

### 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 →

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 →

### Addition: Traditional Algorithm

This algorithm is useful for adding large numbers. We add place values and regroup when needed.

$$\begin{array}{r} \phantom{0}^1 \phantom{0}^1 \\ 13,089 \\ + 4,684 \\ \hline 17,773 \end{array}$$

### Subtraction: Count Up or Count Back

When subtracting, we can count back to find the difference of 2 numbers. In many situations, it is easier to count up. Consider  $536 - 179$ .

#### Counting Up

$$\begin{aligned} 179 + 21 &= 200 \\ 200 + 300 &= 500 \\ 500 + \underline{36} &= 536 \\ &\quad 357 \end{aligned}$$

The total of our **counting up** is 357.  
So,  $536 - 179 = 357$

#### Counting Back

$$\begin{aligned} 536 - 36 &= 500 \\ 500 - 300 &= 200 \\ 200 - \underline{21} &= 179 \\ &\quad (-) 357 \end{aligned}$$

The total of our **counting back** is 357.  
So,  $536 - 179 = 357$

### 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.

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

### Subtraction: Traditional Algorithm

This algorithm is useful for subtracting large numbers. We regroup when necessary.

$$\begin{array}{r} \phantom{0}^8 \phantom{0}^1 \\ 14,290 \\ - 3,236 \\ \hline 11,054 \end{array}$$

### Multiplication: Partial Products

Students move from area/array models to working with numbers.

Consider  $26 \times 45$ , 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.

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

So,  $26 \times 45 = 1,170$

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  $51 \times 21$ . We might think of 21 as  $10 + 10 + 1$ :

$$\begin{aligned} (51 \times 10) + (51 \times 10) + (51 \times 1) \\ 510 \quad + \quad 510 \quad + \quad 51 \\ 1,020 \quad + \quad 51 \\ \hline 1,071 \end{aligned}$$

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

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

$$\begin{aligned} 4 \times 300 &= 1,200 \\ 4 \times 20 &= 80 \\ + \quad 4 \times 7 &= 28 \\ \hline 1,308 \end{aligned}$$

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

### Multiplication: Partial Products Algorithm

In this algorithm, we break apart the numbers by place value to find parts of the product. We add them back together to get the final product. This algorithm begins in the **ones** place.

$$\begin{array}{r} 48 \\ \times 32 \\ \hline 16 \quad \longleftarrow (2 \times 8) \\ 80 \quad \longleftarrow (2 \times 40) \\ 240 \quad \longleftarrow (30 \times 8) \\ + 1200 \quad \longleftarrow (30 \times 40) \\ \hline 1,536 \end{array}$$

### Multiplication: Partial Products Algorithm

In this algorithm, we break apart the numbers by place value to find parts of the product. We add them back together to get the final product. This algorithm begins in the **tens** place.

$$\begin{array}{r} 48 \\ \times 32 \\ \hline 1200 \quad \longleftarrow (40 \times 30) \\ 240 \quad \longleftarrow (30 \times 8) \\ 80 \quad \longleftarrow (40 \times 2) \\ + 16 \quad \longleftarrow (8 \times 2) \\ \hline 1,536 \end{array}$$

### Multiplication: Traditional Algorithm

This is a digit-based algorithm. It is useful for multiplying large numbers. We begin in the ones place and proceed to multiply each digit. We combine products of each place value.

$$\begin{array}{r} 48 \\ \times 32 \\ \hline 96 \quad \longleftarrow (2 \times 8) + (2 \times 40) \\ + 1440 \quad \longleftarrow (30 \times 8) + (30 \times 40) \\ \hline 1,536 \end{array}$$

### Division\*

5<sup>th</sup> grade students continue 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 ( $4 \times 50 = 200$ )

We can put 10 in each box ( $4 \times 10 = 40$ )

We can put 3 in each box ( $4 \times 3 = 12$ )

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.

$$240 \div 4 = 60$$

$$60 + 3 = 63$$

$$12 \div 4 = 3$$

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

We may also consider Think Multiplication to work with division. Consider  $932 \div 45$ .

We can think of “What times 45 equals 932?”

We might think  $45 \times 10 = 450$ , so...

$$45 \times 20 = 900$$

20 groups of 45 is 900. We have 32 leftover but that is not enough for another group.

$932 \div 45 = 20$  with 32 leftover.

\* The long division algorithm is introduced in grade 6 after students develop deep understanding of grouping and division.

# Developing Computational Fluency

Grade 5



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>