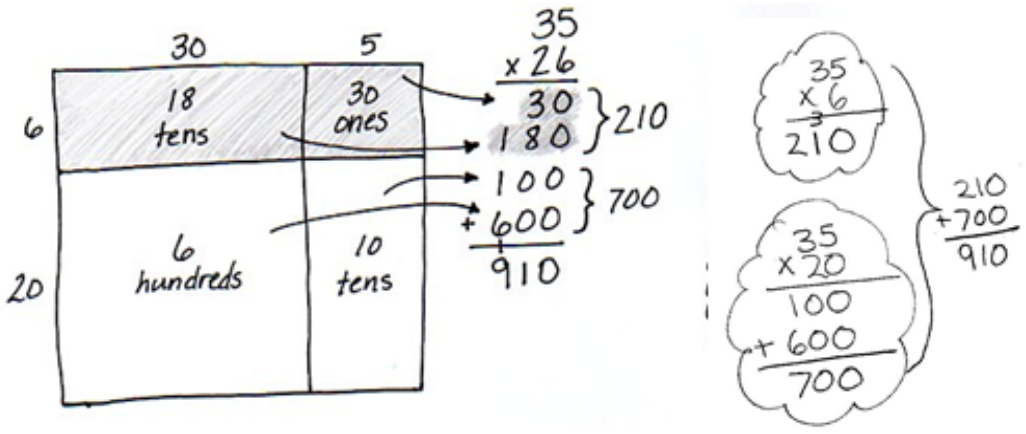


Area Model

Grade 4: Multiplication

26 x 35

Students bridge partial products to the recording of multiplication via the standard algorithm.



Area Model

Grade 5: Multiplication

524 x 126

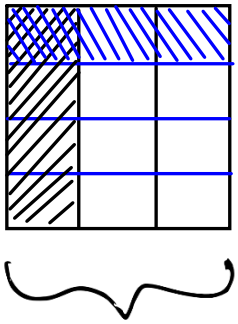
	500	20	4
6	3,000	120	24
30	15,000	600	120
100	50,000	2,000	400

$$\begin{array}{r} 524 \\ \times\ 136 \\ \hline 3{,}144 \\ 15{,}720 \\ +52{,}400 \end{array}$$

Area Model

Grade 5: Multiplication of Fractions

$$\frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$$



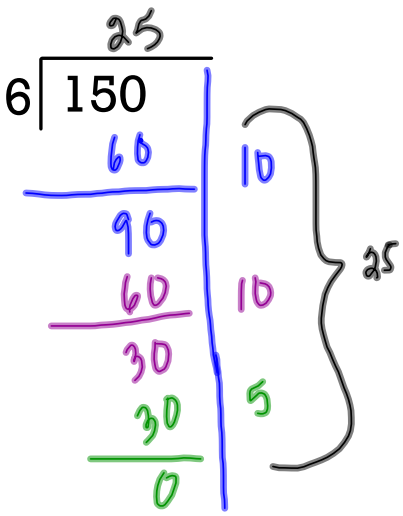
1 whole

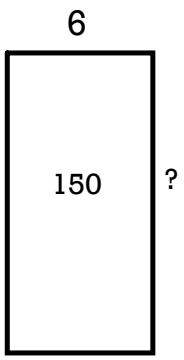
Area Model

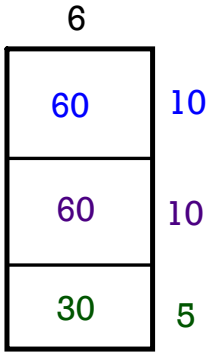
Grade 4: Division

Students represent division with single-digit divisors using the area model.

In Division, one part (divisor) and the whole (dividend) is known and the remaining part (quotient) is unknown.







Area Model

Grade 5: Division