

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 $248 + 345$

$$\begin{aligned} 248 &= 200 + 40 + 8 \\ 345 &= 300 + 40 + 5 \\ 500 + 80 + 13 &= 593 \end{aligned}$$

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

$$\begin{aligned} 484 &= 400 + 84 \\ 276 &= 260 + 16 \\ 660 + 100 &= 760 \end{aligned}$$

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.

$$\begin{array}{r} 326 + 274 \\ -1 \quad +1 \\ \hline 325 + 275 = 600 \end{array}$$

More Friendly Problem \longrightarrow

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

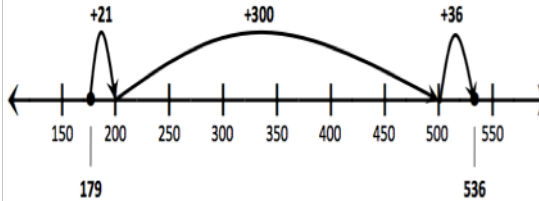
$$\begin{array}{r} 173 + 389 \\ +27 \quad -27 \\ \hline 200 + 362 = 562 \end{array}$$

More Friendly Problem \longrightarrow

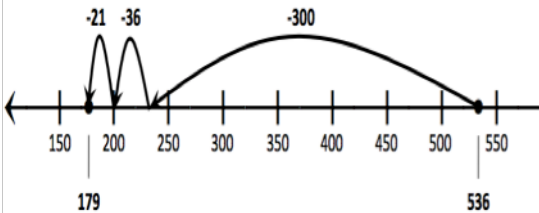
Subtraction: Count Up or Count Back

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. (above)



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

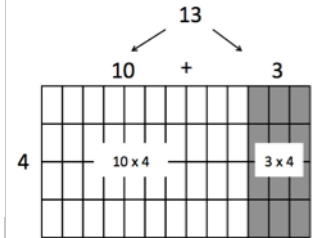
We can use "friendlier numbers" to solve problems. $4,000 - 563$ can be challenging to regroup. But the difference between these numbers is the same as the difference between $3,999 - 562$. Now, we don't need to regroup.

$$\begin{array}{r} \text{(Original problem)} \quad 4,000 \quad - \quad 563 = \\ \text{(Compensation)} \quad -1 \quad \quad \quad -1 \\ \hline 3,999 \quad - \quad 562 = 3,437 \end{array}$$

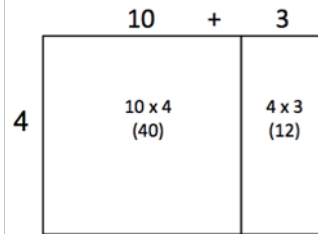
Multiplication: Area/Array

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

$$\begin{aligned} 13 \times 4 &= \\ (10 \times 4) + (3 \times 4) &= \\ 40 + 12 &= \\ 52 & \end{aligned}$$



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



$$40 + 12 = 52$$

The open model also works well with 2 or 3-digit factors. This supports development of algorithms later, as well as mental mathematics. Consider 29×14

$$\begin{array}{r} 20 \quad + \quad 9 \\ 10 \quad \begin{array}{|c|c|} \hline 200 & 90 \\ \hline \end{array} \\ + \\ 4 \quad \begin{array}{|c|c|} \hline 80 & 36 \\ \hline \end{array} \\ \hline 200 + 90 + 80 + 36 = 406 \quad \text{So, } 29 \times 14 = 406 \end{array}$$

Multiplication: Multiples of 10

Understanding why we "add zeros."

$$\begin{array}{ll} 3 \times 6 = 18 & 20 \times 40 = \\ 3 \times 6 \text{ tens} = 18 \text{ tens} & (2 \times 10) \times (4 \times 10) = \\ 3 \times 60 = 180 & 2 \times 4 \times 10 \times 10 = \\ & 8 \times 100 = 800 \end{array}$$

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 <http://smart.wikispaces.hcpss.org>

Multiplication: Partial Products

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

Consider 26×45 , we can break apart each factor by its place value.

$26 = (20 + 6)$ We can then multiply each
 $45 = (40 + 5)$ of the "parts" and add them back together.

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

So, $26 \times 45 = 1,170$ 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 51×21 . We might think of 21 as $10 + 10 + 1$:

$$\begin{array}{r} (51 \times 10) + (51 \times 10) + (51 \times 1) \\ 510 + 510 + 51 \\ 1,020 + 51 \end{array}$$

So, $51 \times 21 = 1,071$ 1,071

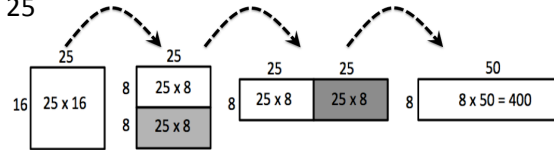
Another example, consider 4×327 . We can break 327 into $(300 + 20 + 7)$ then multiply.

$$\begin{array}{r} 4 \times 300 = 1,200 \\ 4 \times 20 = 80 \\ + 4 \times 7 = 28 \end{array}$$

So, $4 \times 327 = 1,308$ 1,308

Doubling and Halving

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 16×25



The image shows that we can halve 16 ($8 + 8$) and then double 25. So, 16×25 is the same as 8×50 .

Division

4th 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? ($252 \div 4$)

We can put 50 in each box (4×50) = 200

We can put 10 in each box (4×10) = 40

We can put 3 in each box (4×3) = 12
63 252

So, we can put 63 buttons in each box.

$$252 \div 4 = 63$$

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

$$240 \div 4 = 60$$

$$60 + 3 = 63$$

$$12 \div 4 = 3$$

$$\text{So, } 252 \div 4 = 63$$