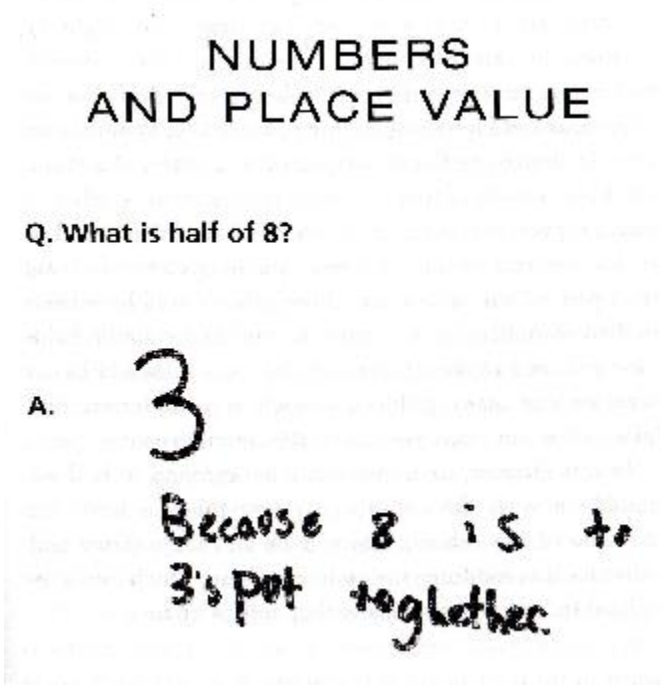


Mathematics

Kings Worthy Primary School

Tuesday 26th September 2017

Miss Evers

Maths Manager

Hampshire County Council

Continuing Professional Development Standard

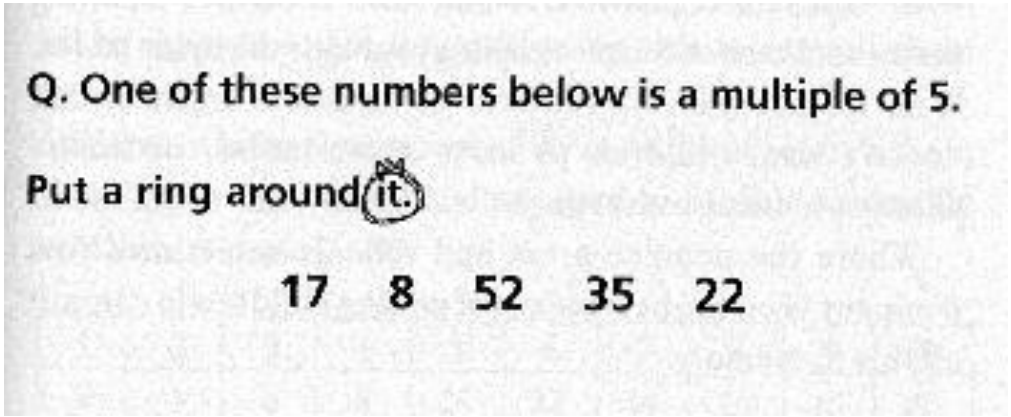
National Centre for Excellence in the Teaching of Mathematics

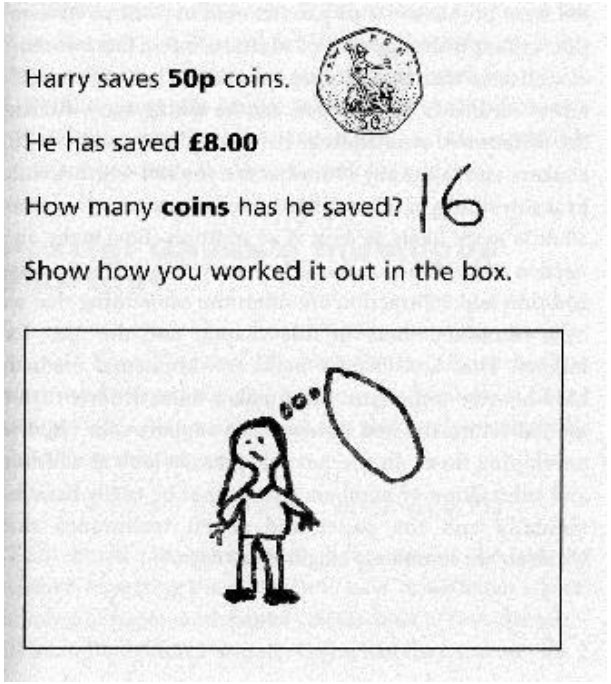
Aims of the session

- To develop an understanding of how calculation strategies are developed in upper Key Stage 2
- To gain an understanding of age-related expectations in maths at Key Stage 2 as well as KS2 SATs tests.

When you were at school…..

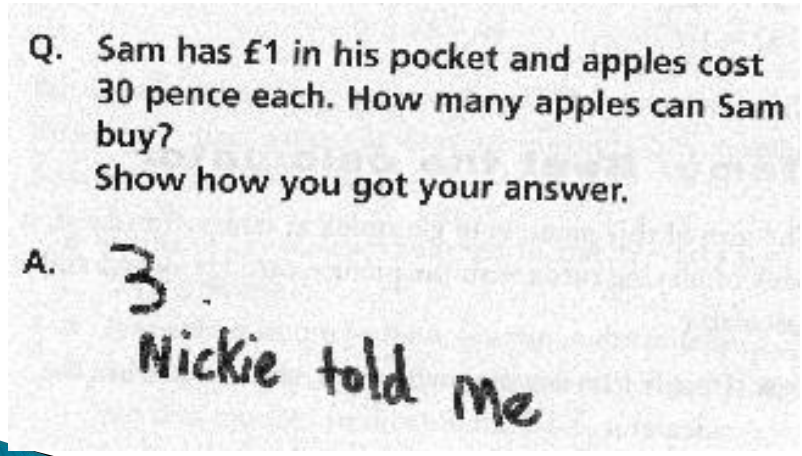
- How did you feel about maths?
- What were your experiences of maths like?
- How do you feel about maths now?

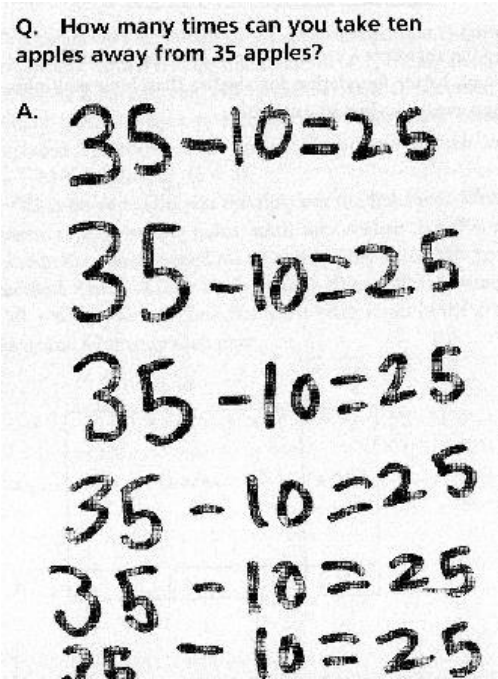




Maths in school today….

- Maths is fun!
- Children are encouraged to "have a go"!
- They are not afraid to be wrong – mistakes are part of the learning
- Maths is made purposeful and interesting





Why has maths changed?

- Children used to learn "standard methods" – we were shown what to do before understanding was consolidated
- If you couldn't remember, or hadn't understood the methods…you went wrong
- Today, we teach methods that help children to understand the underlying maths and the basic concepts involved
- Children need to develop "**number sense**" – more insight into mathematics

Today's techniques…

- …are not just about getting the right answer – but about knowing and understanding how you got there
- …are not new – many pre-date the techniques you learned
- …eventually join up with the ones you did in school – but the children understand them thoroughly
- …reduce the chance of mistakes being made
- …build a firm foundation for understanding more complicated mathematics later on

A balanced mathematical diet…

- Number and Place Value
- Addition & Subtraction
- Multiplication & Division
- Fractions
- Measurement
- Geometry

(Position & Direction)

(Properties of shapes)

- Statistics

Year 5

- Understand & use decimals to 3dp
- Solve problems using up to 3dp, and fractions
- Write percentages as fractions; fractions as decimals
- Use vocabulary of primes, prime factors, composite numbers, etc.
- Know prime numbers to 20
- Understand square and cube numbers
- Use standard multiplication & division methods for up to 4 digits
- Add and subtract fractions with the same denominator
- Multiply proper fractions and mixed numbers by whole numbers
- Distinguish regular and irregular polygons
- Calculate the mean average

Year 6

- Compare and order fractions greater than 1
- Long division
- 4 operations with fractions
- Calculate decimal equivalent of fractions
- Understand & use order of operations (BODMAS)
- Plot points in all 4 quadrants
- Convert between miles and kilometres
- Name radius/diameter and know relationship
- Use formulae for area/volume of shapes
- Calculate area of triangles & parallelograms
- Calculate volume of 3-d shapes
- Use letters to represent unknowns (algebra)
- Generate and describe linear sequences

Place Value

- Our number system consists of ten digits

  0, 1, 2, 3, 4, 5, 6, 7, 8, 9

- The place of each digit determines its value.

- For example, the “6” digit can represent for 6, sixty, six hundred. It depends where we place it…

  6….65….653

Partitioning

- This means breaking up numbers into smaller numbers
- All numbers can be partitioned in many different ways
- If children understand about partitioning numbers in different ways, they will calculate more **efficiently** – and with understanding.

Number Lines

- They help to develop an ability to order numbers, and give children a sense of where numbers sit in our number system
- They allow children to draw a picture – or model – in their heads when calculating
- Can be used in a range of aspects of mathematics – numbers and the number system, fractions, decimals, percentages, addition, subtraction, multiplication, division, measures, handling data
- Numberlines will have been used throughout your child's time at Kings Worthy – they help them to gain a secure understanding of Place Value.
- By this stage in the National Curriculum, all children should now be making steps towards/be secure in using more formal methods to calculate numbers up to 1 million.
- You can recap any questions regarding numberlines in the KS1 or Yr3/4 presentations on our website.

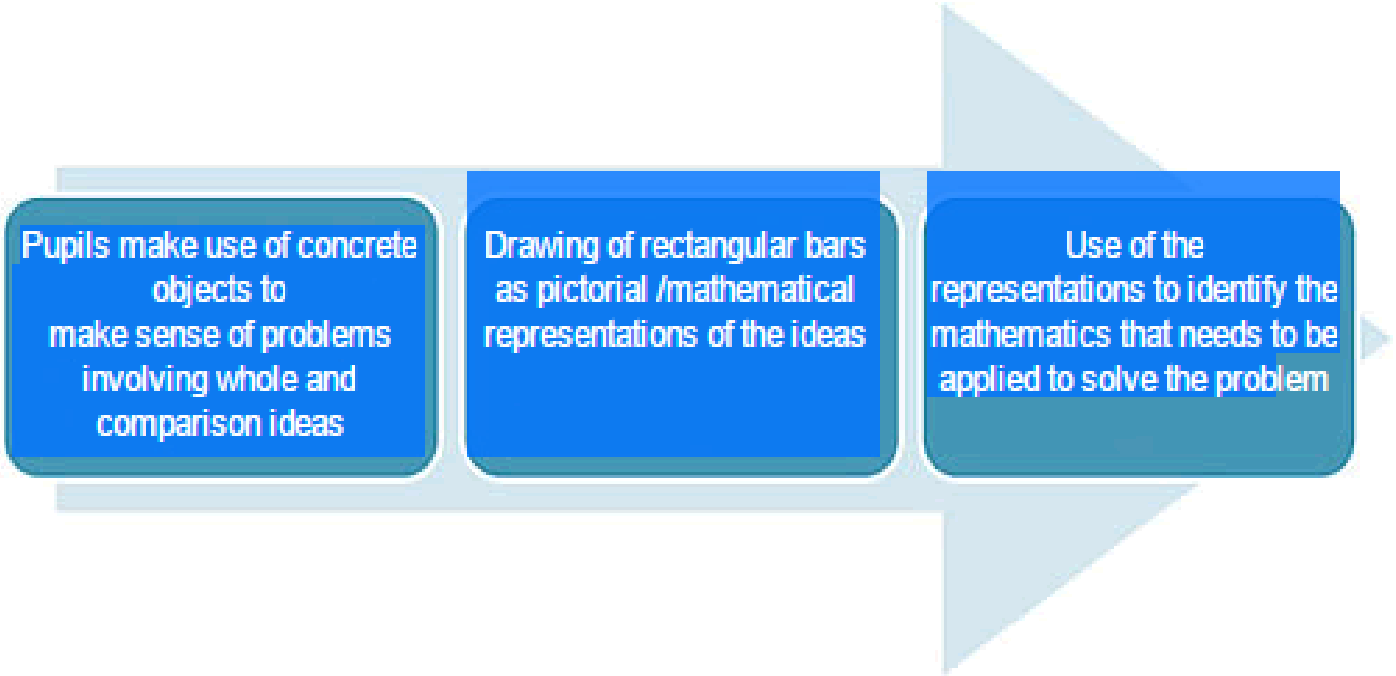
Practical objects CONCRETE

Bar model to represent objects VISUAL

Calculation strategies ABSTRACT

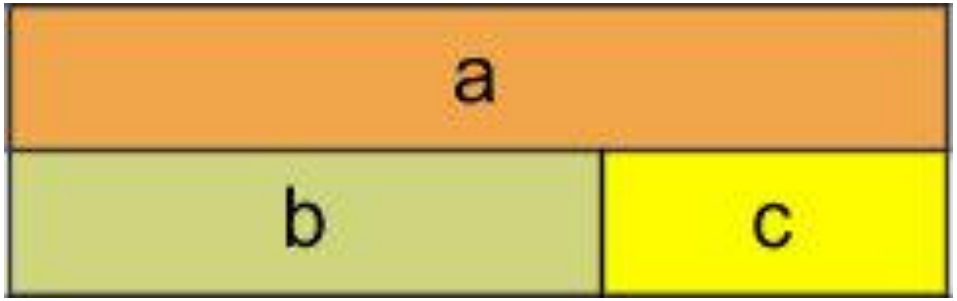
The bar model is used in Singapore and other countries, such as Japan and the USA, to support children in problem solving. It is not a method for solving problems, but a way of revealing the mathematical structure within a problem and gaining insight and clarity as to how to solve it.

It supports the transformation of real life problems into a mathematical form and can bridge the gap between concrete mathematical experiences and abstract representations.



concrete	visual	abstract

Addition and Subtraction



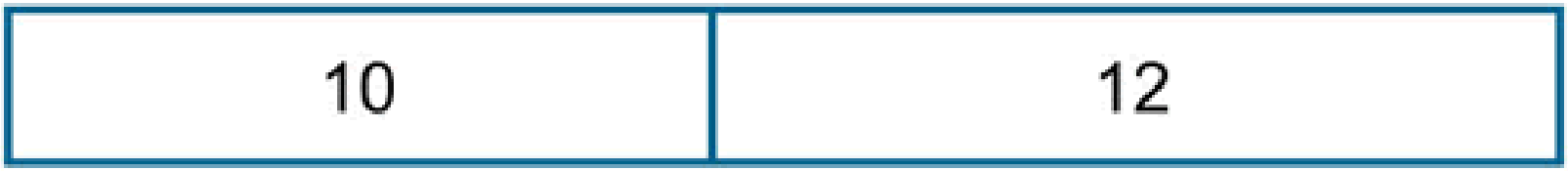
This diagram shows all of the following relationships;
a = b + c ; a = c + b ; a – b = c ; a – c = b

To prepare young children for the bar model it is a good idea to encourage them to line up objects in a linear arrangement when representing addition and subtraction problems.

Such arrangements will also help children to organise their counting. The physical objects can then be replaced, in time, with linking cubes and with a bar drawn next to it. The question can then be asked “what’s the same, what’s different?” to support the children in their reasoning and in making sense of the bar as an abstract representation of the physical objects.

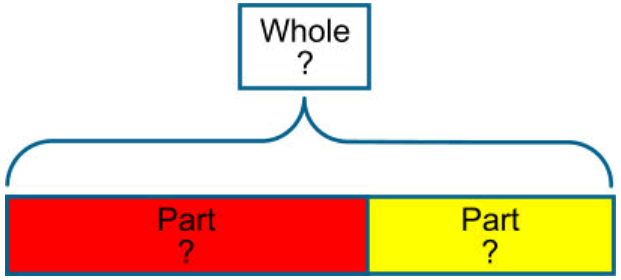
It is useful for children to work in pairs with one manipulating the cubes, while the other records by drawing the bars and then writing the number sentence underneath. The children can then swap roles.

Sam had 10 red marbles and 12 blue marbles. How many marbles did he have altogether?



$10 + 12 = 22$

In problems involving addition and subtraction there are three possible unknowns as illustrated below and given the value of two of them the third can be found.



Why are images important?

- Resources, models and images help children to visualise and understand mathematical concepts
- They build up – and remember - the mental picture in their minds
- They should be available throughout the primary years. Children will rely on them less and less
- TIMES TABLES!

Mental skills and strategies

We constantly draw upon **mental strategies** that we know and have internalised when we carry out calculations

- doubling
- adding multiples of ten
- partitioning
- compensating
- applying known facts

Children need to learn and understand these strategies – and know how and when to apply them.

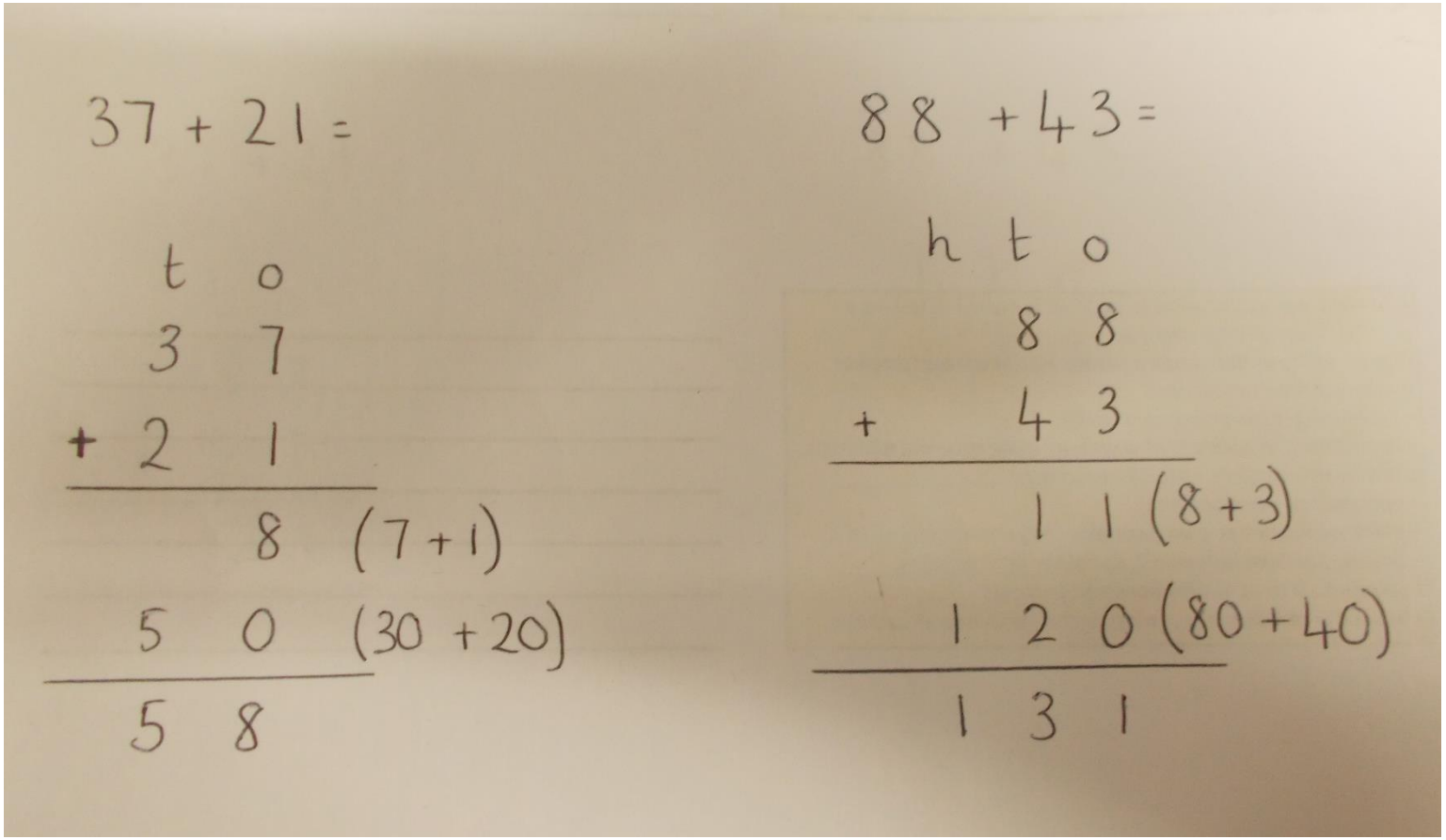
BODMAS (BIDMAS)

- Brackets
- Order (powers)
- Division
- Multiplication
- Addition
- Subtraction

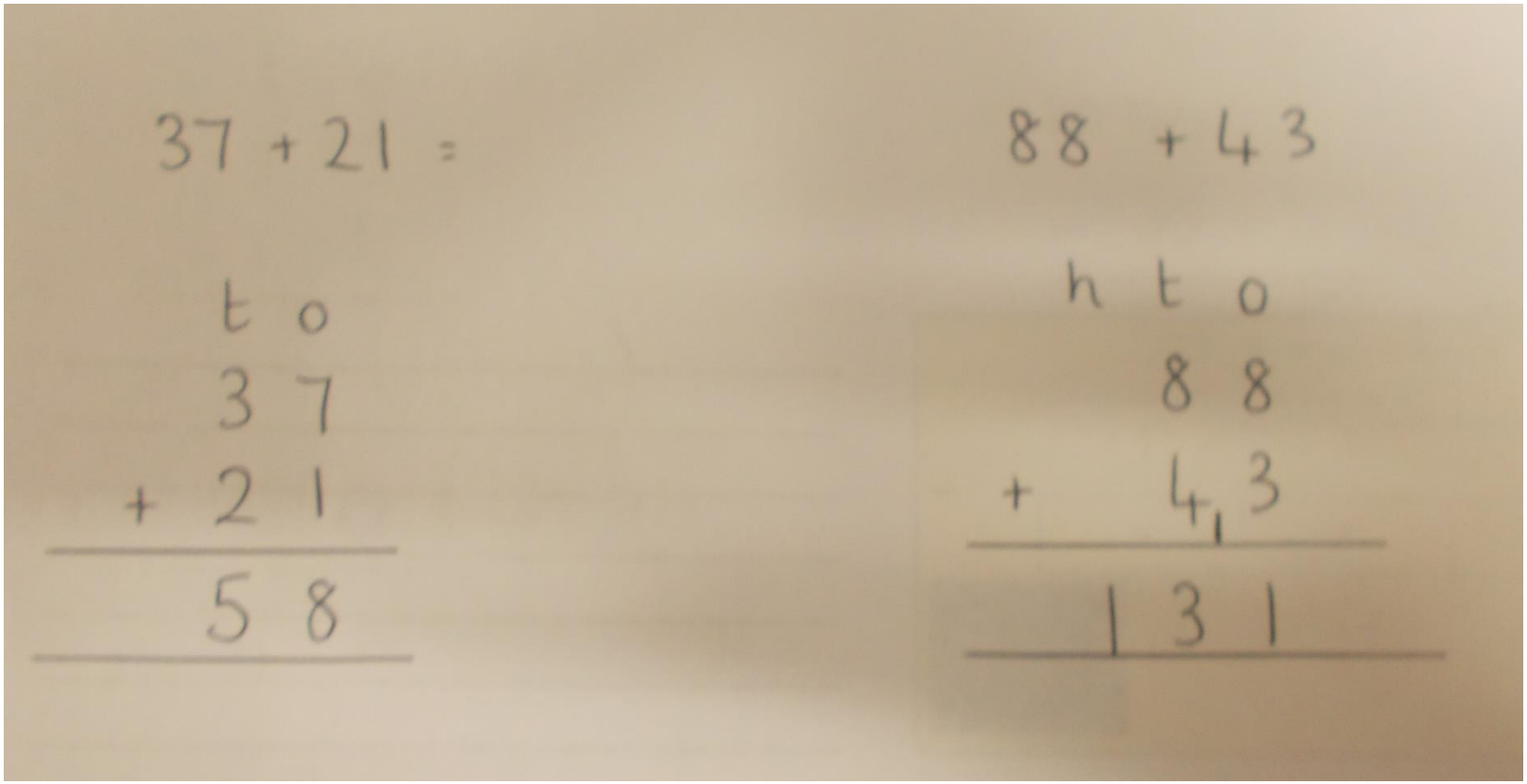
Progression in addition methods

- Numberlines (see previous presentations)
- Column (expanded)
- Column
- Formal compact method

Addition – column expanded



Addition – column method



Formal methods – addition

789 + 642 becomes

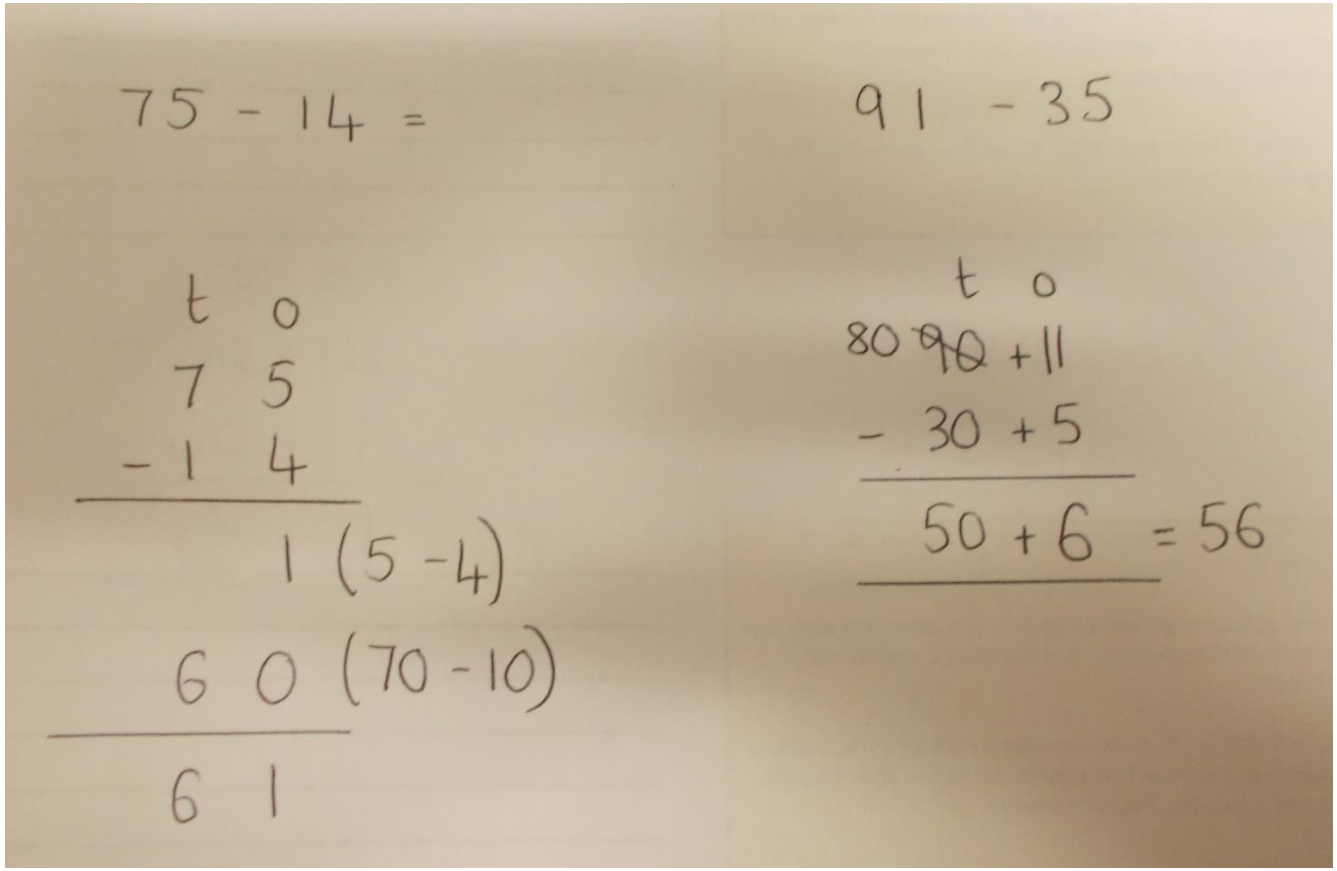
	7	8	9
+	6	4	2
1	4	3	1
	1	1	

Answer: 1431

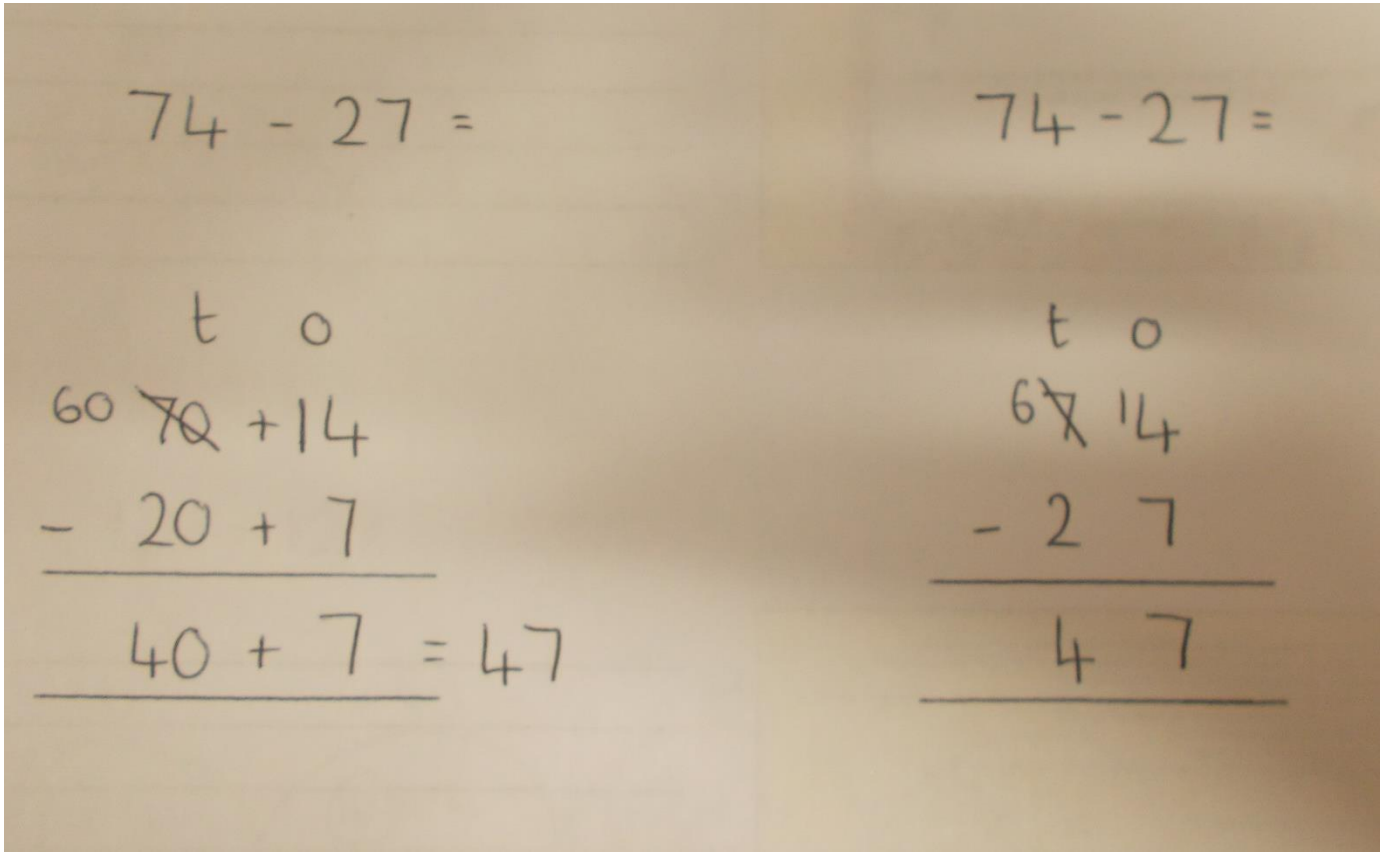
Progression in subtraction methods

- Numberlines (see previous presentations)
- Column method (expanded)
- Column method
- Formal compact method

Subtraction – column expanded



Subtraction – column expanded



Formal methods – subtraction

874 – 523 becomes

	8	7	4
–	5	2	3
	3	5	1

Answer: 351

932 – 457 becomes

	8	12	1
	~~9~~	~~3~~	2
–	4	5	7
	4	7	5

Answer: 475

932 – 457 becomes

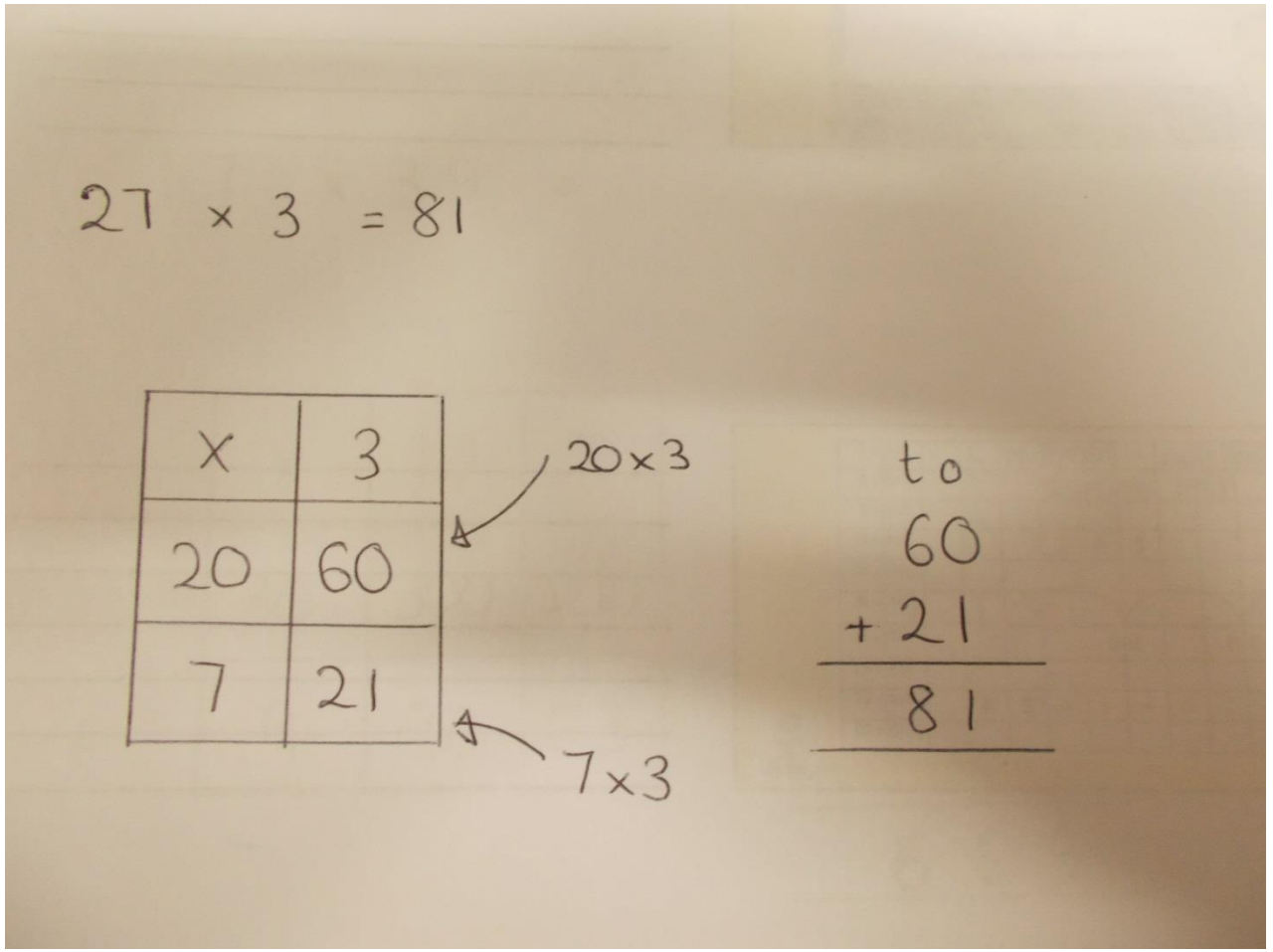
		1	1
	9	3	2
–	~~4~~	~~5~~	7
		5	6
	4	7	5

Answer: 475

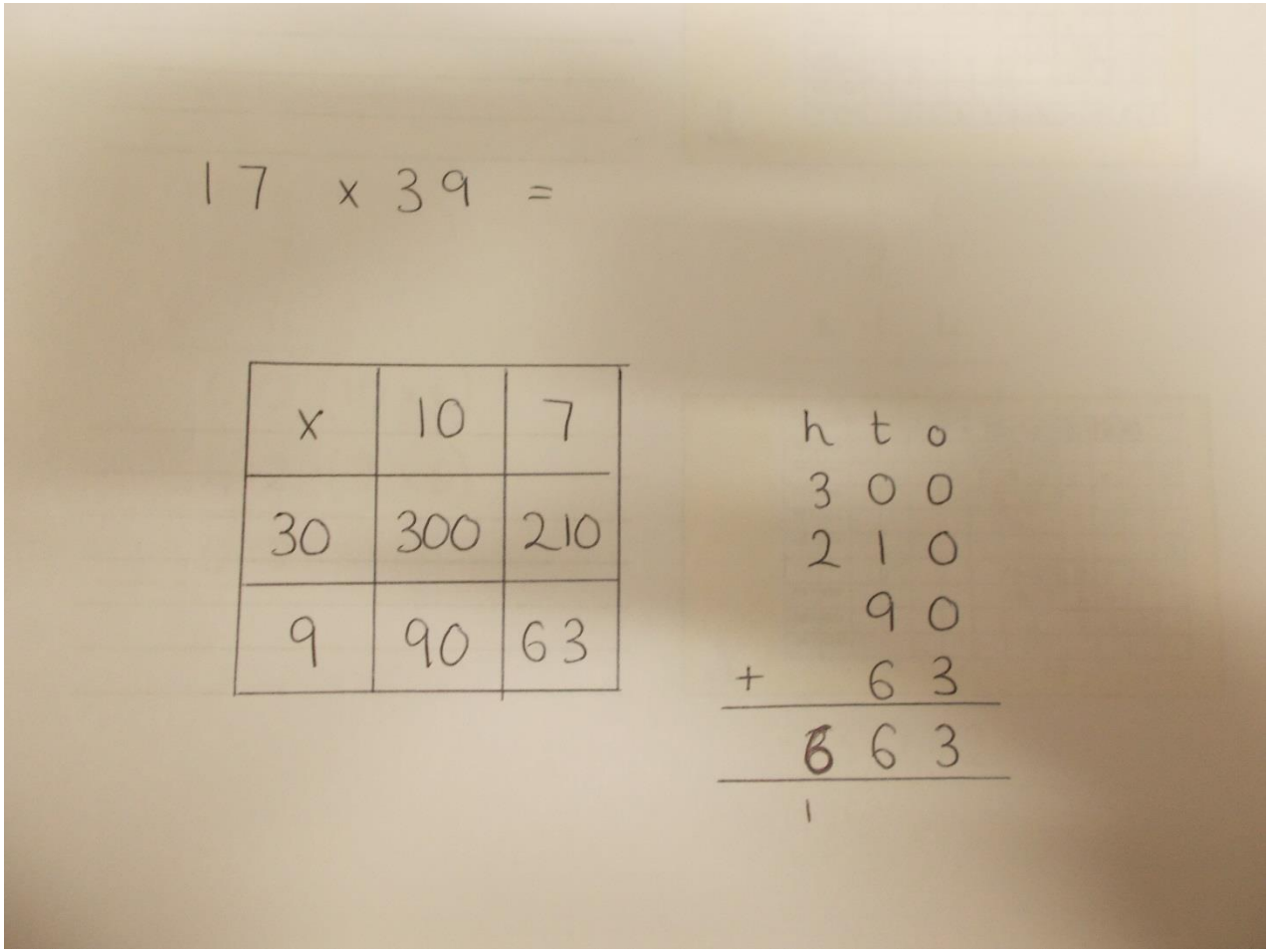
Progression in multiplication strategies

- ‘Sets of’ using objects
- Arrays
- Repeated addition on a number line
- Grid (2digit x 1digit)
- Grid (2digit x 2digit)
- Expanded short
- Formal compact method

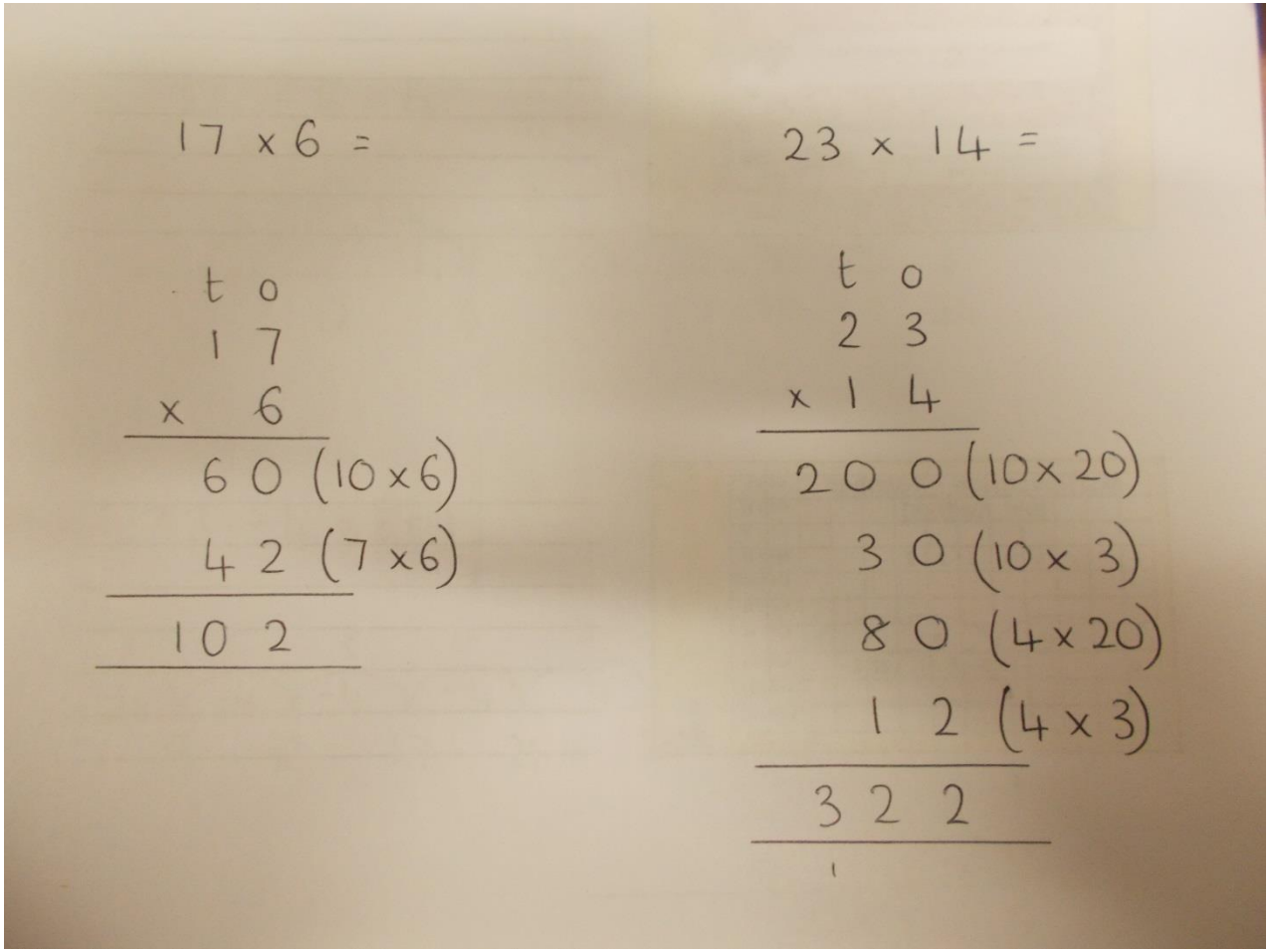
Grid (2digit x 1digit)



Grid (2digit x 2digit)

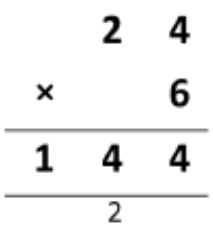


Expanded column method



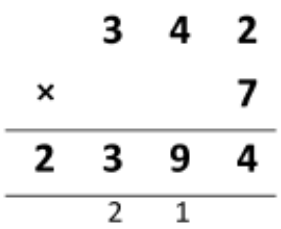
Formal methods – short multiplication

24 × 6 becomes



Answer: 144

342 × 7 becomes



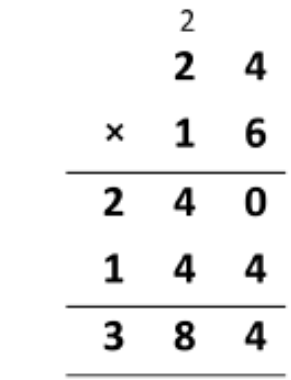
Answer: 2394

2741 × 6 becomes

Answer: 16 446

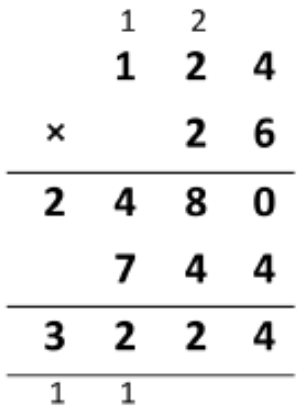
Formal methods – long multiplication

24 × 16 becomes



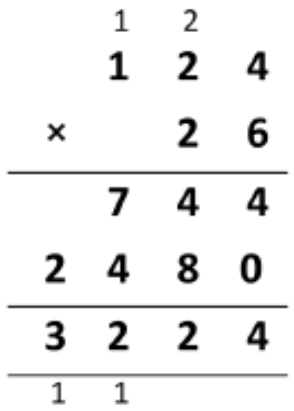
Answer: 384

124 × 26 becomes



Answer: 3224

124 × 26 becomes

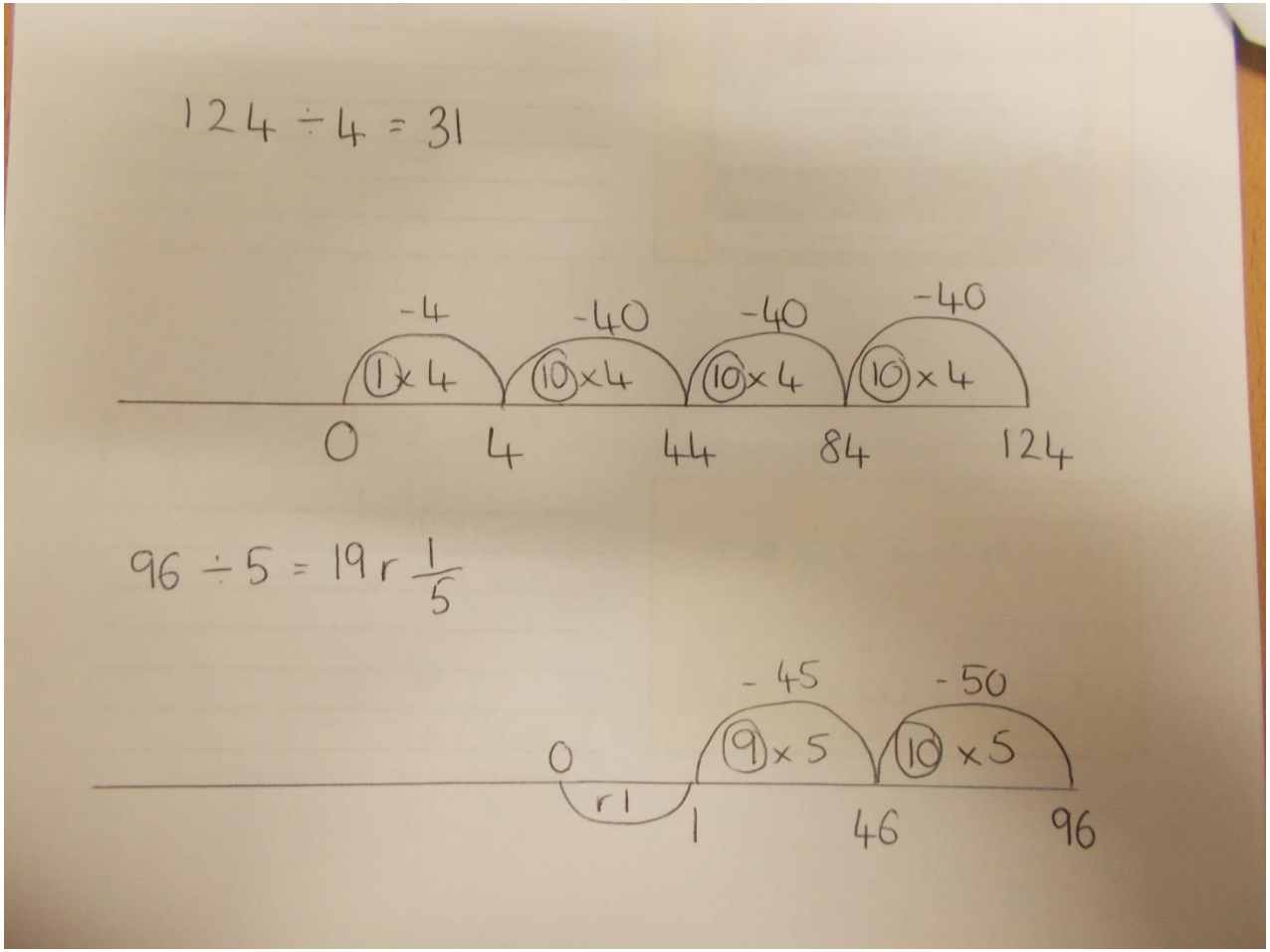


Answer: 3224

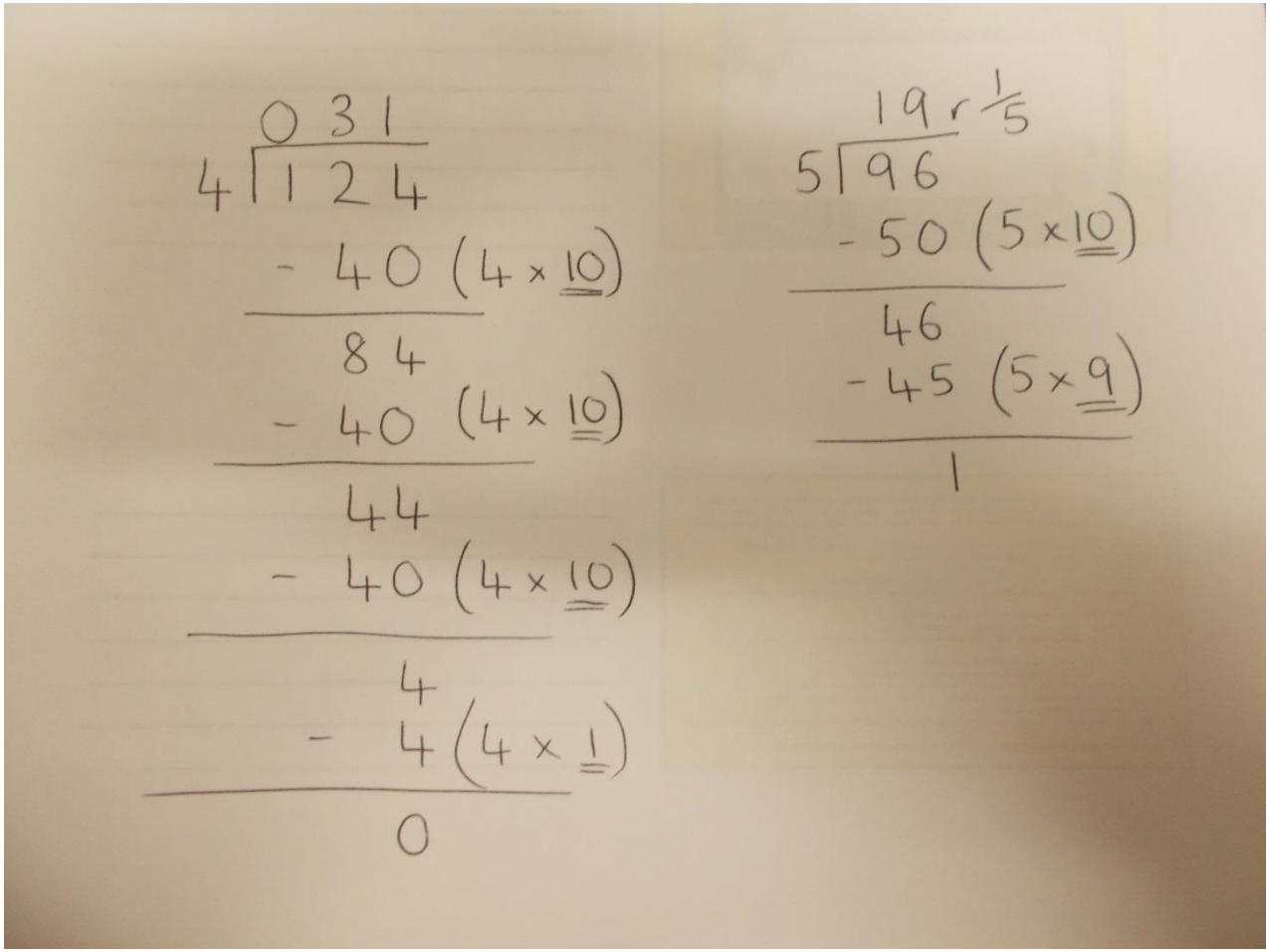
Progression in division

- Sharing
- Sharing and grouping
- Jottings to share or group
- Repeated subtraction on a number line
- Chunking on a number line
- Vertical chunking
- Bus stop
- Long division

Repeated subtraction – chunking

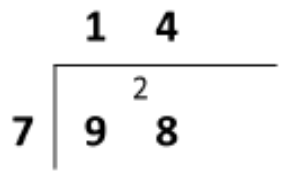


Vertical chunking and bus stop method



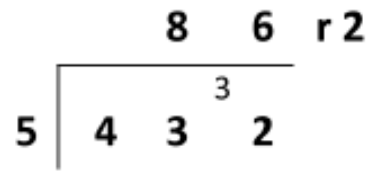
Formal methods – short division

98 ÷ 7 becomes



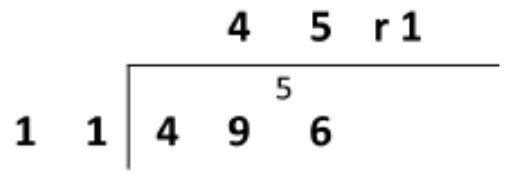
Answer: 14

432 ÷ 5 becomes



Answer: 86 remainder 2

496 ÷ 11 becomes



Answer: $45\frac{1}{11}$

Formal methods – long division

432 ÷ 15 becomes

$$
\begin{array}{r}
 & 2 & 8 & \text{r } 12 \\
\hline
15 \;\big)\; 4 & 3 & 2 & \\
 & 3 & 0 & 0 \\
\hline
 & 1 & 3 & 2 \\
 & 1 & 2 & 0 \\
\hline
 & & 1 & 2
\end{array}
$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$
\begin{array}{rl}
 & 2\ 8 \\
\hline
15 \;\big)\; 4\ 3\ 2 & \\
3\ 0\ 0 & 15\times 20 \\
\hline
1\ 3\ 2 & \\
1\ 2\ 0 & 15\times 8 \\
\hline
\quad 1\ 2 &
\end{array}
$$

$\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$

Answer: $28\ \frac{4}{5}$

432 ÷ 15 becomes

$$
\begin{array}{r}
 & 2 & 8 \cdot 8 \\
\hline
15 \;\big)\; 4 & 3 & 2 \cdot 0 \\
 & 3 & 0 \quad\downarrow \\
\hline
 & 1 & 3 \quad 2 \\
 & 1 & 2 \quad 0 \quad\downarrow \\
\hline
 & & 1\ 2\ 0 \\
 & & 1\ 2\ 0 \\
\hline
 & & \quad 0
\end{array}
$$

Answer: 28·8

Year 5 Problems

1. Every day for 4 days Helen scored 7.5 in a test. On the fifth day she scored 8. What was her total score?
2. I cut 60 cm from 3.3m of string and shared the rest between 3 friends. How much string did they get each?
3. How many jugs with a capacity of 250ml could you fill with 10 litres of water?
4. All the children in the school are going on a residential trip to the outdoor activity centre. They will be divided into 6 equal groups If there are 246 children in the school how many will be in each group?
5. Robert calculated 25% of 600. What answer does he get?
6. Sam calculated 40% of 120. What answer does he get?
7. Rita worked out that 1/6 of a number was 12. What was the number she started with?

Year 6 Problems

1. Three quarters of a number is 54. What is the number?
2. Which is more; 59 of 252 or 47 of 238?
3. There are 36 packets of biscuits. One half are chocolate, a ninth are digestive and a third are wafer biscuits. The rest are ginger nuts. How many biscuits are ginger nuts?
4. There is 20% off in a sale. How much would a track suit cost, if the normal price was £44.50?
5. There is 20% off in a sale. The reduced price of the jeans is £36. What was the original price?
6. At a dance there are 4 girls to every 3 boys. There are 63 children altogether? How many girls are there?
7. Seven in every nine packets of crisps in a box are salt and vinegar. The rest are plain. There are 63 packets of salt and vinegar crisps. How many packets of plain crisps are there?

Achieving mastery of particular topics and areas of mathematics.

Mastery is not just being able to memorise key facts and procedures and answer test questions accurately and quickly.

It involves knowing ‘why’ as well as knowing ‘that’ and knowing ‘how’.

Developing mastery with greater depth is characterised by pupils' ability to:

• solve problems of greater complexity (i.e. where the approach is not immediately obvious), demonstrating creativity and imagination;

• independently explore and investigate mathematical contexts and structures, communicate results clearly and systematically explain and generalise the mathematics.

CALCULATION

Thinking Tom says;

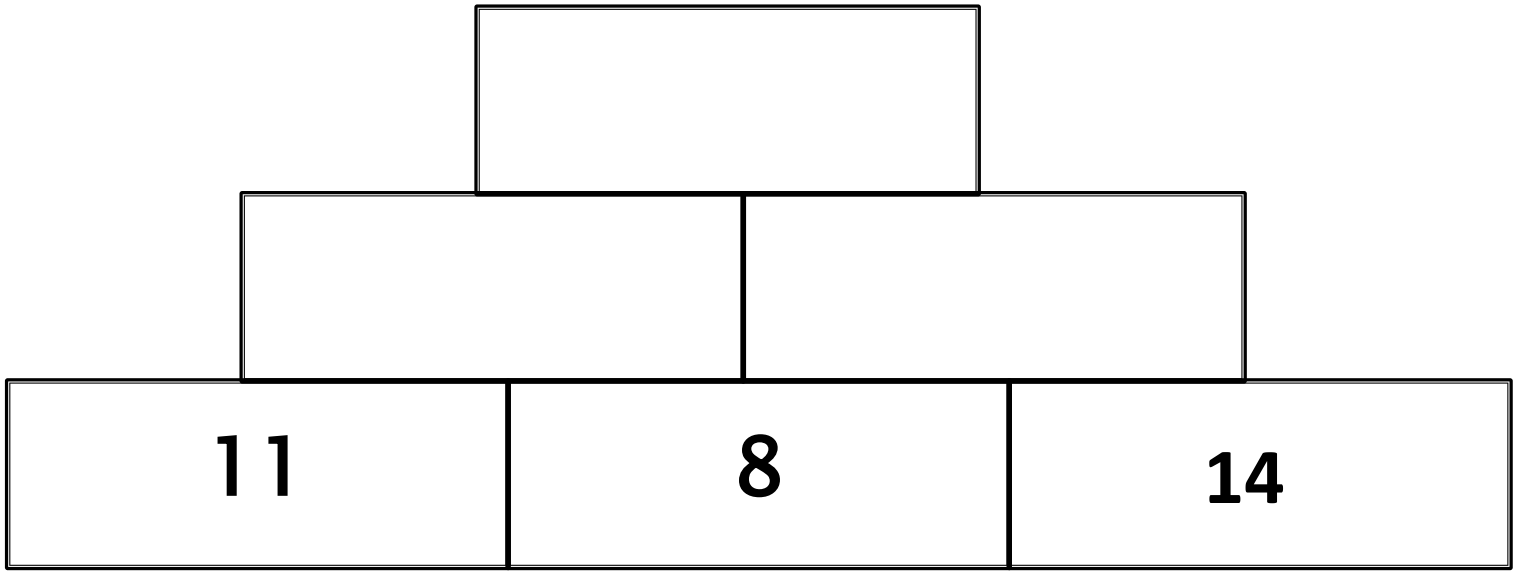
"20 + 11 x 3 = (20 + 11) x 3."

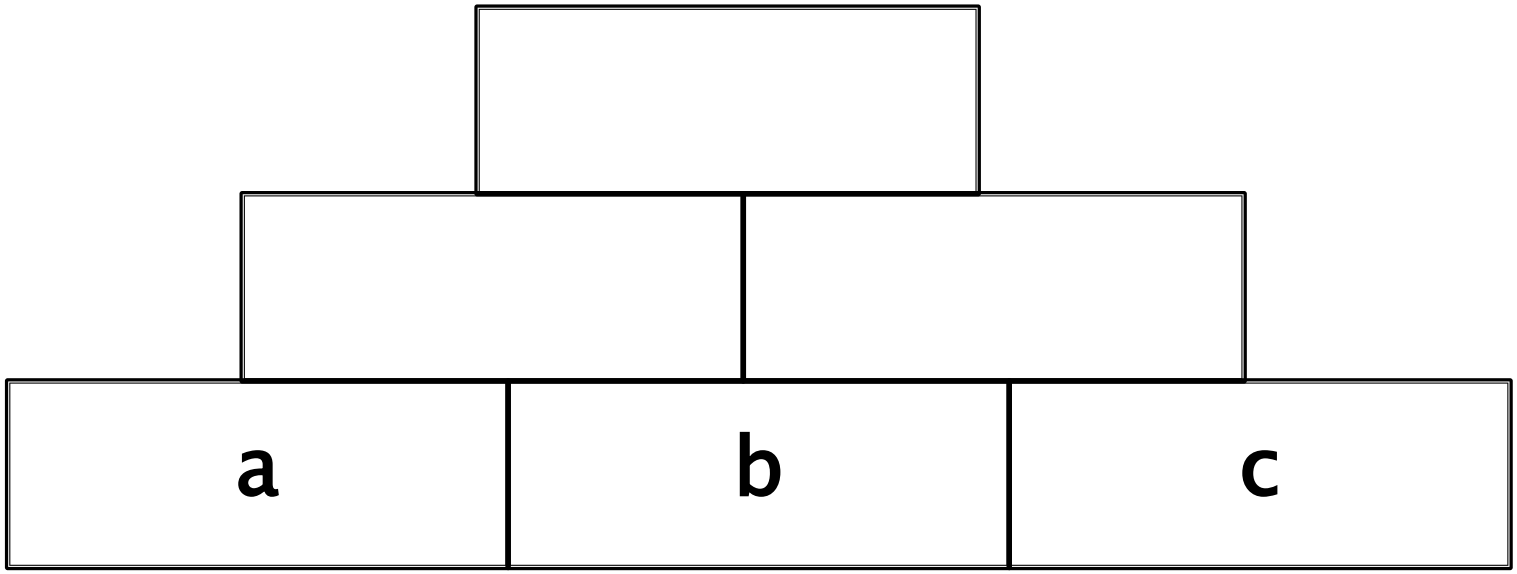
What do you think?

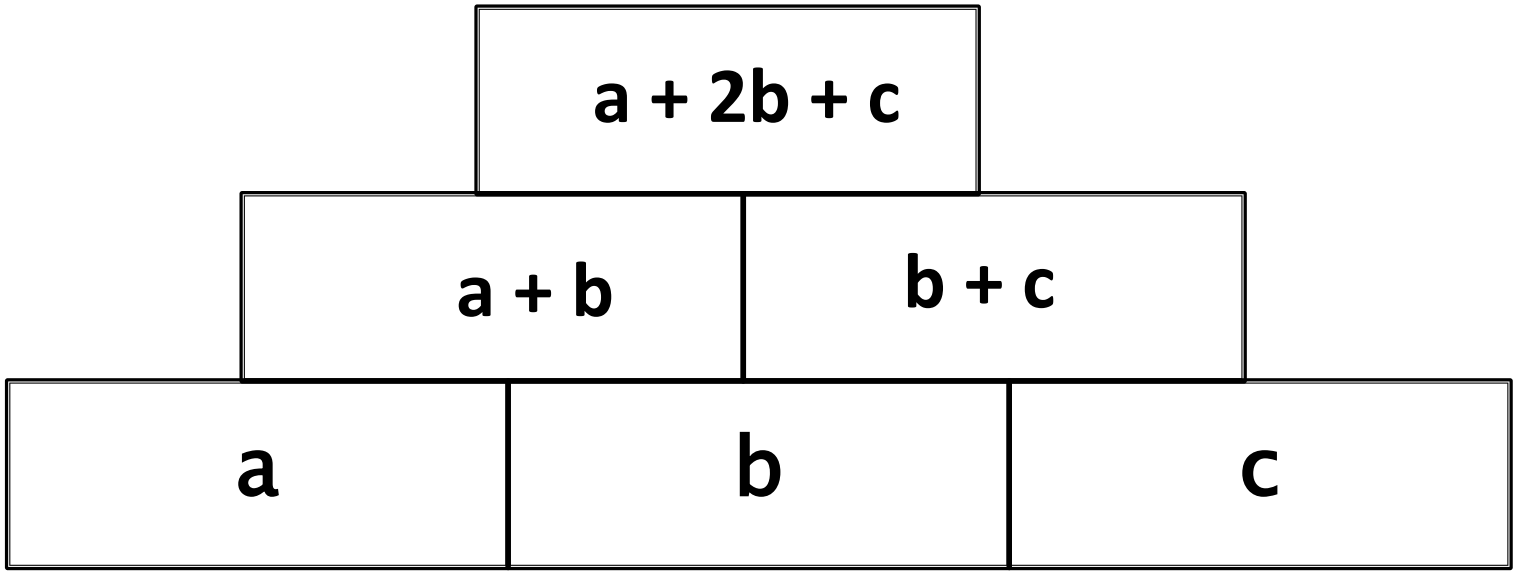
Convince Me!

Task: Can you create a similar number sentence, using brackets on one side, where both sides are equal.

Can I use simple formulae?




a
b
c


a + 2b + c
a + b
b + c
a
b
c

A useful checklist for what to look out for when assessing a pupil's understanding might be:

A pupil really understands a mathematical concept, idea or technique if he or she can:

- **describe** it in his or her own words;
- **represent** it in a variety of ways (e.g. using concrete materials, pictures and symbols – the CPA approach)
- **explain** it to someone else;
- **make up his or her own examples** (and non-examples) of it;
- **see connections** between it and other facts or ideas;
- **recognise it in new situations and contexts**;
- **make use of it in various ways**, including in new situations.

Why does this work? ***Convince me.***

Use reasoning prompts to do this:

- Why do you think that …?
- Can you explain why that is right?
- How do you know?
- How did you reach that conclusion?
- What might explain that …?
- How is that possible?
- Can you show me …?
- Is there another way …?
- What explanation do you think is best …?
- Have you tried all the possible cases?
- Does it always work? Why?
- What do you notice when …?

SATs

- Current Year 6

- Paper 1 – Arithmetic (30 minutes)
- Paper 2 – Reasoning (40 minutes)
- Paper 3 – Reasoning (40 minutes)

- 110 marks in 110 minutes

Examples from Arithmetic paper

- 555 +
  656

1 1/7 - 3/7 =

2376 ×
15

28) 1652

120 – 15 x 5

5 x £3.99

When tackling a mathematical problem, children will ask themselves…

- What do I know about these numbers?
- Can I do this in my head?
- Do I know the approximate size of the answer?
- If I can't do it all in my head, what do I need to write down to help me?

"Most adults assume that maths is a subject that is entirely about being *able to do it* and *getting it right*. We challenge this view. We think that one of the most important aspects of maths is *being stuck* and *getting it wrong*. A maths question isn't called a 'problem' for nothing."

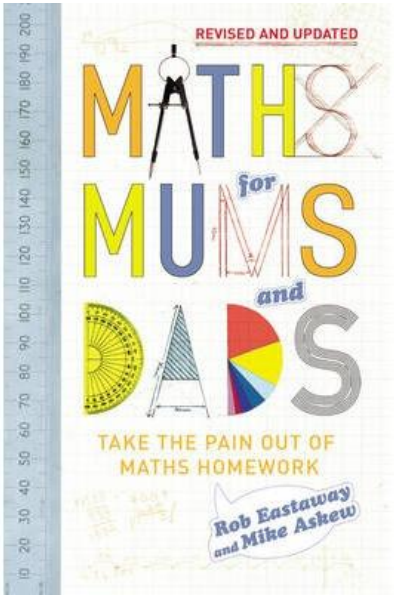
Maths for Mums and Dads

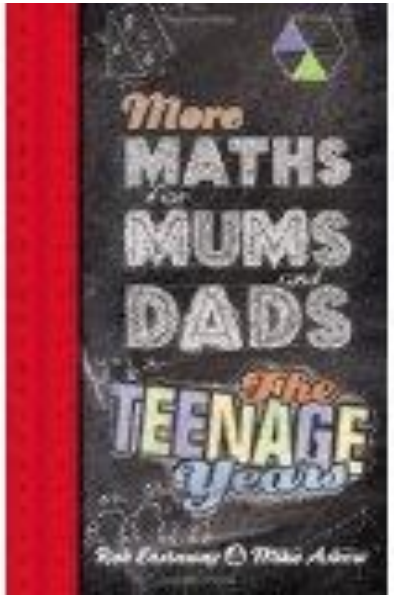
- “It’s the school’s job to provide the structured learning….Your role is to nurture and support your child’s mathematical knowledge away from school, to bring it into their real lives and, most important of all, to turn it into an exciting adventure”

From “Maths for Mums and Dads” – Rob Eastaway and Mike Askew

Maths for Mums and Dads

- **ISBN: 978-0-224-08635-6**





Have your questions been answered?