Multiplication: Partial Products

Students move from area/array models (other side) to working with numbers.

Consider 26 x 45. We can break apart each factor by its place value.

26 = (20 + 6)
45 = (40 + 5)

We can then multiply each of the "parts" and add them back together.

$$(20 \times 40) + (20 \times 5) + (40 \times 6) + (6 \times 5)$$
$$800 + 100 + 240 + 30$$
$$900 + 240 + 30$$
$$1{,}140 + 30$$
$$1{,}170$$

So, 26 x 45 = 1,170

It might seem like a lot of numbers above. But when we think about it, the multiplication is quite simple. This understanding develops mental math, the traditional algorithm, and algebraic concepts, including factoring polynomials.

Sometimes, it makes sense to work with different parts. Consider 51 x 21. We might think of 21 as 10 + 10 + 1:

$$(51 \times 10) + (51 \times 10) + (51 \times 1)$$
$$510 + 510 + 51$$
$$1{,}020 + 51$$
$$1{,}071$$

So, 51 x 21 = 1,071

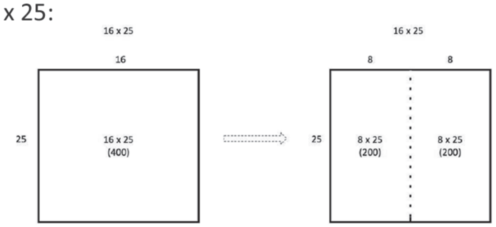
For another example, consider 4 x 327. We can break 327 into (300 + 20 + 7) and then multiply.

$$4 \times 300 = 1{,}200$$
$$4 \times 20 = 80$$
$$+ \quad 4 \times 7 = 28$$
$$1{,}308$$

So, 4 x 327 = 1,308

Halve and Double

There are many strategies we can take advantage of so that computation is efficient. Doubling and halving is an example. When multiplying, we can double one factor and halve the other. The product is unchanged. This makes some numbers easier to work with. Consider 16 x 25:



Division

Fourth-grade students are beginning to develop an understanding of division with larger numbers. One approach is to take groups of numbers—usually "friendly numbers"—out.

Consider this:
We have 252 buttons to put in 4 boxes. How many buttons can we put in each box? (252 ÷ 4)

We can put 50 in each box (4 x 50) = 200
We can put 10 in each box (4 x 10) = 40
We can put <u>3</u> in each box (4 x 3) = <u>12</u>
63 252

So, we can put 63 buttons in each box.
252 ÷ 4 = 63

Another approach is to break apart the dividend into "friendly numbers." Consider 252 ÷ 4. We could break 252 into (240 + 12) and divide each by 4.

240 ÷ 4 = 60 60 + 3 = 63
12 ÷ 4 = 3 So, 252 ÷ 4 = 63

Developing Computational Fluency

Grade 4

Elementary Mathematics Office
Howard County Public School System

This brochure highlights some of the methods for developing computational fluency.

For more information about computation and elementary mathematics, visit https://hcpss.instructure.com/courses/34430/pages/grade-4-star-mathematics-overview

Addition: Partial Sums

Many times, it is easier to break apart addends. Often, it makes sense to break them apart by their place value. Consider 248 + 345:

248 = 200 + 40 + 8
345 = 300 + 40 + 5
500 + 80 + 13 = 593

Sometimes, we might use partial sums in different ways to make an easier problem. Consider 484 + 276:

484 = 400 + 84
276 = 260 + 16
660 + 100 = 760

Addition: Adjusting

We can adjust addends to make them easier to work with. We can adjust by giving a value from one addend to another.

Consider 326 + 274. We can take 1 from 326 and give it to 274.

326 + 274
-1 +1
More Friendly Problem → 325 + 275 = 600

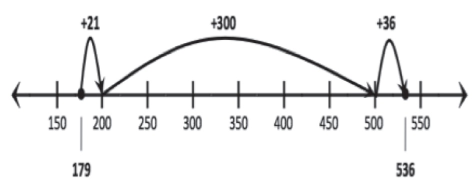
Consider 173 + 389. We can take 27 from 389 and give it to 173 to make 200.

173 + 389
+ 27 -27
More Friendly Problem → 200 + 362 = 562

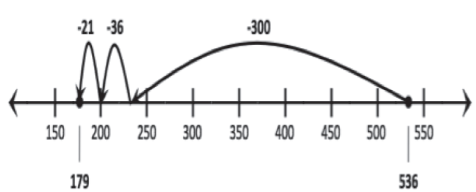
Subtraction: Count Up or Count Back

When subtracting, we can count back to find the difference of two numbers. In many situations, it is easier to count up.

Consider 536 – 179



We can count up from one number to the other. The difference is 300 + 21 + 36, or 357.



We can count back from one number to the other. The difference is -300 (land at 236), -36 (land at 200), -21 (end at 179).

Subtraction: Adjusting

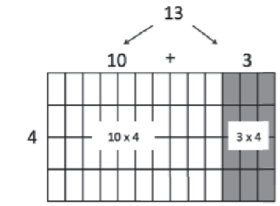
We can use "friendlier numbers" to solve problems. 4,000 – 563 can be challenging to regroup. But the difference between these numbers is the same as the difference between 3,999 – 562. Now, we don't need to regroup.

(Original problem)	4,000	-	563 =
(Compensation)	- 1		- 1
	3,999	-	562 = 3,437

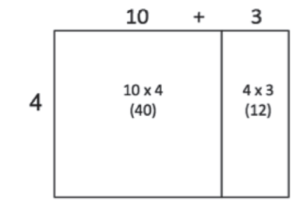
Multiplication: Area/Array

The area/array model for multiplication and the distributive property are used to solve multiplication problems.

13 x 4 =
(10 x 4) + (3 x 4) =
40 + 12 =
52

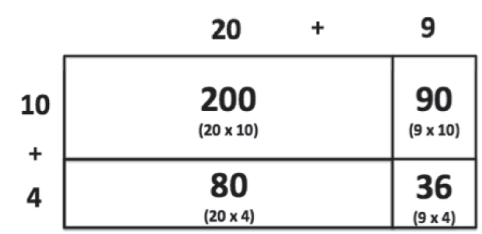


This is the same model without grid lines. It is considered an "open model."



40 + 12 = 52

The open model also works well with two- or three-digit factors. This supports development of algorithms later, as well as mental mathematics. Consider 29 x 14:



200 + 90 + 80 + 36 = 406 So, 29 x 14 = 406

Multiplication: Multiples of 10

Understanding why we "add zeros."

3 x 6 = 18
3 x 6 tens = 18 tens
3 x 60 = 180

20 x 40 =
(2 x 10) x (4 x 10) =
2 x 4 x 10 x 10 =
8 x 100 = 800