Helping your child with Maths

Ashleigh Primary and Nursery School

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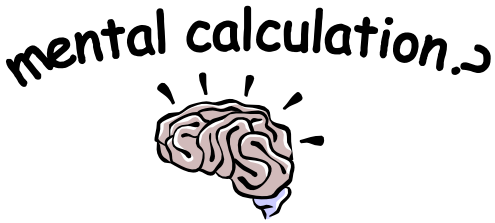
“They didn’t do it like that in my day!”

Do your children ask for help with their maths homework and start talking in a foreign language, using words like ‘partitioning’, ‘chunking’, ‘grid multiplication’…..?

If so, you may feel the need for some translation. This booklet is designed to explain some of the methods used to teach calculation in our school. They will still end up with the standard method we were taught, which links with the expectations in the New Mathematics Curriculum from September 2014. The difference is that they will build up to it and understand the method and why it works.

Which is more important:



or

This will depend on the numbers involved and the individual child.

When faced with a calculation, no matter how large or difficult the numbers may appear to be, all children should ask themselves:

Can I do this in my head?

Do I know the approximate size of the answer?

If I can’t do it wholly in my head, what do I need to write down in order to help me calculate the answer?

Will the written method I know be helpful?

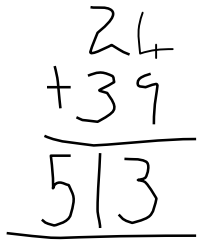
When do children need to start recording?

The following table shows how some sort of recording is relevant throughout the primary years with mental strategies playing an important role throughout. Children progress at different rates and the progression depends on the child's understanding.

Reception		Year6
← Making a record of a calculation →		
← Jotting to support a mental strategy →		
← Explaining a mental strategy →		
← Developing written methods →		

It is important to encourage children to look first at the problem and then get them to decide which is the best method to choose – pictures, mental calculation with or without jottings, structured recording or calculator.

Children attempting to use formal written methods without a secure understanding will try to remember rules, which may result in unnecessary and mistaken applications of a standard method.



Some of the methods explained in this booklet involve 'partitioning' and a set of place value cards are attached which can be pasted onto card and cut out (your child will show you how to use them).

Addition

Children are taught to understand addition as combining two sets and counting on.

2+3= ☐ At a party, I eat 2 cakes and my friend eats 3. How many cakes did we eat altogether? 	Children could draw a picture to help them work out the answer
8+4= ☐ 8 people are on the bus. 4 more get on at the next stop. How many people are on the bus now?  or 	Children could use dots or tally marks to represent objects (quicker than drawing a picture)

ADDITION

Using an informal method by counting on in multiples of 10 with a number line

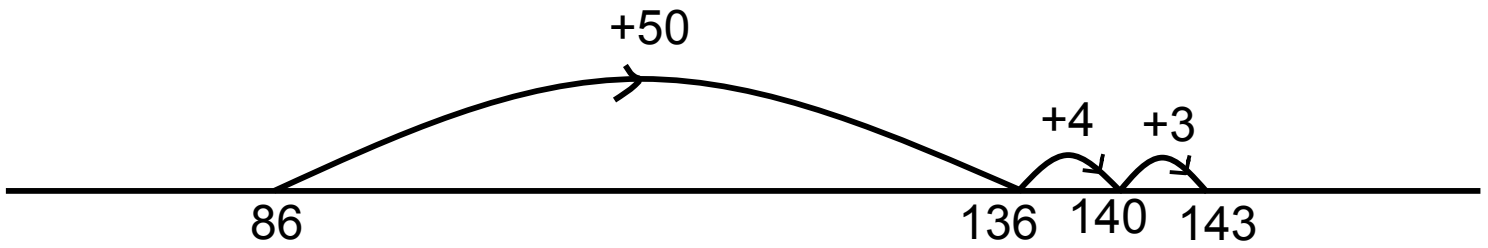
TU + TU

86 + 57

TU + TU

86 + 57

Start at 86 (the larger number) on the number line. *Partition* the smaller number 57 into tens and units and count on the multiples of 10 first and then the units.



86 + 57 = 143

ADDITION

Using a number line to add too much and then subtract *(compensate)*

HTU + TU

754 + 96

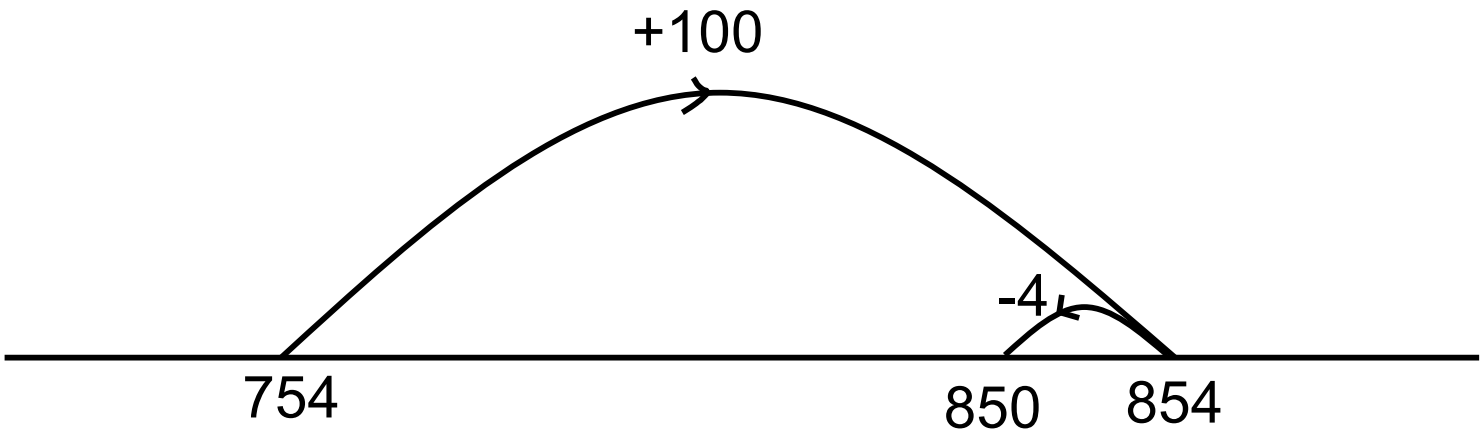
Why are you subtracting when you should be adding?

I noticed that 96 is close to 100. 100 is easier to add than 96 but that means I've added 4 too many. I need to subtract 4 from the number I reach.

HTU + TU

754 + 96

Start with the larger number 754. Add on 100 and then subtract 4.



754 + 96 = 850

ADDITION

HTU + TU

625 + 148

Expanded method: moving on from adding the *most significant digits* first to adding *least significant digits* first

Why switch to adding the units *(least significant digits)* first?

I know that I can add numbers in any order and the total will be the same. My teacher has told me that I need to practise adding the units first. The next method I will learn works this way. I must remember to line the numbers up in the correct columns.

HTU + HTU

625 + 148

Add *most significant digits* first:
(in this example, **hundreds**)

625	
+ 148	
700	600 + 100
60	20 + 40
13	5 + 8
773	

Add *least significant digits* first:
(in this example, **units**)

625	
+ 148	
13	5 + 8
60	20 + 40
700	600 + 100
773	

Mentally add

700 + 60 + 13 = 773

625 + 148 = 773

ADDITION

Using a standard method

HTU + HTU

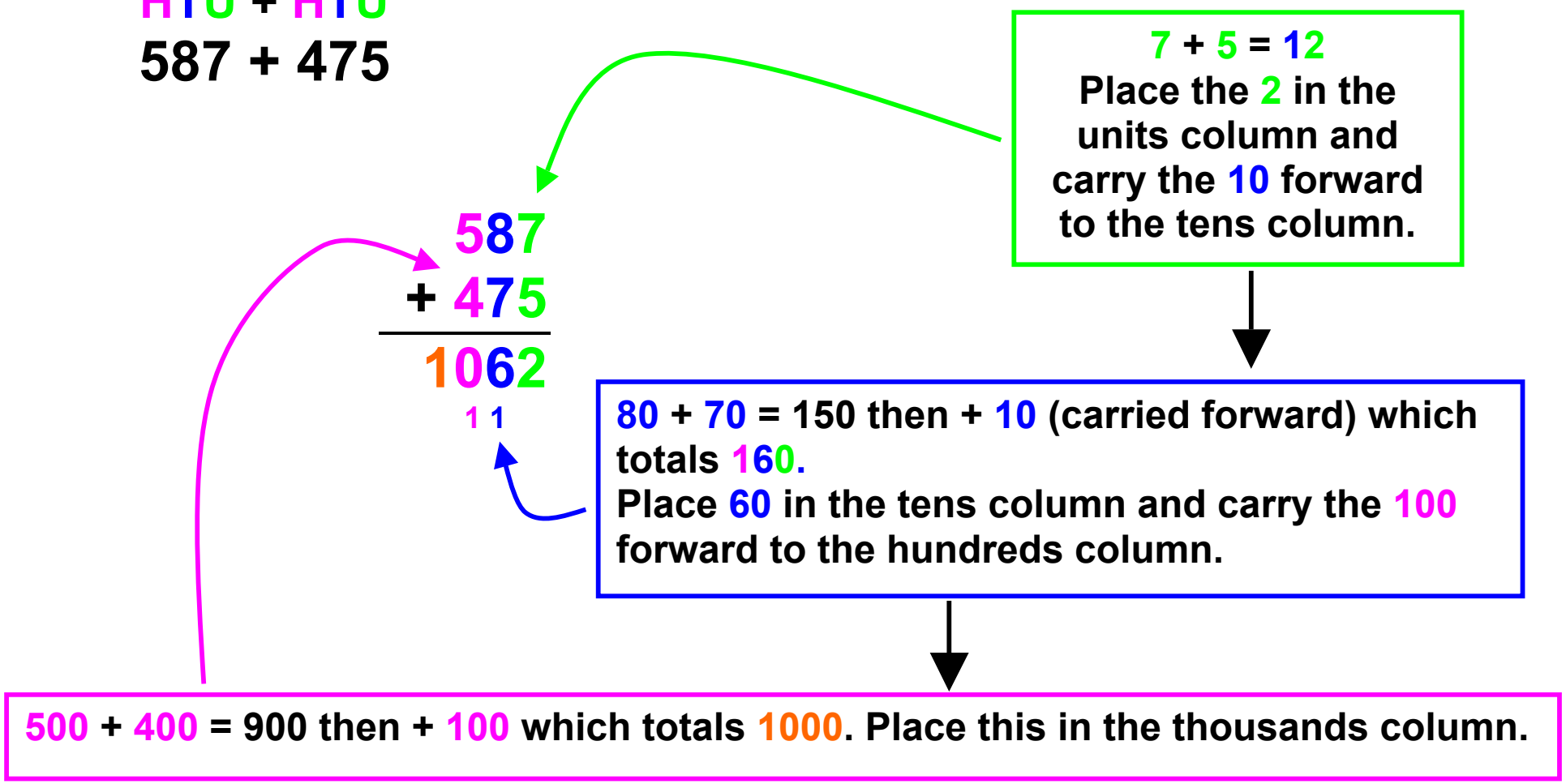
587 + 475

Why do you say 80 + 70 instead of 8 + 7?

I need to remember the value of each digit, so I know the size of the numbers I am adding and whether my answer makes sense.

HTU + HTU

587 + 475



587 + 475 = 1062

Subtraction

Children are taught to understand subtraction as taking away (counting back) and finding the difference (counting up)

5-2=☐ I had five balloons. Two burst. How many did I have left?  Take away A teddy bear costs £5 and a doll costs £2. How much more does the bear cost?  Find the difference	Drawing a picture helps children to visualise the problem.
8-3=☐ Mum baked 8 biscuits. I ate 3. How many were left?  Take away Lisa has 8 felt tip pens and Tim has 3. How many more does Lisa have?  Find the difference	Using dots or tally marks is quicker than drawing a detailed picture.

SUBTRACTION

Ⓐ Counting on or Ⓑ counting back?

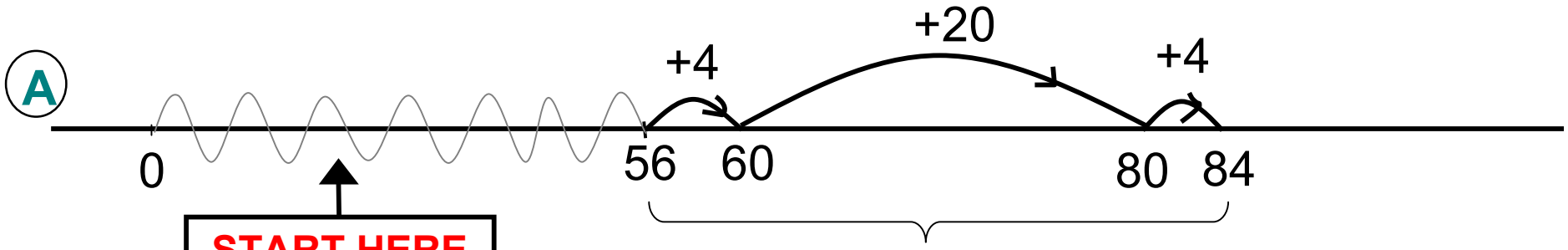
TU - TU

84 - 56

How do you decide whether to count on or count back?

If the numbers are close together like 203 – 198 it's quicker to count on. If they're a long way apart like 203 – 5 it's quicker to take away. Sometimes I count on because that's easier than taking away.

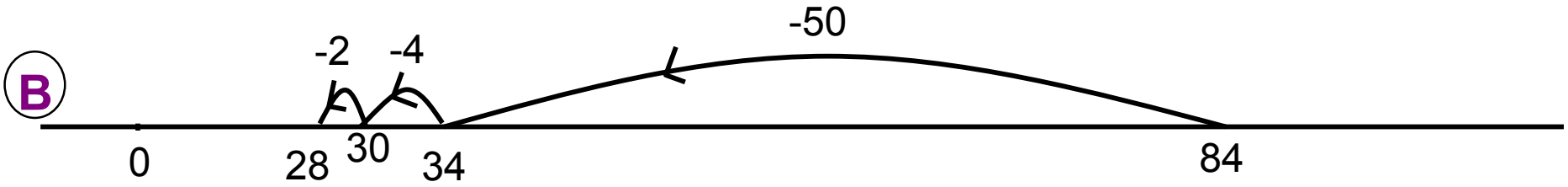
TU - TU
84 - 56



START HERE

Start by 'taking away' (crossing out) the 56.

Find the *difference* between the two numbers.
Count on from 56 to 84.
20 + 4 + 4 = 28



Partition 56 and count back (subtract) 50 and then 6.

START HERE

84 – 56 = 28

SUBTRACTION

HTU - HTU

954 - 586

Complementary addition

A Number line

B Written method

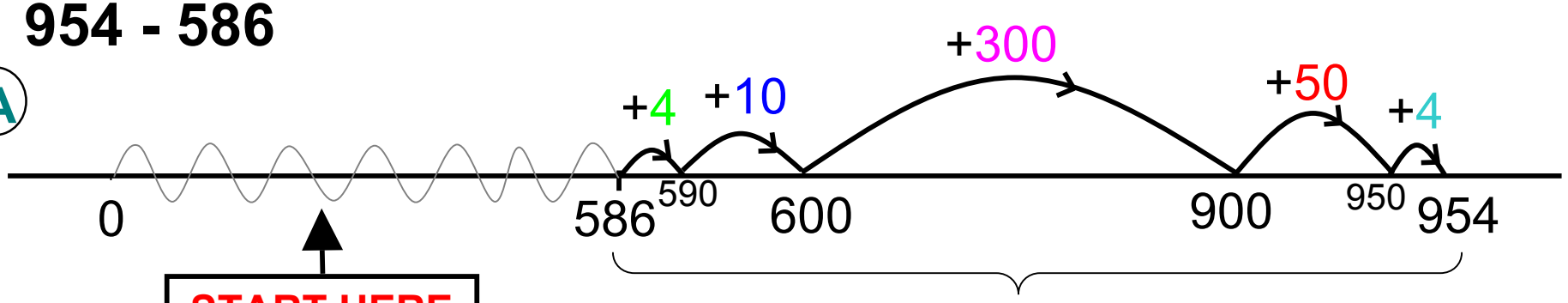
The number line method is very clear. Why do you use method B and write the numbers vertically?

I could make mistakes. Method B helps me line the numbers up and see what I need to add.

HTU - HTU

954 - 586

A



START HERE

'Take away' the 586.

Find the *difference* between the two numbers.
Count on from 586 to 954.
300 + 50 + 10 + 4 + 4 = 368

B

START HERE

Count on to the next multiple of 10.

Count on to the next multiple of 100.

Count on in 100s.

Count on to the larger number in the calculation which is 954.

954	
- 586	
4	To make 590
10	To make 600
300	To make 900
50	To make 950
4	To make 954
368	

954 - 586 = 368

SUBTRACTION

Working towards a standard method *(decomposition)*

HTU - TU

154 - 37

Why do you need to rearrange the numbers 50 + 4 and rewrite them as 40 + 14?

The whole number is 154. It is possible to subtract 7 but for this method I need to do one subtraction in each column. So I exchange one ten from the tens column for ten ones in the units column.

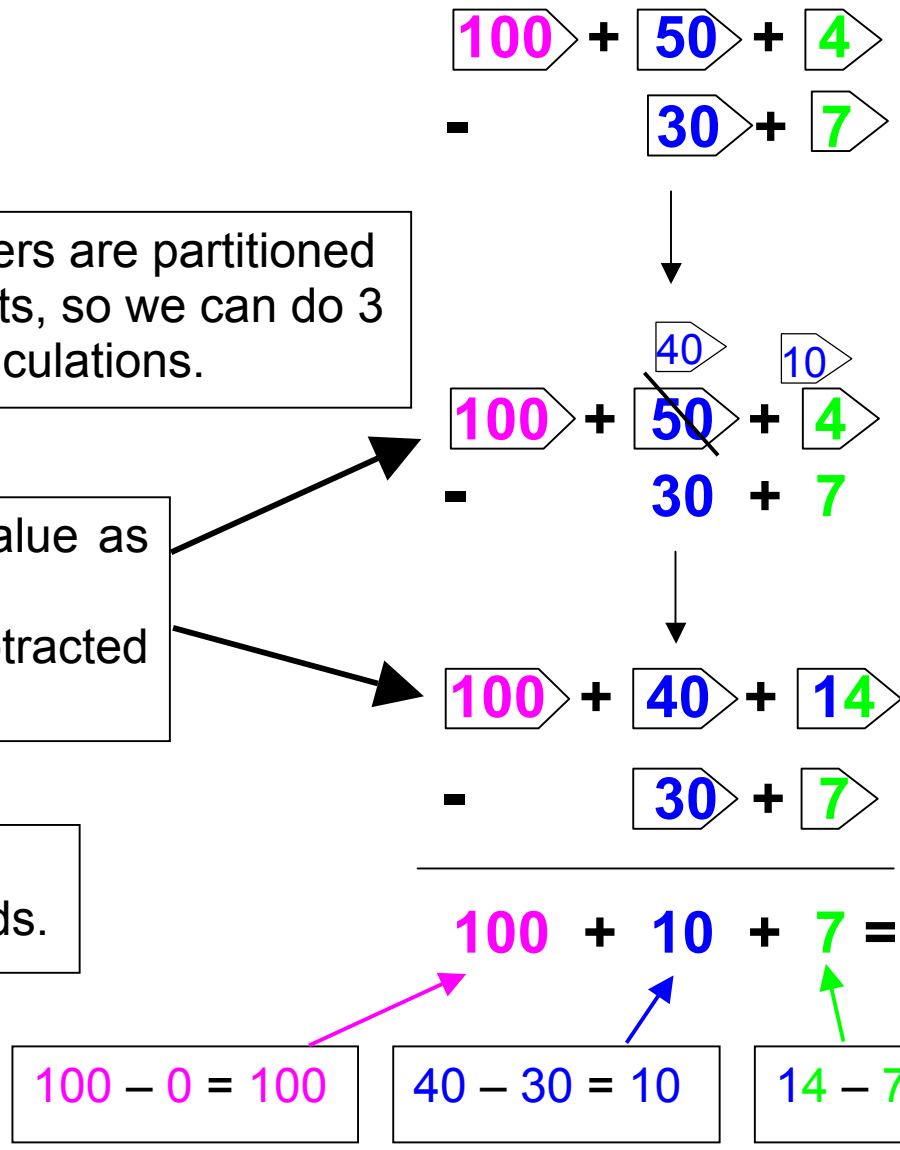
HTU - TU

154 - 37

Both these numbers are partitioned into their HTU parts, so we can do 3 easier calculations.

54 is the same value as 40 10 4.
Now 7 can be subtracted from 14.

Subtract the units, tens, then hundreds.



Here the answers from each calculation are added to give the answer.

154 - 37 = 117

SUBTRACTION

Standard method *(**decomposition**)*

HTU - HTU

754 - 286

Why didn't you use the standard method straight away?

Because all the stages I have learnt before have really helped me understand exactly what I'm doing.

HTU - HTU

754 - 286

54 is the same value as 40 10 4.
Now 6 can be subtracted from 14.

740 is the same value as 600 + 100 + 40.
Now 80 can be subtracted from 140.

Or, more efficiently the *standard method.*

$$\begin{array}{r} {}^{40}\not{5}0 \quad {}^{1}4 \\ 700 + \quad + \\ -\ 200 + 80 + 6 \end{array}$$

$$\begin{array}{r} {}^{600}\not{7}00 \quad {}^{1}40 \\ + \quad + 14 \\ -\ 200 + 80 + 6 \end{array}$$

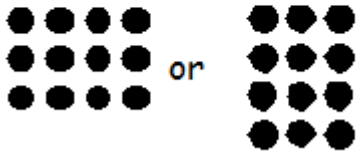
$$\begin{array}{r} 600 + 140 + 14 \\ -\ 200 + 80 + 6 \\ \hline 400 + 60 + 8 = 468 \end{array}$$

$$\begin{array}{r} {}^{6}\not{7}{}^{1}5{}^{1}4 \\ -\ 286 \\ \hline 468 \end{array}$$

754 – 286 = 468

Multiplication

Children are taught to understand multiplication as repeated addition and scaling. It can also describe an array.

2x4= □ Each child has two eyes. How many eyes do four children have?  2 + 2 + 2 + 2	Again a picture can be useful.
5x3= □ There are 5 cakes in a pack. How many cakes in 3 packs?  5 + 5 + 5	Dots or tally marks are often drawn in groups. This shows 3 lots of 5.
4x3= □ A chew costs 4p. How much do 3 chews cost?  or	Drawing an array (3 rows of 4 or 3 columns of 4) gives children an image of the answer. It also helps develop the understanding that 4x3 is the same as 3x4.

MULTIPLICATION

Introducing multiplication on a number line

TU X U

14 x 5

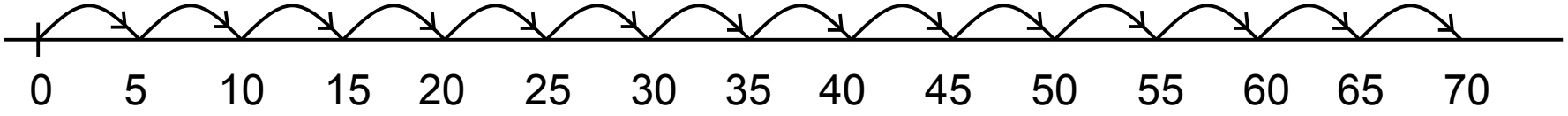
How is multiplication the same as repeated addition?

The number line helps me see each group of 5 clearly. If I add 5 fourteen times, that is the same as 5 multiplied by 14 (5 x 14). I can make 14 individual jumps of 5 along the number line, or 1 jump of 5 x 10 and 1 jump of 5 x 4. Table facts will help me do this more quickly.

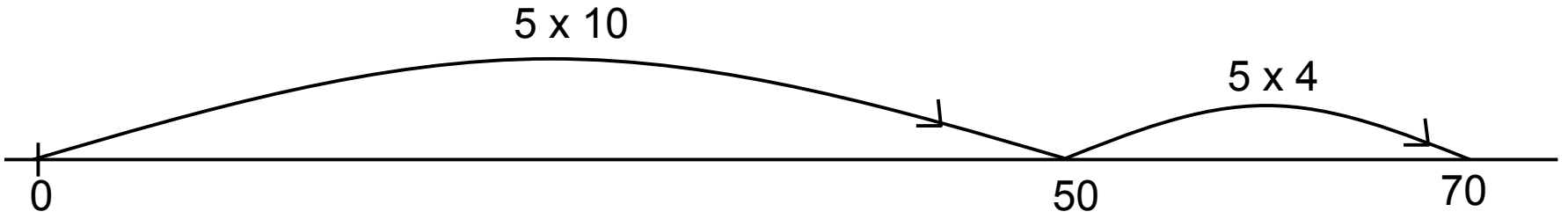
TU x U

14 x 5

The number line shows 5 multiplied by 14. This is equal to 14 multiplied by 5 (14 jumps of 5 on the number line).



Multiplication is *repeated addition*.



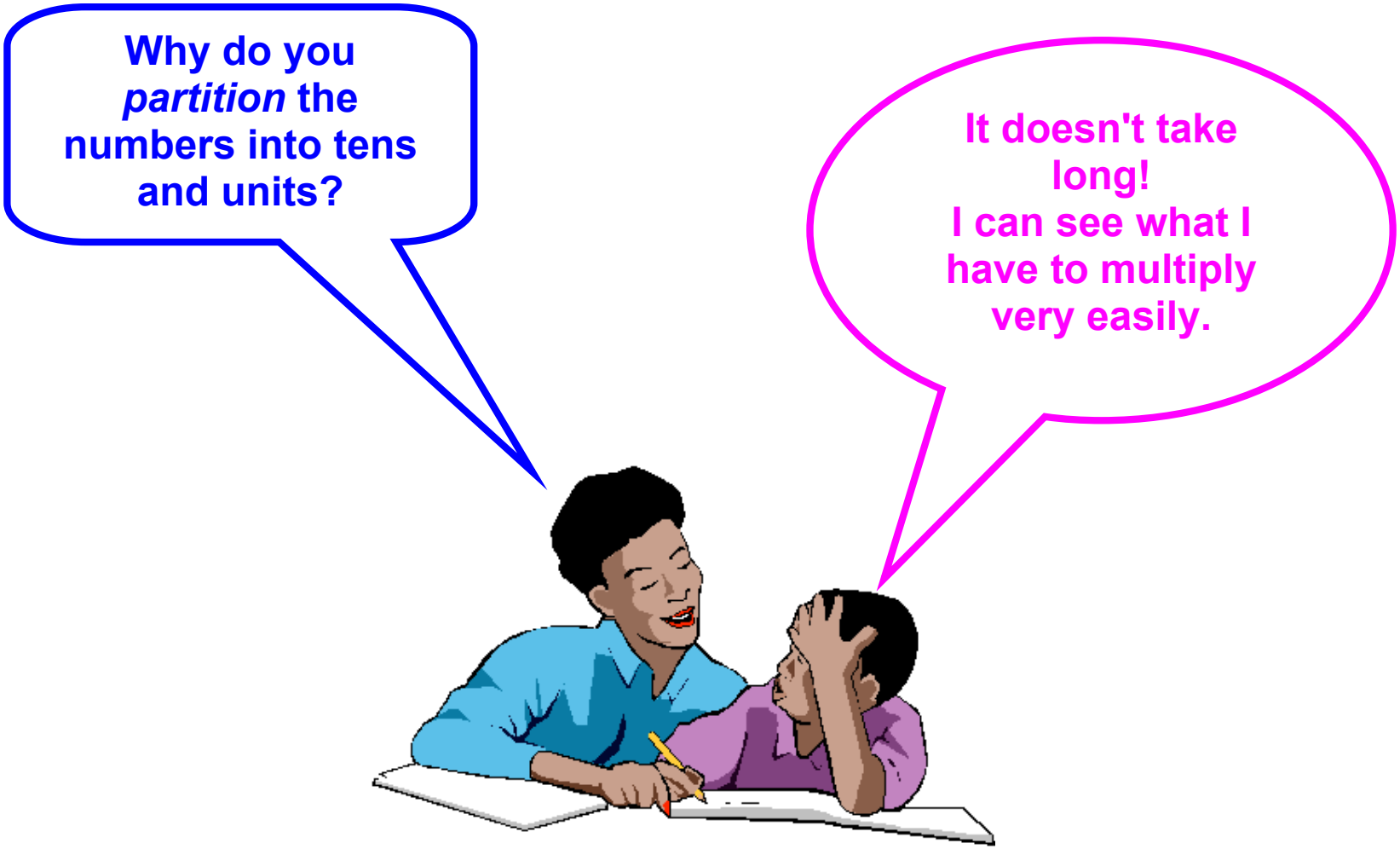
Using table facts to make bigger jumps is more efficient.

14 x 5 = 70

GRID MULTIPLICATION

TU X U

14 x 5



TU X U

14 x 5

Partition TU number into tens and units parts.

14 becomes 10 and 4

14 x 5

X	10	4	
5	50	20	**70**

50 comes from multiplying 10 by 5. It is called a *part-product*.

20 comes from multiplying 4 by 5. Another *part-product*.

The *part – products* are totalled to give the *final product* or answer of 70.

14 x 5 = 70

GRID MULTIPLICATION

TU X TU

46 x 32

Isn't it difficult to multiply 40 by 30?

I know that 30 is 3 x 10 and multiplying by 10 is easy so I do 40 x 3 x 10 = 120 x 10 = 1200.

You've got to do a lot of calculations – don't you get confused?

The layout of the grid helps me organise what I have to do. I like this method.

TU X TU

46 x 32

Both numbers are *partitioned* into their tens and units parts, 46 becomes 40 and 6 and 32 becomes 30 and 2.

46 x 32

X	40	6	
30	1200	180	1380
2	80	12	92
			1472

The *part products* are added in stages to give the final *product* or answer of 1472.

46 x 32 = 1472

MULTIPLICATION

Grid method, Expanded method and Compact method

TU X U

23 x 8

What are the brackets for in the expanded method?

They remind me which numbers I am multiplying.
I also have to remember to line the numbers up as hundreds, tens and units.

Why do you multiply 3 by 8 first in the compact method?
In all the other methods I've noticed that you've multiplied the tens number first!

I multiply the units first so I can carry forward any tens I need to!
This method is very quick but I have to remember to add on any numbers I carry forward.

TU x U
23 x 8

GRID METHOD

X	20	3	
8	160	24	184

EXPANDED METHOD

20 multiplied by 8 equals 160.
3 multiplied by 8 equals 24.

Final product from totalling the *part-products*.

HTU
23
x 8
160 (20 x 8)
24 (3 x 8)
184

COMPACT METHOD
(short multiplication)

HTU
23
x 8
184
2

3 multiplied by 8 equals 24 (the first *part product*).

2 is the 2 tens that need to be carried forward and added to the next *part product*.

20 multiplied by 8 equals 160 (2nd *part product*), **plus** the 2 tens equals 180.

The digits are put in the correct columns, to give the answer 184.

23 x 8 = 184

MULTIPLICATION

Grid method, Expanded method and Compact method

TU X TU

46 x 32

I recognise the long multiplication method. How do you multiply 46 by 30?

Well!… I know that 46 x 30 is the same as 46 x 3 x 10. I know my answer will end in zero when I multiply this whole number by 10. So… I put the zero in first. Then I multiply 46 x 3 using the short multiplication method.

TU X TU
46 x 32

GRID METHOD

X	40	6	
30	1200	180	1380
2	80	12	92
			1472

EXPANDED METHOD

The 4 *part products* are set out vertically underneath the calculation.

Part products totalled to give final product.

```
  46
x 32
1200   (40 x 30)
 180   (6 x 30)
  80   (40 x 2)
  12   (6 x 2)
1472
```

COMPACT METHOD
(long multiplication)

```
  46
x 32
1380   (46 x 30)
  92   (46 x 2)
1472
```

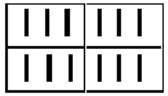
46 x 30 is the same as 46 x 3 x 10.

46 x 2 mentally or by short multiplication.

46 x 32 = 1472

Division

Children are taught to understand division as sharing and grouping

6÷2=☐ 6 lollies are shared between 2 children. How many lollies does each child get?  sharing between 2 There are 6 lollies. How many children can have two each?  grouping in 2's	More pictures! Drawing often gives children a way into solving the problem.
12÷4=☐ 12 apples are shared equally between 4 baskets. How many apples are in each basket?  sharing between 4 4 apples are packed in a basket. How many baskets can you fill with 12 apples?  grouping in 4's	Dots or tally marks can either be shared out one at a time or split up into groups.

DIVISION

Introducing division on a number line

TU ÷ U

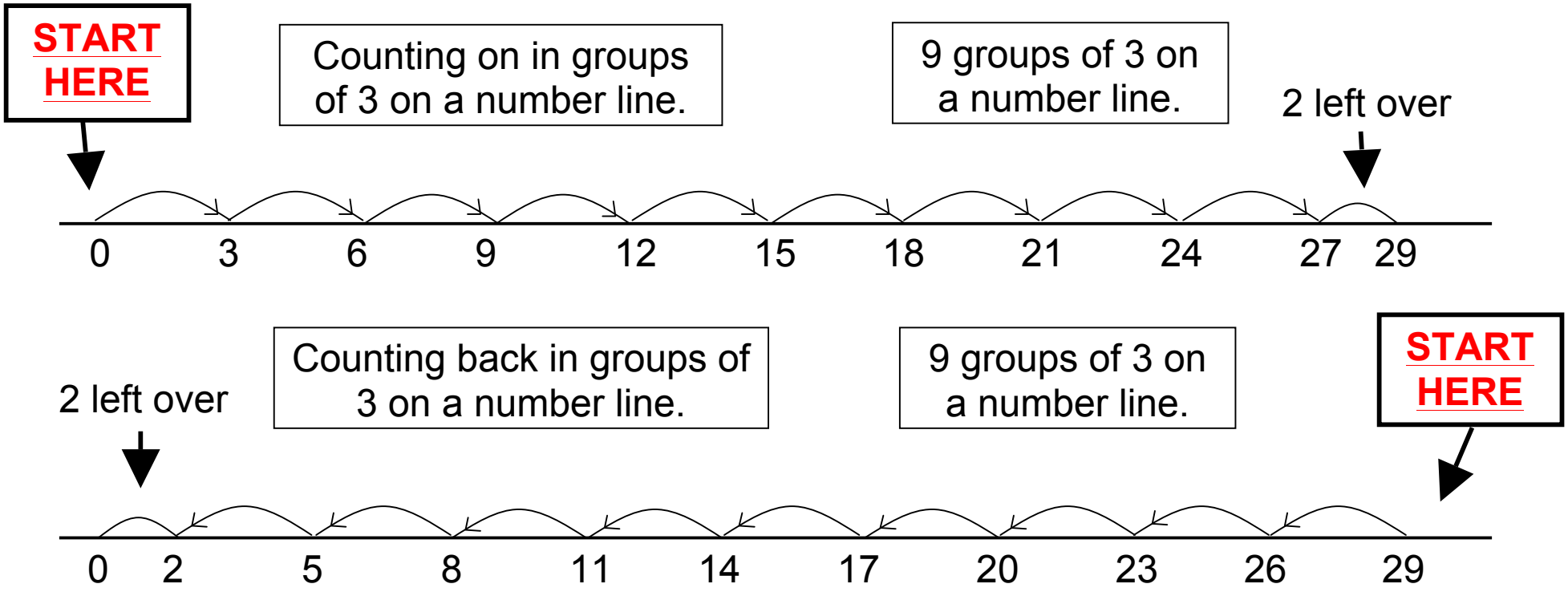
29 ÷ 3

Why are you adding on one line and subtracting on the other? And what has subtraction got to do with division?

I need to see how many groups of 3 there are in 29, so I either add on or take away groups of 3 until I can't add or take any more. Using the subtraction method will help me later on.

TU ÷ U

29 ÷ 3



There are 9 groups of 3 in 29, with 2 left over.

29 ÷ 3 = 9 r2

DIVISION

TU ÷ U

72 ÷ 5

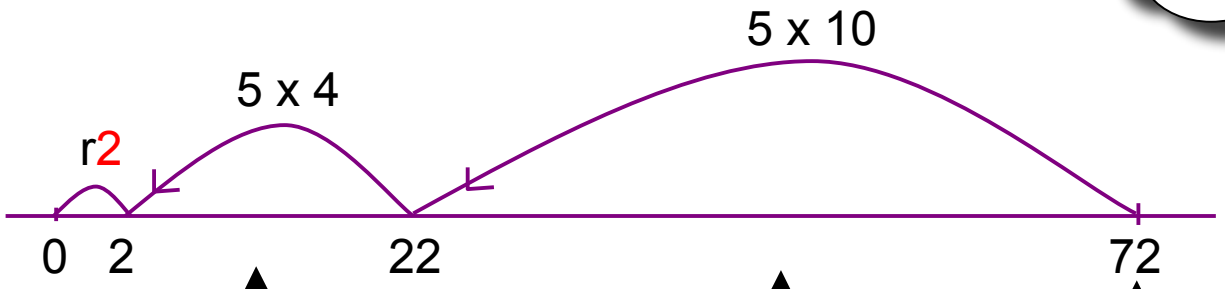
Chunking on a number line

I've never heard of chunking before! How does this help with division?

If I can, I try to take out 10 groups of the number I'm dividing by. This is a big chunk and makes the calculation easier. But I can take out chunks that are any number of groups.

TU ÷ U

72 ÷ 5



Subtract 4 groups of 5 (20) from 22 to land on 2.

Subtract 10 groups of 5 (50) from 72 to land on 22.

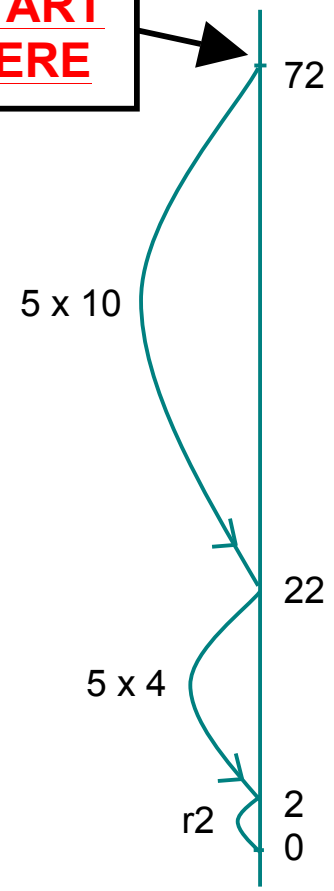
START HERE

14 groups of 5 subtracted altogether.

2 left! This is the *remainder*.

Numberlines can be vertical or horizontal.

START HERE



72 ÷ 5 = 14 r2

DIVISION BY CHUNKING

HTU ÷ U

256 ÷ 7

How do you decide what size chunk to subtract?

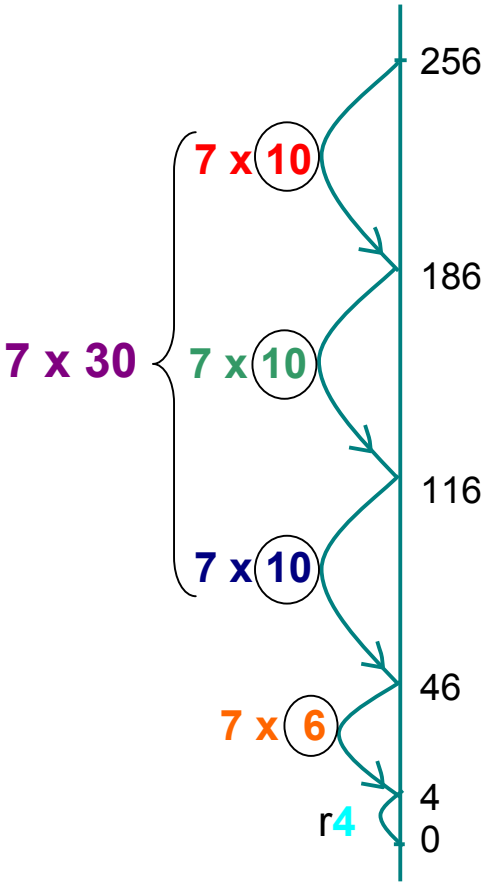
I look for chunks of 10 first. If I take bigger chunks it makes the calculation quicker and easier. Method (C) is shorter and more efficient than (B) .

HTU ÷ U

256 ÷ 7

How many groups of 7 in 256?

A



B

256
-70 (7 x 10)
186
-70 (7 x 10)
116
-70 (7 x 10)
46
-42 (7 x 6)
4

Subtract chunks of 70 (7 x 10).

How many groups of 7 in 46?

Total the numbers of groups of 7.

10 + 10 + 10 + 6 = 36

C

256
-210 (7 x 30)
46
-42 (7 x 6)
4

Subtract one large chunk of 210 (7 x 30).

36 groups of 7 have been subtracted and there is 4 left over.

256 ÷ 7 = 36 r4

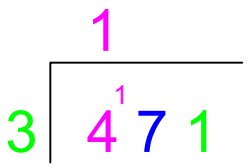
SHORT COMPACT DIVISION

Isn't it easier to say 'how many 3s in 4?'

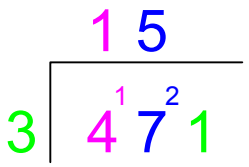
I need to remember the value of each digit so I know whether my answer makes sense. I will only use this method when I am confident with mental and chunking methods of division.

HTU ÷ U

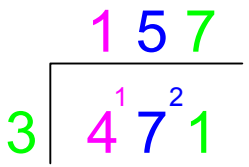
471 ÷ 3



Q: What is the largest number of hundreds that will divide exactly by 3?
A: 300 divided by 3 = 100. This leaves 100 which is exchanged for ten tens in the tens column.



Q: What is the largest number of tens that will divide exactly by 3?
A: 150 divided by 3 = 50. This leaves 20 which is exchanged for 20 units in the units column.



Q: What is the largest number of units that will divide exactly by 3?
A: 21 divided by 3 = 7

471 ÷ 3 = 157

CALCULATIONS IN CONTEXT

All the methods in this booklet support children in using their mental and written skills to solve calculations. Children need to be encouraged to use the method that they understand and can use confidently.

It is important that children are able to choose the most appropriate method for the calculation. For example:

4003 - 3998

These numbers are very close together and so counting up on a number line (actual or imagined) would be the most efficient method.

200 ÷ 4

Dividing by 4 is the same as halving and halving again. As it is easy to halve 200 and easy to halve 100, this would be the most efficient method.

Using and applying appropriate skills is very important, when calculations are needed to solve a problem.

4 C.DS at £2.99 – how much altogether?

£2.99 is almost £3.00 and so round up, multiply, then adjust:

4 x £3.00 = £12.00

£12.00 – 4p = £11.96

Mathematics – key stages 1 and 2
Mathematics Appendix 1: Examples of formal written methods for addition, subtraction, multiplication and division

This appendix sets out some examples of formal written methods for all four operations to illustrate the range of methods that could be taught. It is not intended to be an exhaustive list, nor is it intended to show progression in formal written methods. For example, the exact position of intermediate calculations (superscript and subscript digits) will vary depending on the method and format used.
For multiplication, some pupils may include an addition symbol when adding partial products. For division, some pupils may include a subtraction symbol when subtracting multiples of the divisor.

Addition and subtraction

789 + 642 becomes

$$\begin{array}{r} {}^{1}7\,{}^{1}8\,9 \\ +\ 6\,4\,2 \\ \hline 1\,4\,3\,1 \end{array}$$

Answer: 1431

874 – 523 becomes

$$\begin{array}{r} 8\,7\,4 \\ -\ 5\,2\,3 \\ \hline 3\,5\,1 \end{array}$$

Answer: 351

932 – 457 becomes

$$\begin{array}{r} {}^{8}\cancel{9}\,{}^{12}\cancel{3}\,{}^{1}2 \\ -\ 4\,5\,7 \\ \hline 4\,7\,5 \end{array}$$

Answer: 475

932 – 457 becomes

$$\begin{array}{r} {}^{1}9\,{}^{1}3\,2 \\ -\ \cancel{4}\,{}^{5}\cancel{5}\,7 \\ \hline 4\,7\,5 \end{array}$$

Answer: 475

Short multiplication

24 × 6 becomes

```
    2 4
  ×   6
  -----
  1 4 4
    2
```

Answer: 144

342 × 7 becomes

```
    3 4 2
  ×     7
  -------
  2 3 9 4
    2 1
```

Answer: 2394

2741 × 6 becomes

```
    2 7 4 1
  ×       6
  ---------
  1 6 4 4 6
    4 2
```

Answer: 16 446

Long multiplication

24 × 16 becomes

```
    2
    2 4
  × 1 6
  -----
  2 4 0
  1 4 4
  -----
  3 8 4
  -----
```

Answer: 384

124 × 26 becomes

```
      1 2
    1 2 4
  ×   2 6
  -------
  2 4 8 0
    7 4 4
  -------
  3 2 2 4
  -------
  1 1
```

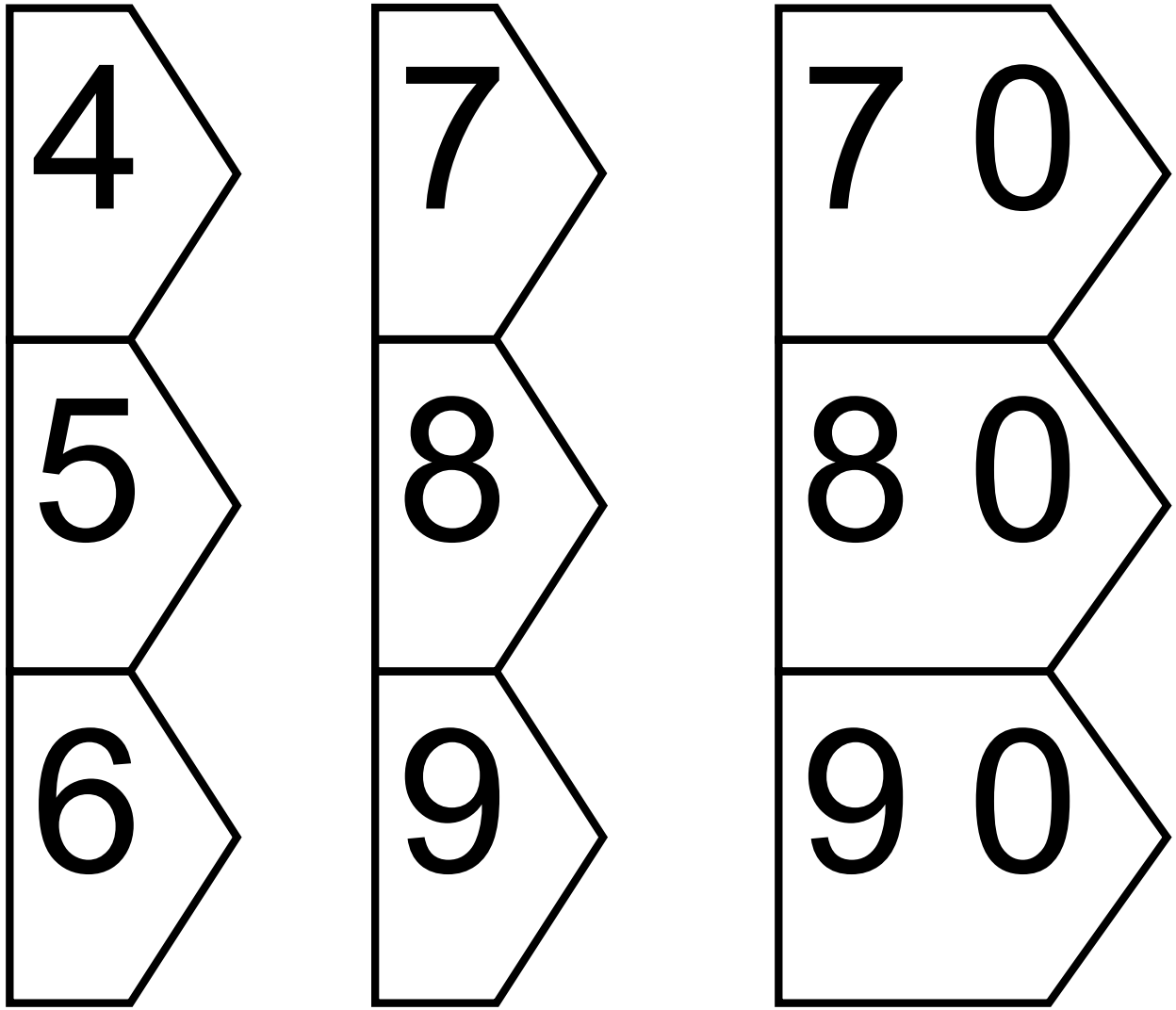
Answer: 3224

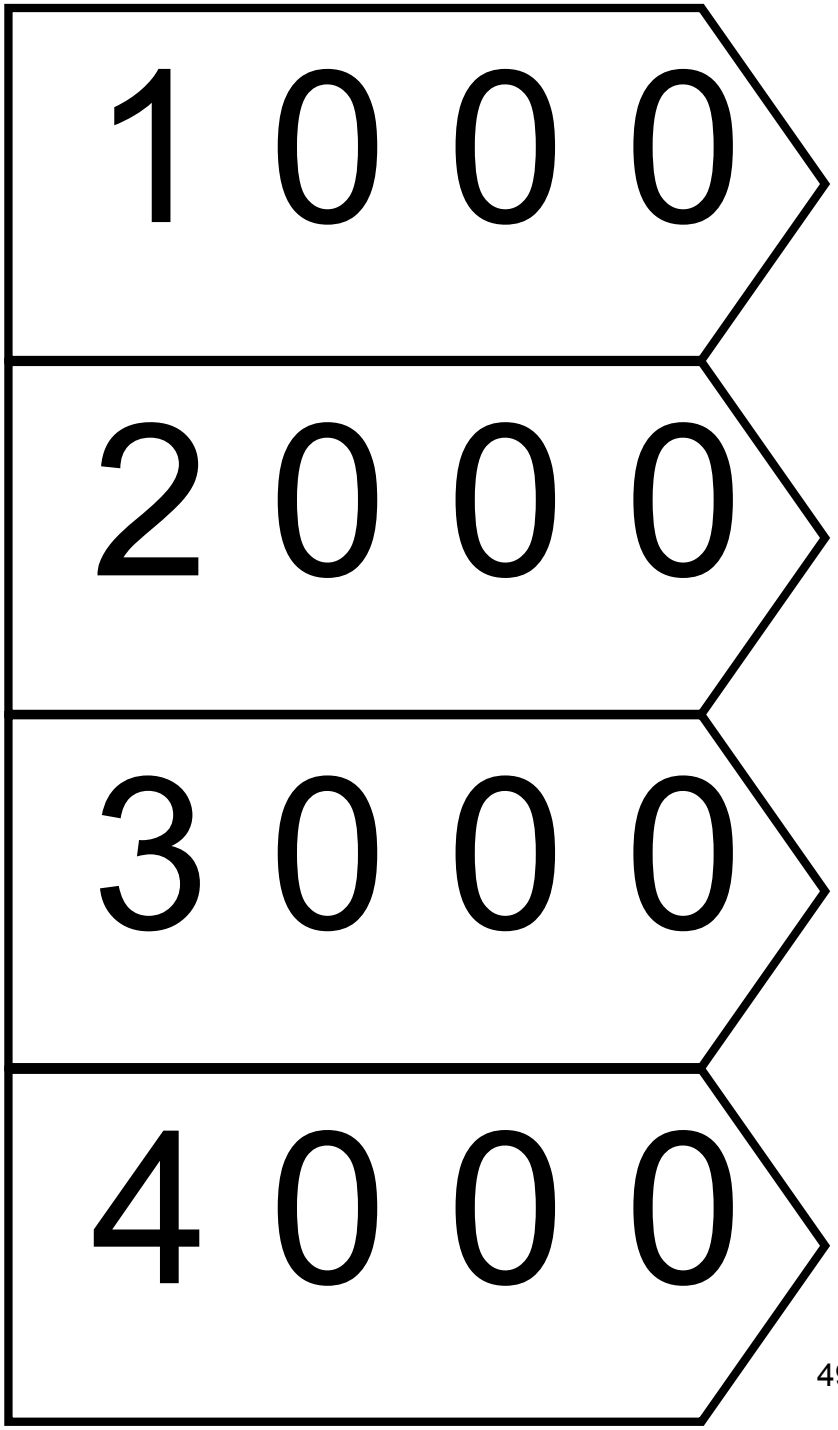
124 × 26 becomes

```
      1 2
    1 2 4
  ×   2 6
  -------
    7 4 4
  2 4 8 0
  -------
  3 2 2 4
  -------
  1 1
```

Answer: 3224

Place Value Cards

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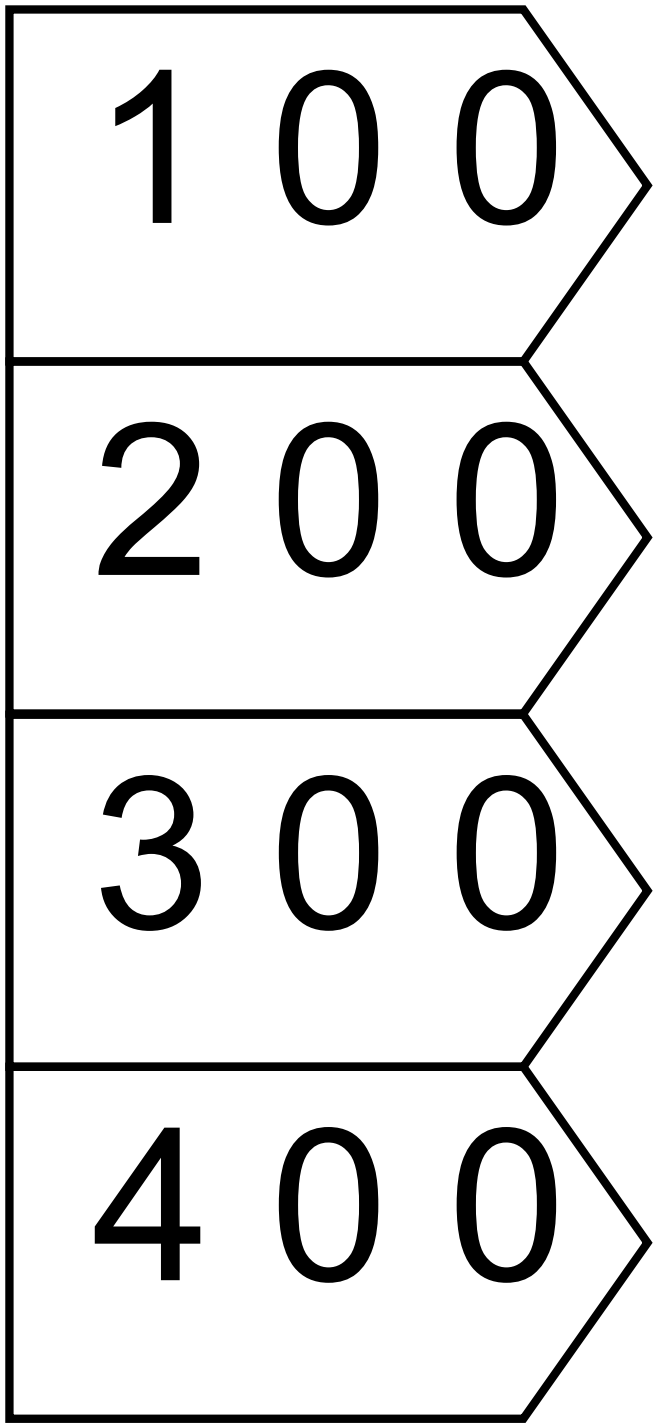
2000
3000
4000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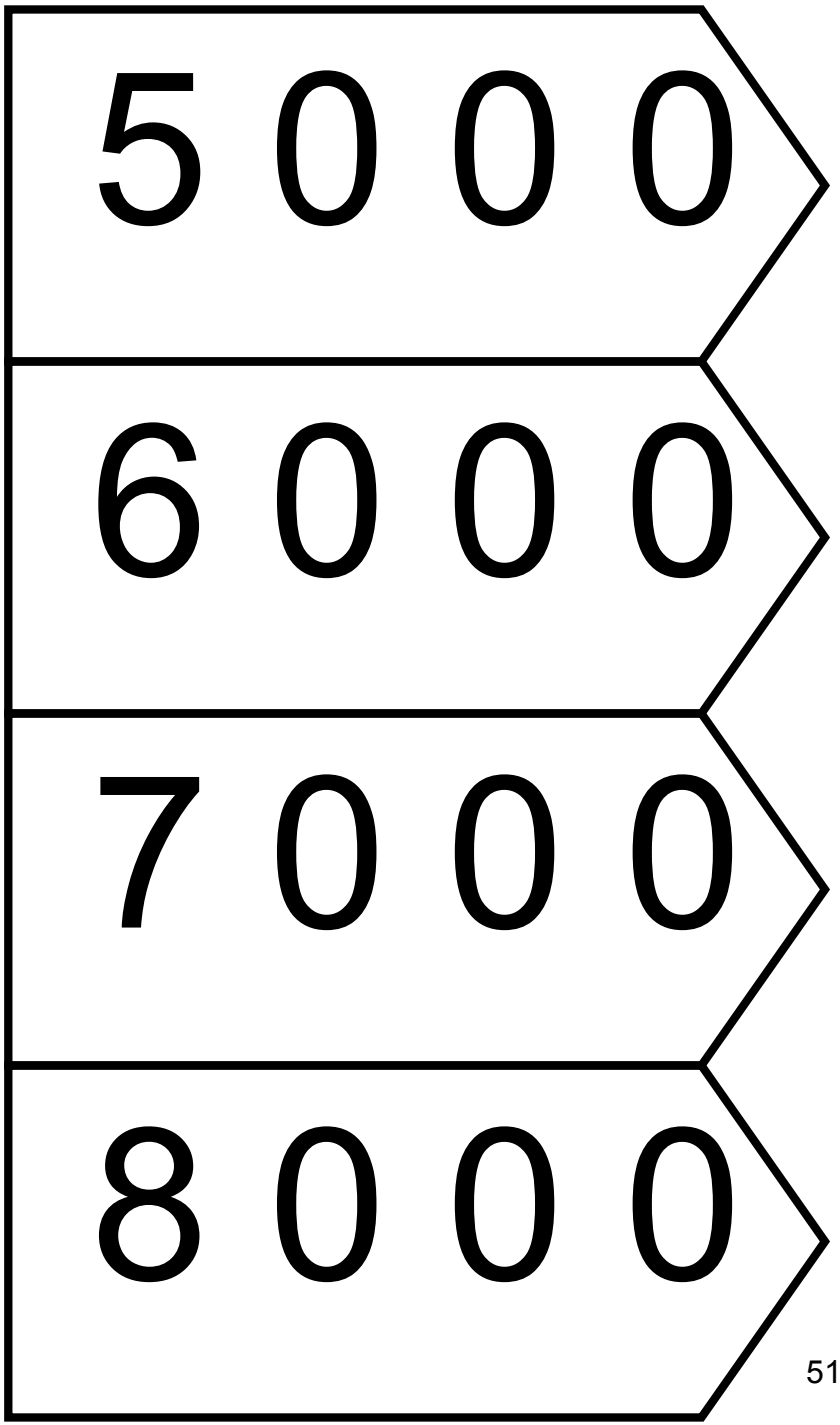
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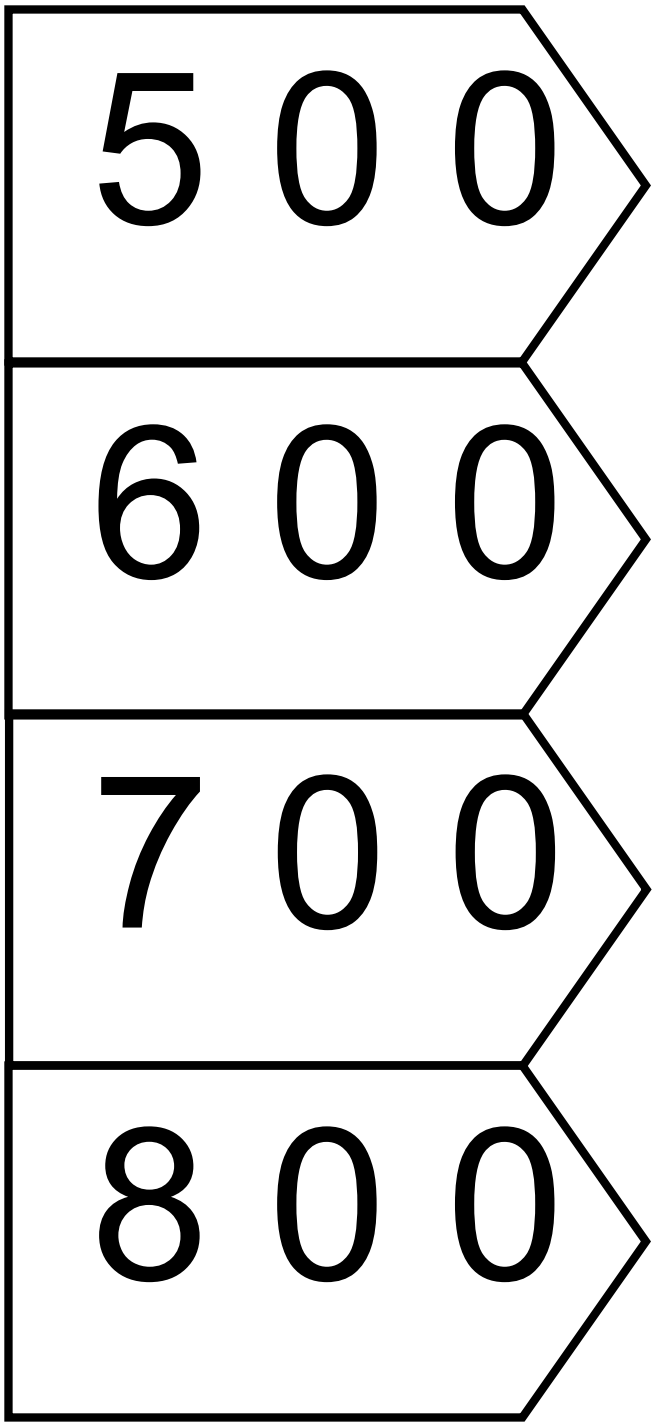
7000
8000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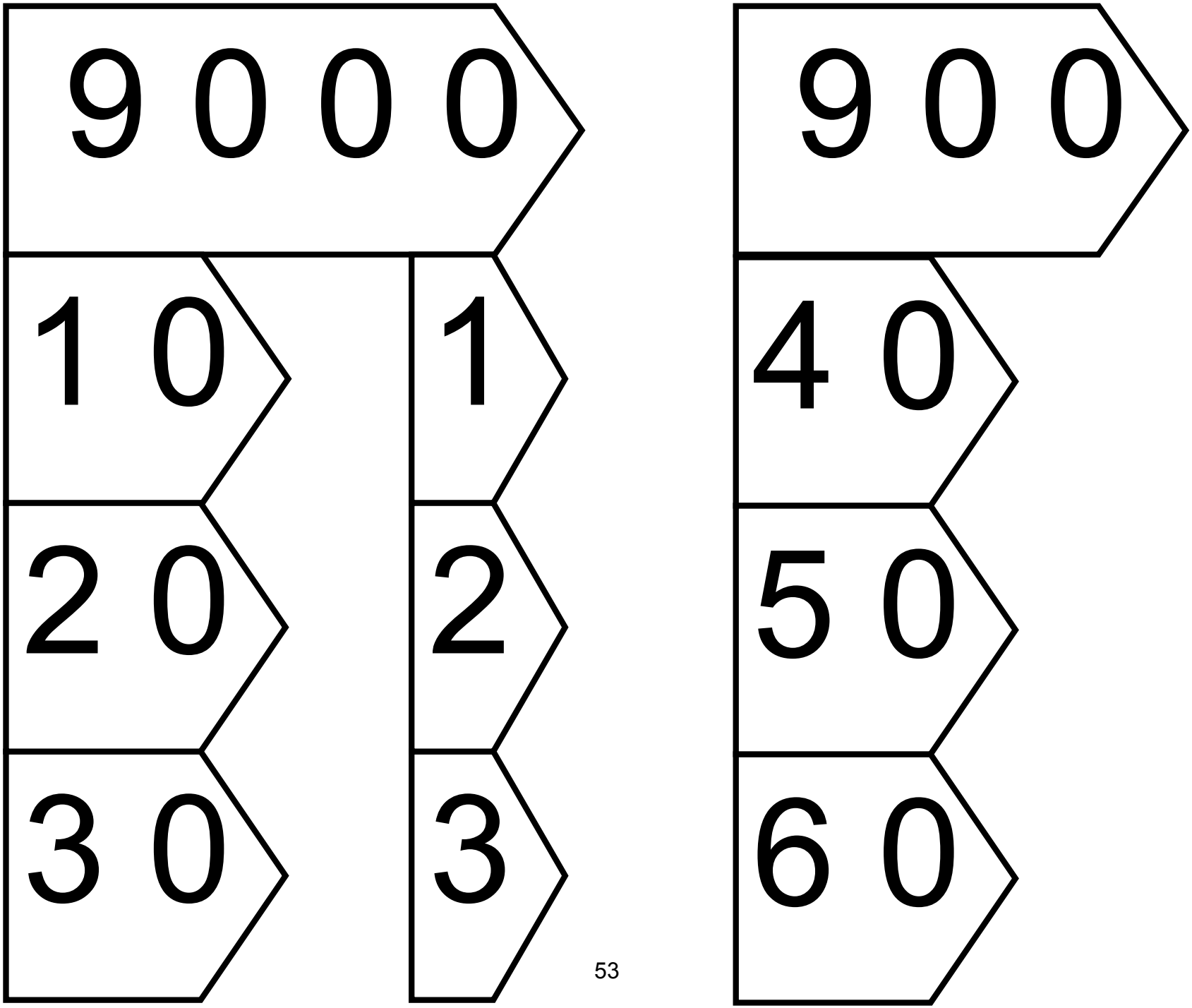
600
700
800


9000
900
10
1
40
20
2
50
30
3
60