Division Strategies

*"A critical area of instruction is to develop student understanding of the **meanings of** multiplication and **division of whole numbers** through activities and problems involving equal-sized groups, arrays, and area models (NGA/CCSSO 2010c)."*

"Also, students recognize division in two different situations: partitive division (also referred to as fair-share division), which requires equal sharing (e.g., how many are in each group?); and quotitive division (or measurement division), which requires determining how many groups (e.g., how many groups can you make?)."

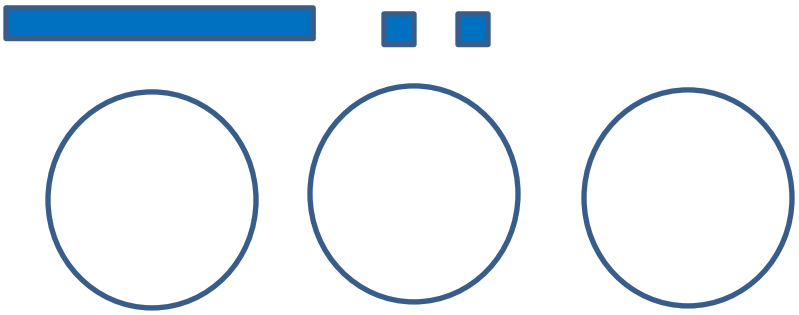
-**Grade Three, California Mathematics Framework**

**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*

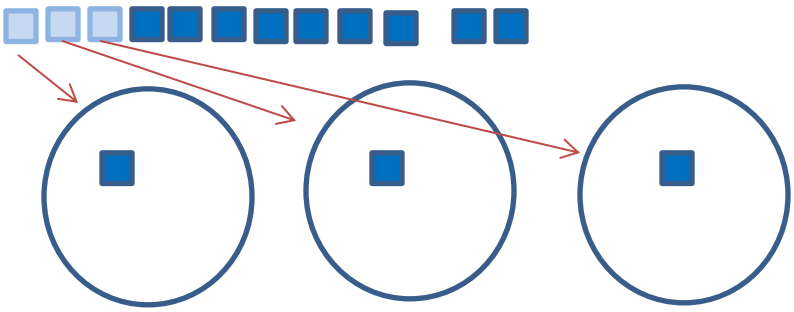
<u>Partitive Division or Fair-Share Division</u> (How many in a group?) **(3.OA.2, 3.OA.3)**

12 ÷ 3

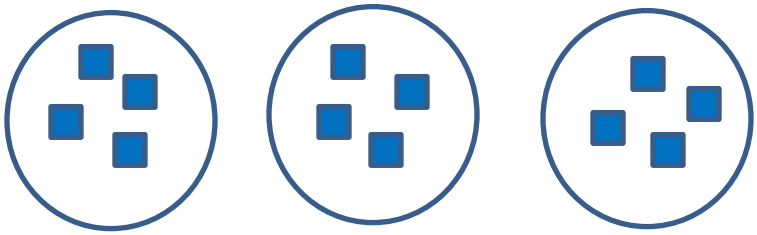
Step 1: Build 12 and draw 3 groups.



Step 2: Divvy out 12. Put one or more blocks at a time depending on the skill level of the students. Make sure to put the same amount in each group. Exchange or trade blocks as needed.



Step 3: Count the number of blocks in each group making sure each group has the same amount. The number of blocks in each group is the **quotient**.



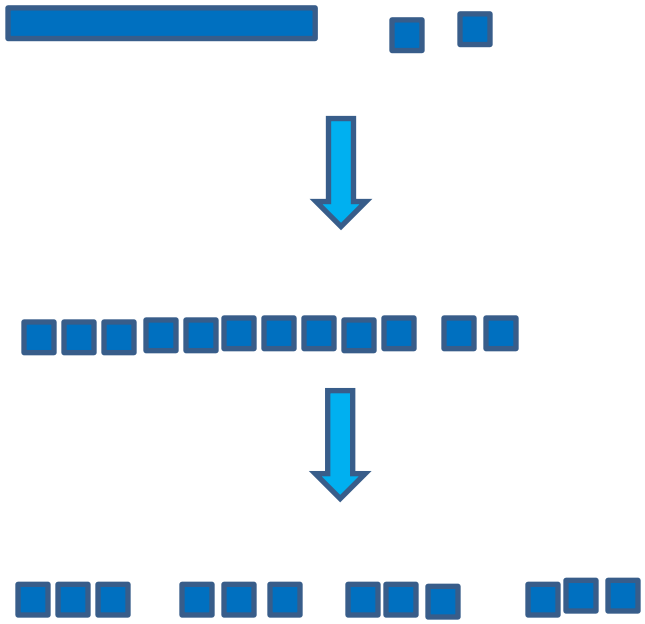
12 ÷ 3 = 4

**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*

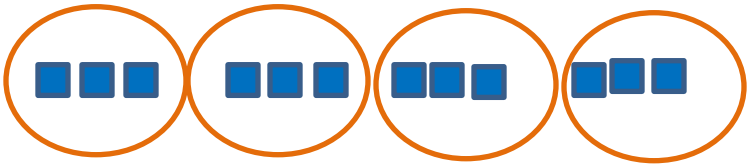
<u>Quotitive Division or Measurement Division</u> (How many groups can you make?)**(3.OA.2, 3.OA.3)**

12 ÷ 3

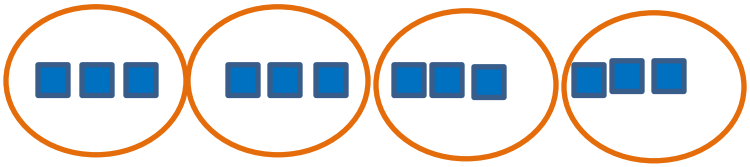
Step 1: Build 12 and remove 3 unit blocks (divisor) at a time. Trade as needed



Step 2: Put the blocks into groups.



Step 3: Count the number of groups created. The number of groups is the **quotient**.



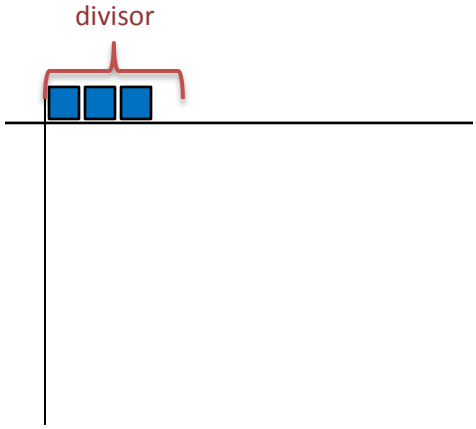
12 ÷ 3 = 4

**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*

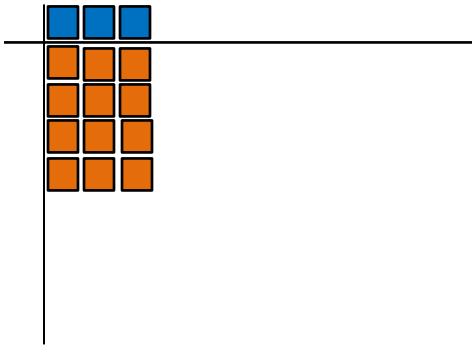
<u>Array and Area Model</u> (3.OA.2, 3.OA.3)

12 ÷ 3

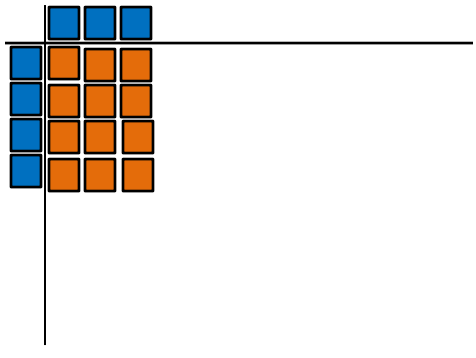
Step 1: Build one dimension (divisor) of the rectangle as a guide



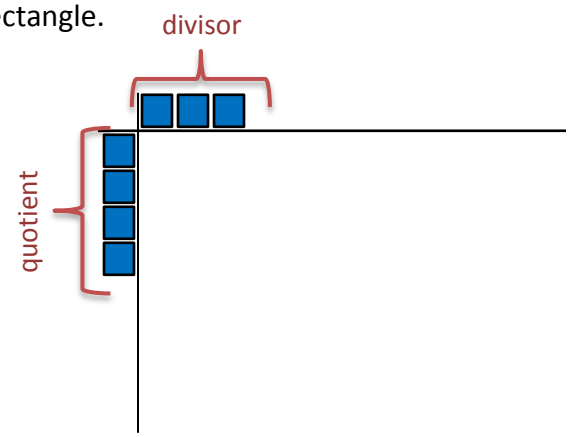
Step 2: Get blocks equivalent to the dividend (area). Build the area of the rectangle using the guide as one of the dimensions. Trade blocks as needed.



Step 3: Build the other dimension (**quotient**) of the rectangle.



12 ÷ 3 = 4



**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*

Division Strategies

"*General methods for computing quotients of multi-digit numbers and one-digit numbers (4.NBT.6) rely on the same understandings as for multiplication, but these are cast in terms of division. For example, students may see division problems as knowing the area of a rectangle but not one side length (the quotient), or as finding the size of a group when the number of groups is known (measurement division)*"

- **Grade Four, California Mathematics Framework**

"Division strategies in grade five extend the methods learned in grade four to two-digit divisors. Students continue to break the dividend into base-ten units and find the quotient place by place, starting from the highest place. They illustrate and explain their calculations by using equations, rectangular arrays, and/or area models."

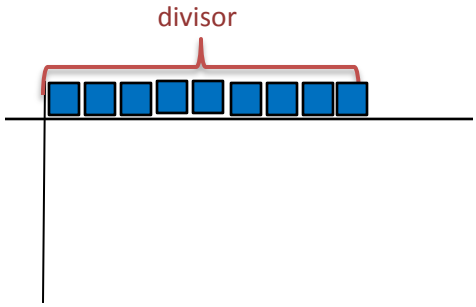
- Grade Five, California Mathematics Framework

**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*

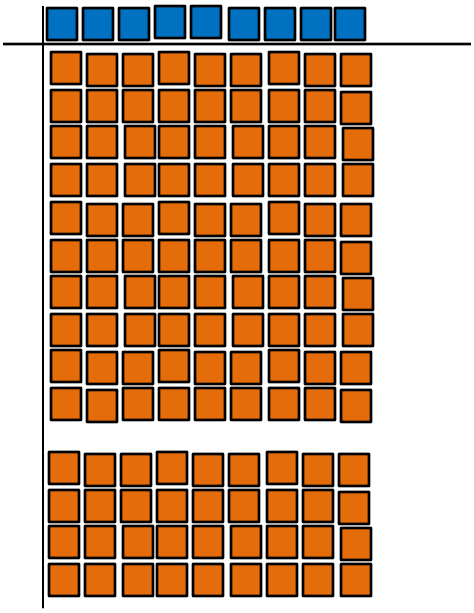
<u>Array and Area Model</u> (4.NBT.6*, 5.NBT.6)**

126 ÷ 9

Step 1: Build one dimension (divisor) of the rectangle as a guide



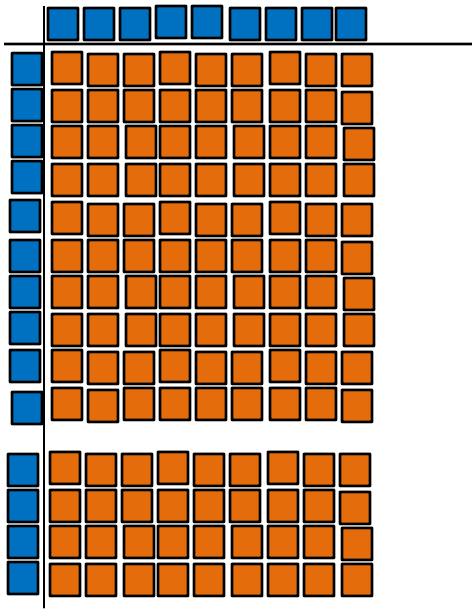
Step 2: Get blocks equivalent to the area (dividend) of the rectangle. Build the area of the rectangle using the guide as one of the dimensions. Trade blocks as needed.

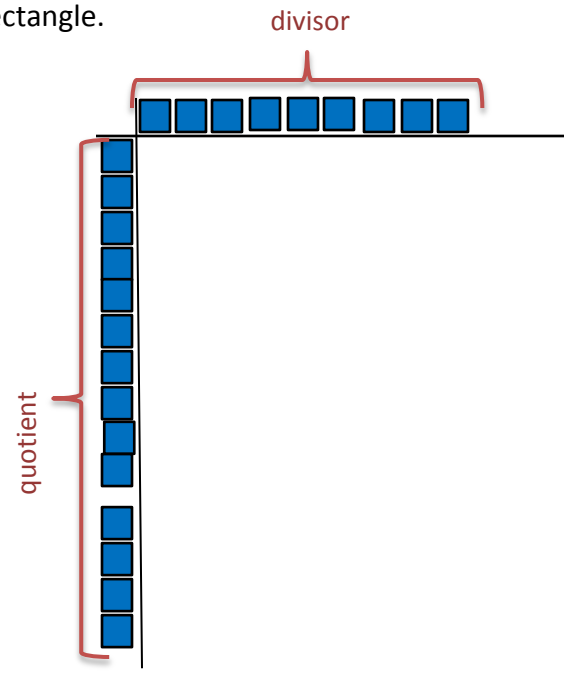


It would take too long to count 126 unit cubes or tiles to fill in the area. This is an opportunity to practice number sense. Ask students about the most efficient method to fill in the area. Possible answer is filling it fist by the tens blocks because 9x 10 = 90 and using the unit cubes to fill in the remaining area.

**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*

Step 3: Build the other dimension (**quotient**) of the rectangle.





126 ÷ 9 = 14

**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*

In developing **Division Strategies** using **Open Area Model**, students should have a deep understanding of multiplication including multiplication by multiples of 10 and 100. The worksheet below can aid in checking for understanding of this concept/skill.

Solve mentally.

4 x 1 = _____	**4 x 10 =_____**	**4 x 100 = _____**
4 x 2 = _____	**4 x 20 = _____**	**4 x 200 = _____**
4 x 6 = _____	**4 x 60 = _____**	**4 x 600 = _____**
3 x _____ = 6	**3 x _____ = 180**	**3 x _____ = 270**
3 x _____ =30	**3 x _____ = 60**	**3 x _____ = 300**
_____ x 4 = 24	**_____ x 30 = 240**	**7 x _____ = 210**
_____ x 40 = 160	**4 x _____ = 800**	**5 x 30 = _____**

**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*

<u>Open Area Model</u> (4.NBT.6*, 5.NBT.6)**

Find the quotient: 536 ÷ 4

Step 1: Draw a rectangle. Label one side with the divisor and the area with the dividend.

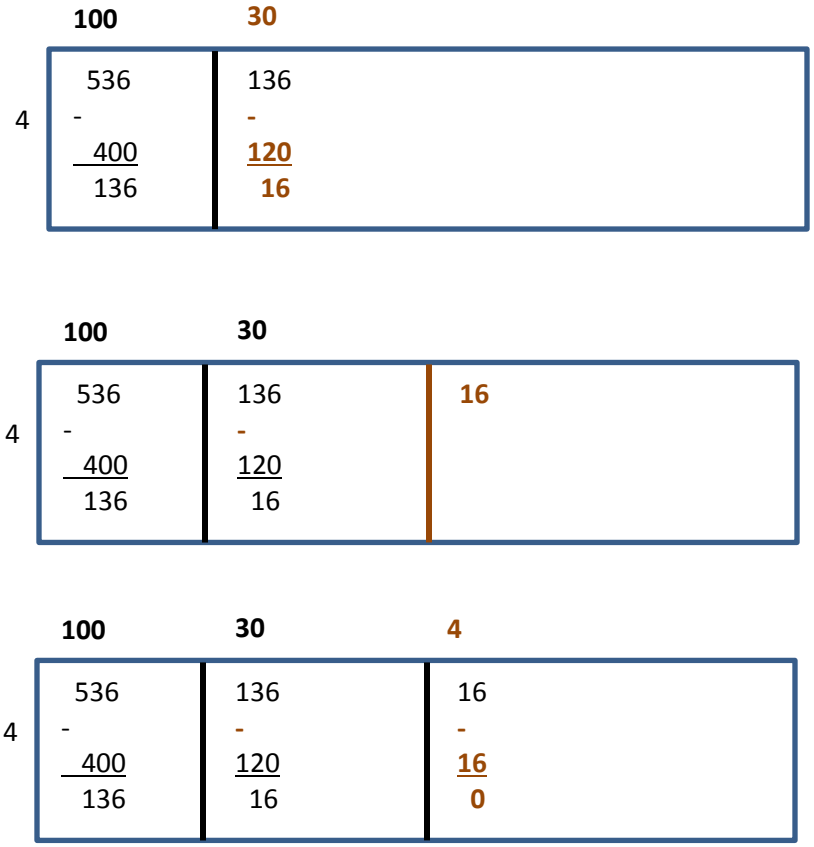
Step 2: Find the greatest factor that can be multiplied to the divisor to get a product closest to the given area. The greatest factor is usually a multiple of 10 or 100, depending on the highest place value of the area. Write this factor as a partial dimension of the other side of the rectangle.

Step 3: Find the difference between the dividend and the product of the divisor and factor found in step 2.

Step 4: Draw a vertical line on the rectangle and write the difference found.

**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*

Step 5: Repeat steps 2 to 4 until the difference is zero or less than the divisor.



Step 6: Add the partial factors or dimensions. The sum is the quotient.

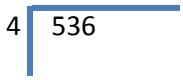
100 + 30 + 4 = 134

**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*

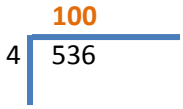
Partial Quotients (Stacking Method) (4.NBT.6*, 5.NBT.6)**

536 ÷ 4

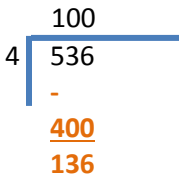
Step 1: Write the problem using long division algorithm symbol.



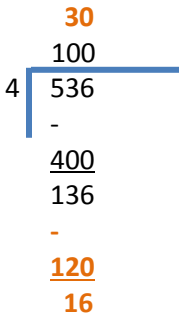
Step 2: Find the greatest factor that can be multiplied to the divisor to get a product closest to the given area. The greatest factor is usually a multiple of 10 or 100, depending on the highest place value of the area, or the number students are comfortable working with. Write this as a partial quotient.



Step 3: Find the difference between the dividend and the product of the divisor and factor found in step 2.



Step 4: Find the greatest factor that can be multiplied to the divisor to get a product closest to the difference found. The greatest factor is usually a multiple of 10 or 100, depending on the highest place value of the area, or the number students are comfortable working with. Write this as a partial quotient on top of the previously found partial quotient (stacked).



**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*

Step 5: Continue to find the partial quotients until the difference is zero or less than the divisor.

```
   4
  30
 100
4 536
  -
 400
 136
  -
 120
  16
  -
  16
   0
```

Step 6: Add the partial quotients to find the quotient of the given problem including any left overs.

```
   4
  30
 100
4 536
  -
 400
 136
  -
 120
  16
  -
  16
   0
```

4 + 30 +100 = 134

536 ÷ 4 = 134

**Up to 4-digit dividends and 1-digit divisor*
***Up to 4-digit dividends and 2-digit divisors*