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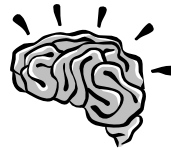
“They didn’t do it like that in my day!”

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 schools following the introduction of the National Numeracy Strategy (NNS) in 1999.

Which is more important:

mental calculation ↷



or

written ↷



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.

Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
← 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.

$$\begin{array}{r} 24 \\ +39 \\ \hline 513 \end{array}$$



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

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

$$\begin{array}{r} \text{TU} + \text{TU} \\ 86 + 57 \end{array}$$

Why use a number line?

It helps me to show on paper what is going on in my head

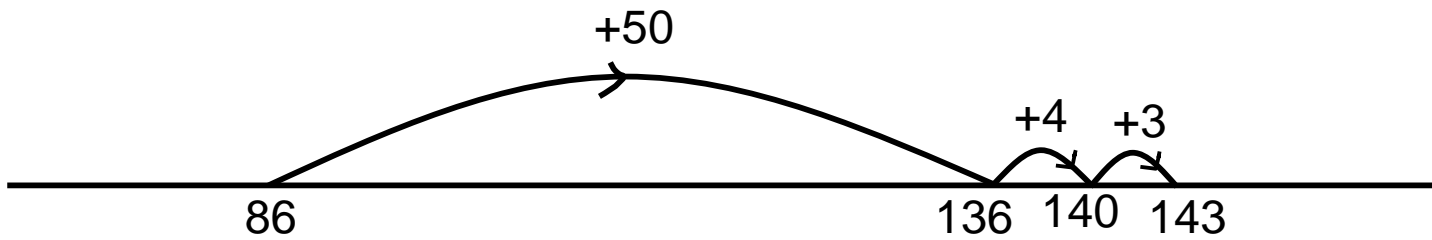


TU + TU

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*)

$$\begin{array}{r} \text{HTU} + \text{TU} \\ 754 + 96 \end{array}$$

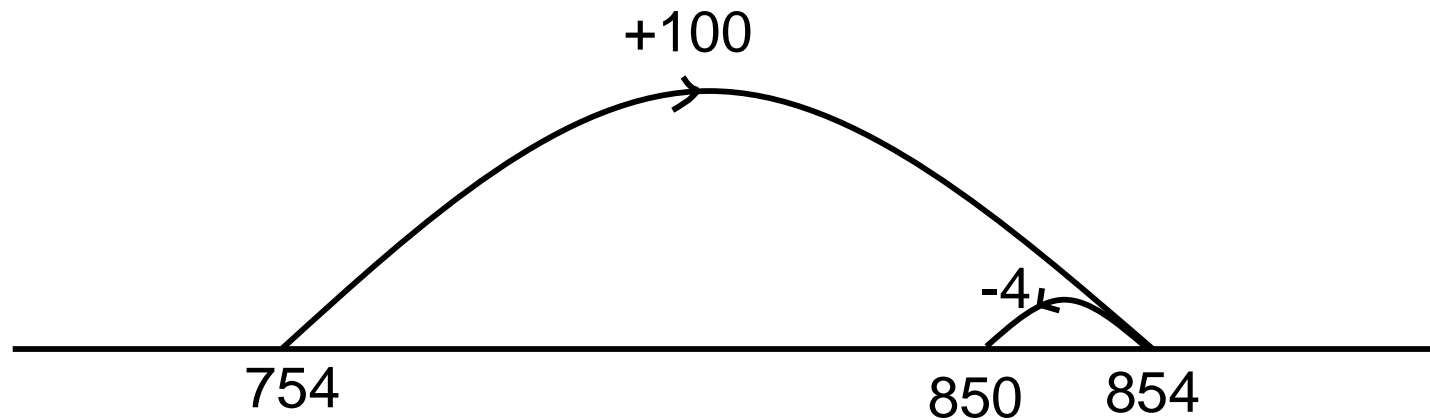
Why are you subtracting when you should be adding?

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.



$$\begin{array}{r} \text{HTU} + \text{TU} \\ 754 + 96 \end{array}$$

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



$$754 + 96 = 850$$

ADDITION

$$\begin{array}{r} \text{HTU} + \text{TU} \\ 625 + 148 \end{array}$$

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**)

$$\begin{array}{r} 625 \\ + 148 \\ \hline 700 \\ 60 \\ 13 \\ \hline 773 \end{array} \quad \begin{array}{l} 600 + 100 \\ 20 + 40 \\ 5 + 8 \end{array}$$

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

$$\begin{array}{r} 625 \\ + 148 \\ \hline 13 \\ 60 \\ 700 \\ \hline 773 \end{array} \quad \begin{array}{l} 5 + 8 \\ 20 + 40 \\ 600 + 100 \end{array}$$

Mentally add
 $700 + 60 + 13 = 773$

$$625 + 148 = 773$$

ADDITION

Using a standard method

$$\begin{array}{r} \text{HTU} + \text{HTU} \\ 587 + 475 \end{array}$$

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

$$\begin{array}{r} 587 \\ + 475 \\ \hline 1062 \\ \text{11} \end{array}$$

$7 + 5 = 12$
Place the **2** in the units column and carry the **10** forward to the tens column.

$80 + 70 = 150$ then $+ 10$ (carried forward) which totals **160**.
Place **60** in the tens column and carry the **100** forward to the hundreds column.

$500 + 400 = 900$ then $+ 100$ which totals **1000**. Place this in the thousands column.

$$587 + 475 = 1062$$

SUBTRACTION

A

B

Counting on or counting back?

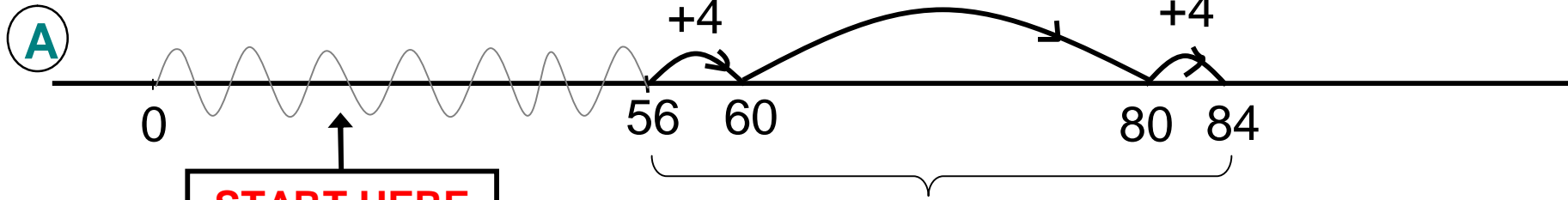
TU - TU
84 - 56

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

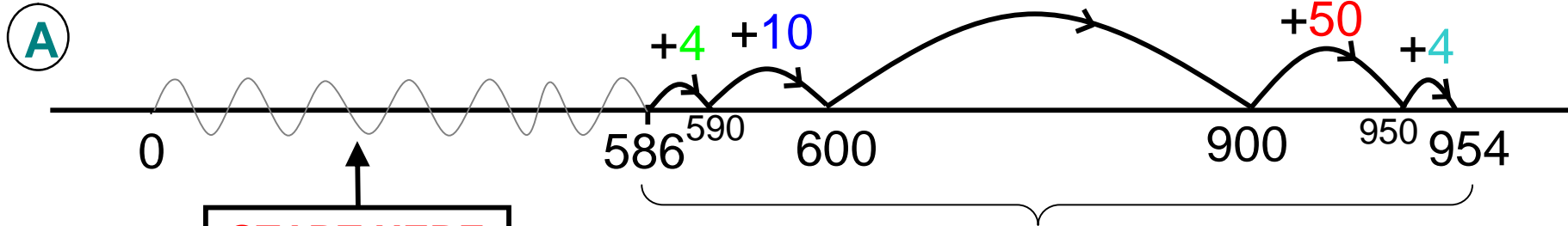
- A** Number line
- B** Written method

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



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.

$$\begin{array}{r} 954 \\ - 586 \\ \hline \end{array}$$

4 To make 590

10 To make 600

300 To make 900

50 To make 950

4 To make 954

$$\begin{array}{r} \hline 368 \end{array}$$

954 - 586 = 368

SUBTRACTION

Working towards a standard method (*decomposition*)

$$\begin{array}{r} \text{HTU} - \text{TU} \\ 154 - 37 \end{array}$$

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.

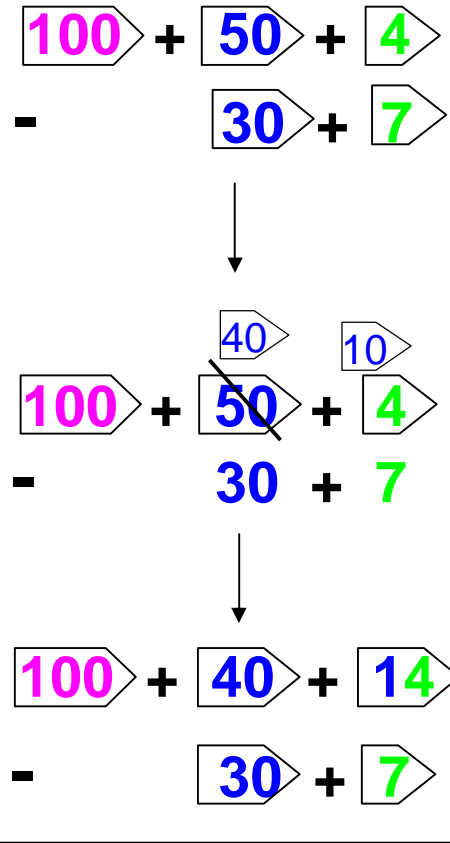


HTU - TU
154 - 37

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.



$100 - 0 = 100$

$40 - 30 = 10$

$14 - 7 = 7$

$100 + 10 + 7 = 117$

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

154 - 37 = 117

SUBTRACTION

Standard method (*decomposition*)

$$\begin{array}{r} \text{HTU} - \text{HTU} \\ 754 - 286 \end{array}$$

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*.

$$\begin{array}{r}
 700 + \overset{40}{\cancel{50}} + \overset{1}{4} \\
 - 200 + 80 + 6 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \overset{600}{\cancel{700}} + \overset{1}{40} + 14 \\
 - 200 + 80 + 6 \\
 \hline
 \end{array}$$

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

$$\begin{array}{r}
 \overset{6}{\cancel{7}}\overset{4}{\cancel{5}}\overset{1}{4} \\
 - 286 \\
 \hline
 468
 \end{array}$$

$$754 - 286 = 468$$

MULTIPLICATION

Introducing multiplication on a number line

$$\begin{array}{r} TU \times U \\ 14 \times 5 \end{array}$$

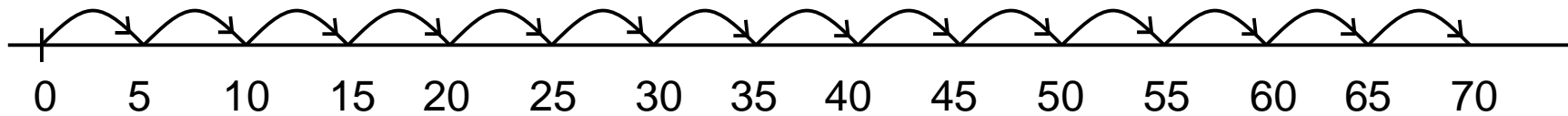
How is multiplication the same as repeated addition?

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 (5×14). I can make 14 individual jumps of 5 along the number line, or 1 jump of 5×10 and 1 jump of 5×4 . Table facts will help me do this more quickly.

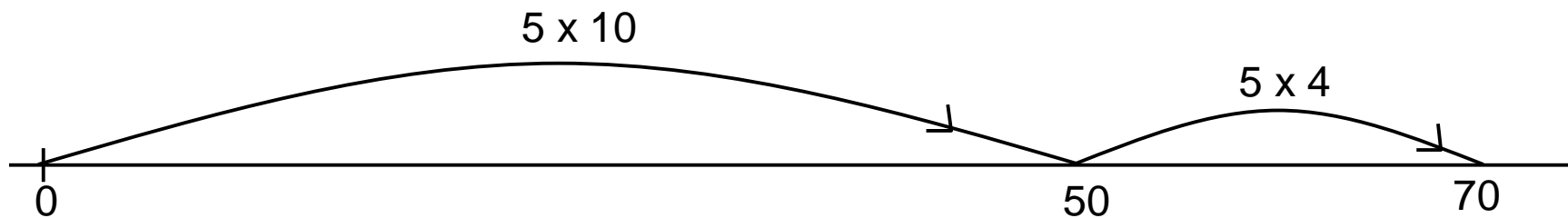


TU x U
14 x 5

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

$$\begin{array}{r} \text{TU X U} \\ 14 \times 5 \end{array}$$

Why do you *partition* the numbers into tens and units?

It doesn't take long!
I can see what I have to multiply very easily.



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

$$\begin{array}{r} \text{TU} \times \text{TU} \\ 46 \times 32 \end{array}$$

Isn't it difficult to multiply 40 by 30?

I know that 30 is 3×10 and multiplying by 10 is easy so I do $40 \times 3 \times 10 = 120 \times 10 = 1200$.

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**

$$\begin{array}{r} \text{TU X U} \\ 23 \times 8 \end{array}$$

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.

MULTIPLICATION

Grid method, **Expanded method**
and **Compact method**

$$\begin{array}{r} \text{TU} \times \text{TU} \\ 46 \times 32 \end{array}$$

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

Well!... I know that 46×30 is the same as $46 \times 3 \times 10$. 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 46×3 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

COMPACT METHOD (long multiplication)

$$\begin{array}{r} 46 \\ \times 32 \\ \hline 1380 \\ 92 \\ \hline 1472 \end{array}$$

(46 x 30)

(46 x 2)

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

46 x 2 mentally or by short multiplication.

EXPANDED METHOD

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

Part products totalled to give final product.

$$\begin{array}{r} 46 \\ \times 32 \\ \hline 1200 \quad (40 \times 30) \\ 180 \quad (6 \times 30) \\ 80 \quad (40 \times 2) \\ 12 \quad (6 \times 2) \\ \hline 1472 \end{array}$$

$$46 \times 32 = 1472$$

DIVISION

TU \div U

29 \div 3

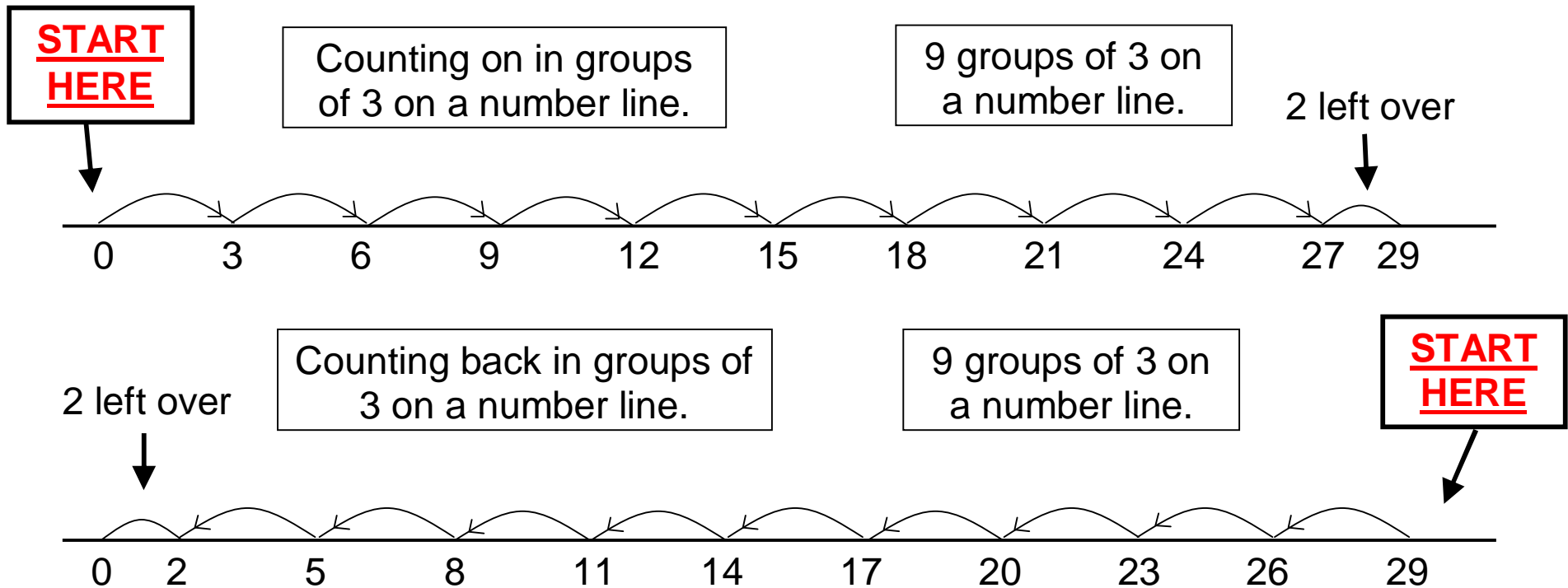
Introducing division on a number line

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.



$$\text{TU} \div \text{U}$$
$$29 \div 3$$



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

$$29 \div 3 = 9 \text{ r}2$$

DIVISION

TU ÷ U

72 ÷ 5

Chunking on a number line

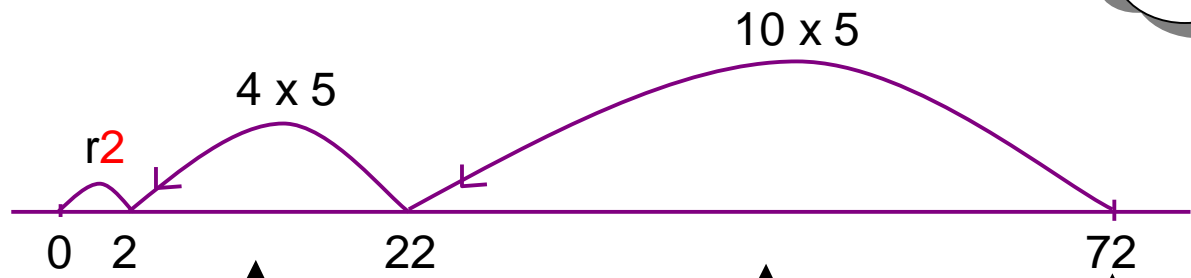
I've never heard of chunking before! How does this help with division?

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

Numberlines can be **vertical** or **horizontal**.



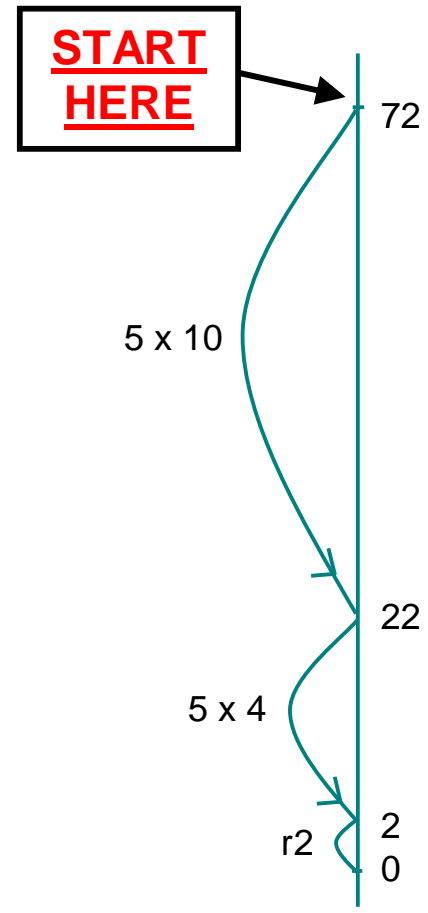
Subtract 4 groups of 5 (20) from 22 to land on 2.

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*.



72 ÷ 5 = 14 r2

DIVISION BY CHUNKING

HTU \div U

256 \div 7

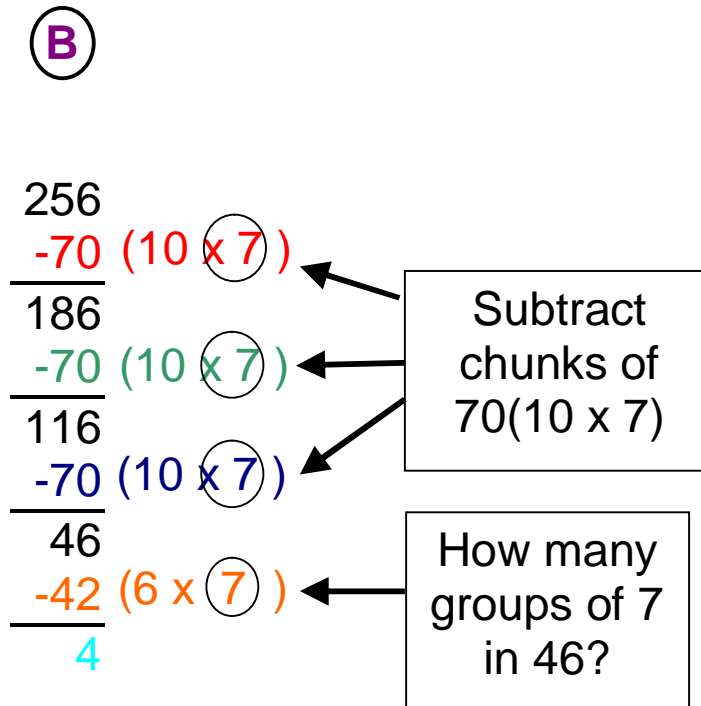
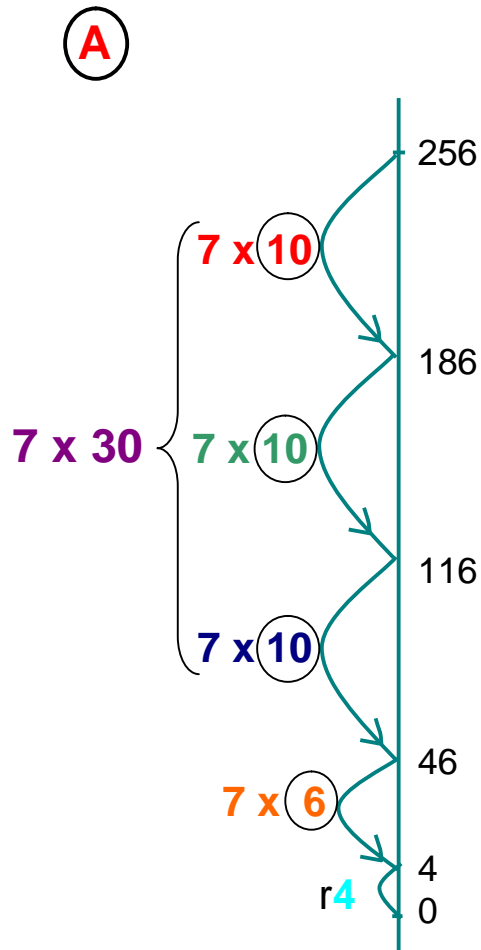
How do you decide what size chunk to subtract?

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**.



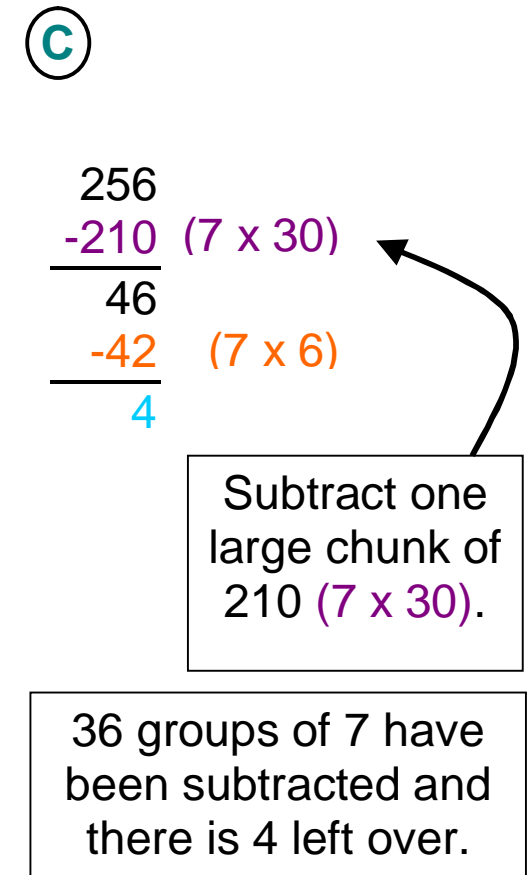
HTU ÷ U
256 ÷ 7

How many groups of 7 in 256?



Total the numbers of groups of 7.

$$\textcircled{10} + \textcircled{10} + \textcircled{10} + \textcircled{6} = 36$$



256 ÷ 7 = 36 r4

Short Division

196 \div 6 is approximately 200 \div 5 = 40

$$\begin{array}{r} \overline{6)196} \\ -180 \quad (30 \times 6) \\ \hline 16 \\ -12 \quad (2 \times 6) \\ \hline 4 \end{array}$$

Answer 32 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

$$471 \div 3$$

$$\begin{array}{r} 1 \\ 3 \overline{) 471} \end{array}$$



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.

$$\begin{array}{r} 15 \\ 3 \overline{) 471} \end{array}$$



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.

$$\begin{array}{r} 157 \\ 3 \overline{) 471} \end{array}$$



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

$$471 \div 3 = 157$$

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.

$$200 \div 4$$

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:

$$4 \times £3.00 = £12.00$$

$$£12.00 - 4p = £11.96$$

Improving your own skills

Many adults think that they aren't very good at Maths. If you think it's time that you did something about your own Maths, there are lots of sources of help.

- Family Learning courses are held every term in Brighton and Hove Primary Schools and pre-school settings – workshops, 6 week courses, or longer courses that run for a term or more. These courses give parents an opportunity to find out how their children are being taught at school nowadays, and an opportunity to learn how they can support their children's learning at home and at school. You can ask at your child's school about the next Family Learning course, or phone 01273 294205 for further information.

- In Brighton and Hove, the main providers of courses for Basic Skills are:

City College, Pelham Street, Brighton.	Tel: 01273 667788
Portslade Community College, Chalky Road, Portslade.	Tel: 01273 422632
Friends Centre, Ship Street, Brighton.	Tel: 01273 327835
Varndean College, Surrenden Road, Brighton.	Tel: 01273 508011
Nacro Services, Enterprise Point, Lewes Road, Brighton.	Tel: 01273 704016

All of these provide a range of free courses for adults who wish to improve their own skills.

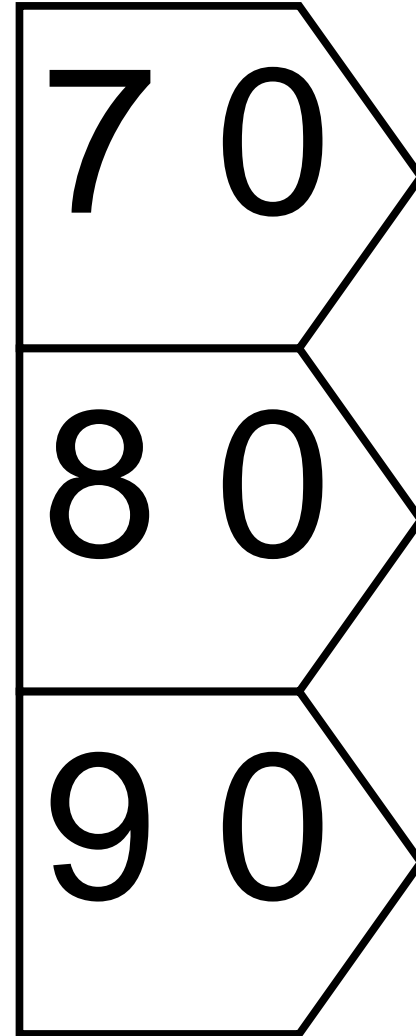
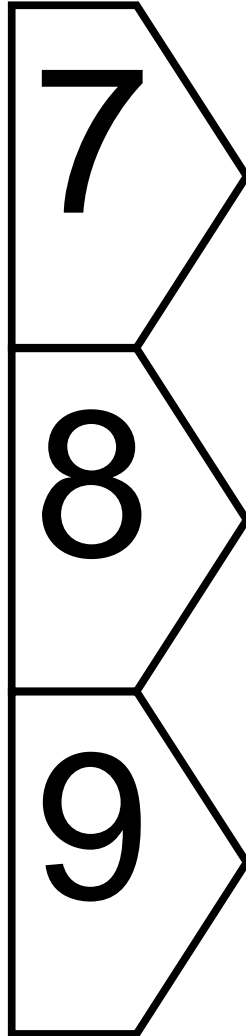
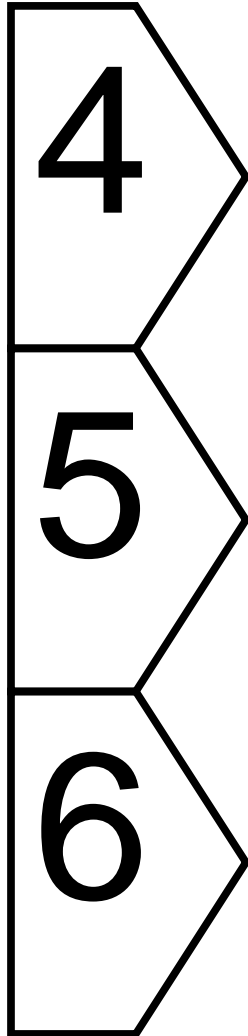
- There are national telephone and internet helplines available to help find an appropriate course.

Learndirect:	www.learndirect.co.uk	0800 100 900
Basic SkillsAgency:	www.basic-skills.co.uk/learners	0800 700 987
BBC Skillswise:	www.bbc.co.uk/skillswise	

- There are several websites designed to help students of all ages find out about different topics in Maths:
 - The BBC site (www.bbc.co.uk) has excellent sections for revision at KS2 and KS3 (www.bbc.co.uk/revisewise), and the GCSE and Skillswise sections also give worked examples of mathematical problems` - particularly useful when your child doesn't understand her homework and you don't either.....

- The DfES0 site for parents (www.parentcentre.gov.uk) is the best source of information about teaching in schools, and how to support your child's learning at home.
- The Parents Online site (www.parentsonline.gov.uk) gives information about children's education, and how parents can support children's education – particularly using the Internet.

Place Value Cards



1 0 0 0

2 0 0 0

3 0 0 0

4 0 0 0

1 0 0

2 0 0

3 0 0

4 0 0

5 0 0 0

6 0 0 0

7 0 0 0

8 0 0 0

5 0 0

6 0 0

7 0 0

8 0 0

9 0 0 0

1 0

1

2 0

2

3 0

3

9 0 0

4 0

5 0

6 0

Acknowledgements

This booklet for parents is the culmination of the work and thoughts of a number of people.

Parents themselves have been voicing their need for support in understanding the methods that their children now use to work out calculations.

Teachers in schools have been trying to meet the need by holding workshops and parents' evenings but have been trawling for suitable materials to offer parents.

This booklet has been written by Susan Saunders of the Primary Team and three primary maths co-ordinators in Brighton and Hove schools:

Wendy Clegg, Y5 teacher, Mile Oak Primary School
Isabelle Marsh, Y2 teacher, St. Andrew's CE Primary
Janet Parfitt, Y6 teacher, Balfour Junior School

Not only did they give of their time during the school holidays and after the school day but did so enthusiastically.

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Finally, many thanks to Georgia Trott, Numeracy Support Officer, for the input of her creative skills in the production of this booklet.

To order further copies of this publication contact:

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