CALCULATING IN UPPER KS2

MATHEMATICS AT ST BOTOLPH'S

AIMS AND OBJECTIVES

- Consider the developmental stages of number and calculation.
- Explore how we teach counting and place value and analyse the resources we use.
- Understand the basic end of year and key stage expectations for mathematics.

- **To provide parents and carers with a clear guide as to which algorithms their children are being taught.**

NATIONAL CURRICULUM

Fluency: flexibility (making connections), speed and accuracy;
Problem solving (not just word problems); and
Reasoning (using mathematical language to clearly explain patterns, hypothesise or enquiries).

St Botolph's children learn to:

- Confidently and accurately **mentally calculate**, without reliance on formal written methods;
- Identify **when** to mentally calculate and when to use formal written methods;
- Identify which **reliable** method of calculating is the **most efficient**;
- Confidently and accurately **reason** in relation to their calculating;
- Confidently and accurately use a varied **vocabulary** when reasoning;
- Use their mental maths and understanding of number to acknowledge whether their answer is feasible.

THE IMPORTANCE OF GUIDED PROGRESSION

- There are lots of progressions for addition, subtraction, multiplication and division. All have advantages and disadvantages – pupils will quickly find their favourites.
- All children need time to consolidate their knowledge to ensure they understand the concepts that underpin the methods.
- The speed at which pupils move through the progressions is very individual.

Fact : it is important that children’s mental methods of calculation are practised and secured alongside their learning and use of efficient written methods for calculations.

Implications for parents and carers: if you want to support the learning and understanding of your children’s written methods, then helping them with mental calculations is imperative!

NATIONAL CURRICULUM

Year 5 Key Objectives - Mathematics

Number and place value

- read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
- interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero
- round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000
- solve number problems and practical problems that involve all of the above
- read Roman numerals to 1000 (M) and recognise years written in Roman numerals

- round decimals with two decimal places to the nearest whole number and to one decimal place
- read, write, order and compare numbers with up to three decimal places
- solve problems involving number up to three decimal places

Year 6 Key Objectives

Number, place value & algebra

- read, write, order and compare numbers up to 10 000 000 and determine the value of each digit
- round any whole number to a required degree of accuracy
- use negative numbers in context, and calculate intervals across zero
- solve number and practical problems that involve all of the above.

- use simple formulae
- generate and describe linear number sequences
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with two unknowns
- enumerate possibilities of combinations of two variables.

NATIONAL CURRICULUM

Calculation

- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- add and subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

- identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- multiply and divide numbers mentally drawing upon known facts
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

- recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3)
- solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes
- solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates.

Statistics

- solve comparison, sum and difference problems using information presented in a line graph
- complete, read and interpret information in tables, including timetables.

NATIONAL CURRICULUM

Calculation (including Ratio/Proportion)

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations

solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

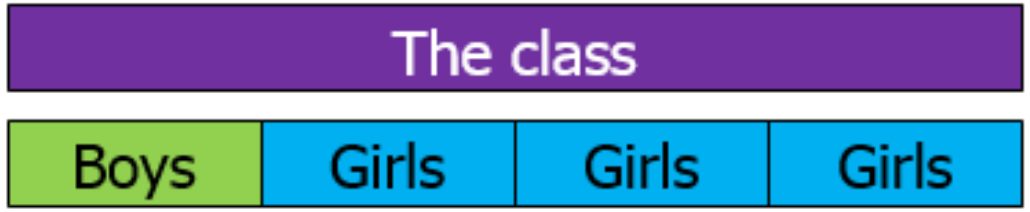
- solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts
- solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and the use of percentages for comparison
- solve problems involving similar shapes where the scale factor is known or can be found
- solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.

END OF KS2 EXPECTATIONS

24 In a class, 18 of the children are girls.

A quarter of the children in the class are boys.

- The bar represents the whole class.

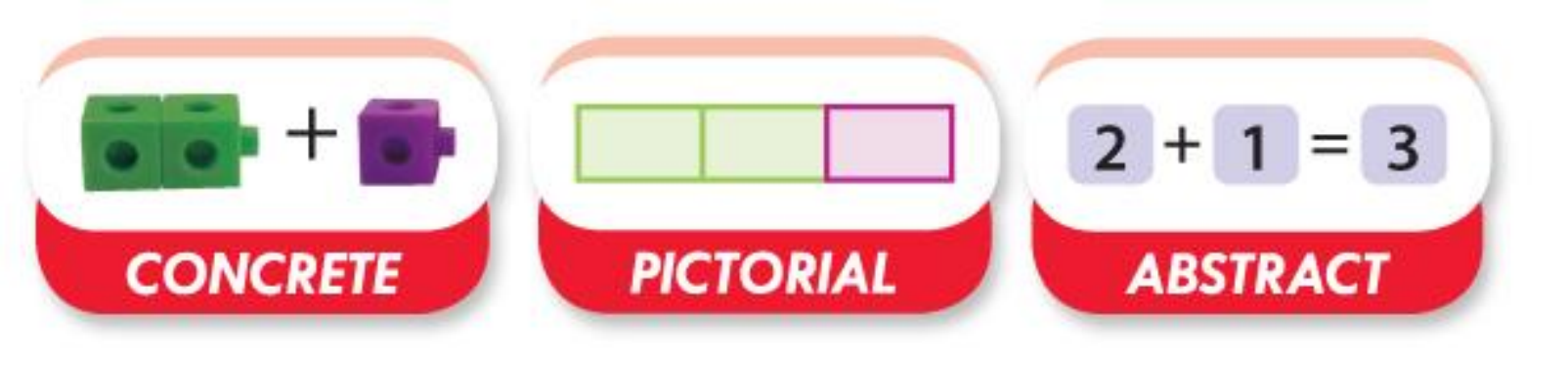


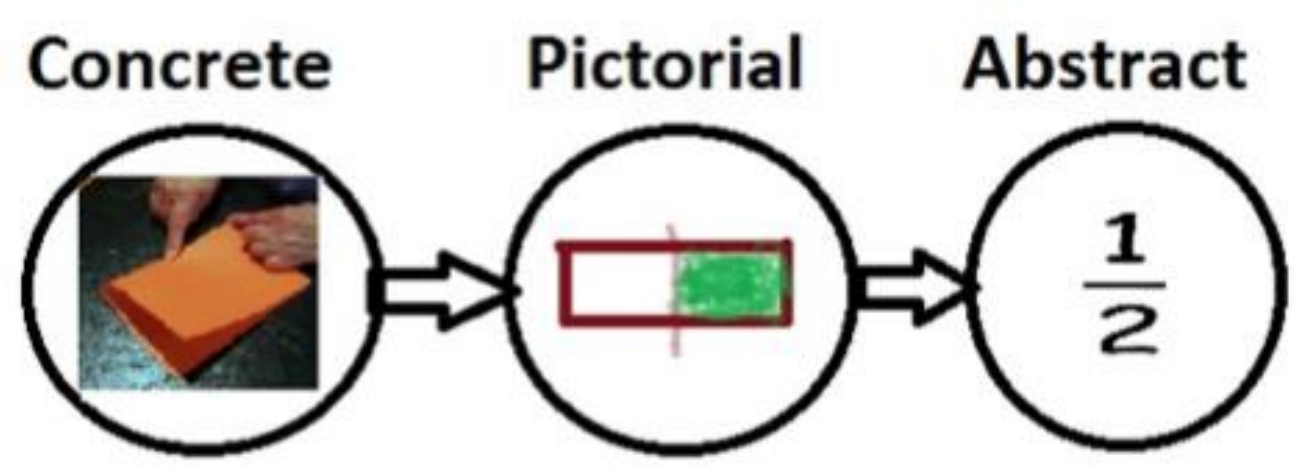
- The rest of the class must be girls

- As there are 18 girls, each of the three girls sections must equal 6.
- So the boys section must also be 6.
- $6 \times 4 = 24$, which means that 24 children are in the class.

SO HOW DO THEY GET THERE…

1. CONCRETE – PICTORIAL - ABSTRACT





2. VOCABULARY

- more, less, many, few
- odd, even
- every other
- how many times
- pattern, pair, rule, relationship
- sequence, linear sequence
- continue, predict
- sort, classify, property
- formula, square number
- ones, tens, hundreds, thousands,

ten thousands, hundred thousands, millions

- place, place value, place holder, digit
- stands for, represents
- exchange, same as , equal to,
- >greater, more, larger, bigger
- <less, fewer, smaller
- greatest, most, biggest, largest
- least, fewest, smallest

one more, ten more, hundred more
one less, ten less, hundred less
compare, order, size, value
first, second, third… twentieth
twenty-first, twenty-second…
last, last but one
before, after, next
between, half-way between
above, below zero, minus
positive, negative
figures, words

General

same, different, identical
partition
number facts, number pairs
missing numbers
Commutative law
Distributive law
Associative law

equivalence
start from, start at
arrange, rearrange
split, separate
adjust, adjusting
change, change over
continue, carry on
what comes next
find, show me, choose, tell me
describe the pattern/rule
solve, check, interpret
all, each, every
in order, in a different order
best way, another way
same way, different way
missing, different, same number

explain you method
explain how you got your answer
give an example of
investigate, interrogate
identify, justify

2. VOCABULARY

- one more, two more… ten more… one hundred more
- altogether, = equal to, the same as
- how many more make…
- how many more is…
- how much more is…
- _ subtract, subtraction, take (away), minus, decrease
- leave, how many are left/have gone
- how many fewer…
- how much less…
- difference between
- number bonds
- boundary
- exchange, regroup
- formal, informal
- columnar
- inverse operations

Calculations (Multiplication and Division)

multiplication/division facts
lots of, groups of, times, multiply,
multiplied by, multiple of, product
once, twice, three times…
repeated addition, array
row, column
doubling, double, near double
half, halve
share, share equally
equal groups of
÷ divide, division, divided by,
divided into
remainder, factor, factorise
quotent, dividend, divisor
= equal to, sign, is the same as
scale up, inverse
prime number, prime factor
composite (non-prime)
square, cube

Calculations (Solving Problems)

pattern, puzzle
calculate, calculation
mental calculation
method, jotting, answer
right, correct, wrong, incorrect
what could we try next
how did you work it out
equation, sign, operation, symbol
predict, relationship
property, sort, classify, consecutive

Calculations (Estimating)

guess how many, estimate
nearly, roughly, close to
approximate, approximately
just over, just under
exactly, exact
too many, too few, enough, not enough
round (up or down), round to the
nearest ten, hundred, thousand

3. 'MASTERY'

Mastery means that children are able to:

- use mathematical knowledge and understanding flexibly and fluently;
- recall key number facts with speed and accuracy;
- use accurate, rapid recall of number facts to be able to calculate unknown number facts efficiently;
- reason and explain mathematical concepts and use this reasoning to solve a variety of problems.

Examples of mastery:

- Can they describe their work in their own words, using mathematical vocabulary?
- Can they explain it to someone else, so that they too understand?
- Can they show their work in a variety of ways, i.e. using objects, pictures, symbols?
- Can they make up their own examples or questions using the concept that they have mastered?
- Can they see/make connections with other areas of mathematics, i.e. fractions and partitioning numbers?
- Can they recognise the same concept in a new situation or context, i.e. do they understand in any way it can be shown?
- Can they make use of their knowledge to work more efficiently, i.e. the quickest, easiest, most accurate way?

ADDITION AND SUBTRACTION

Written methods taught…

Year Four – Empty Number Lines, Partitioning, Short Column

Year Five and Six – Same as Year Four, and Short Column for decimals

+ knowing which is the most efficient method (knowing when to use a method and why)

… but there are many mental methods that support these.

NUMBER SENSE

Number sense

Number bonds

Known facts

Commutativity

Inverse

In Year 5 and 6, we continue to partition numbers to use number bonds to calculate (make 10 strategy),

i.e. 45 + 26 =
45 + 5 (to number bond),
then + 1 +20 (or +10 +10)

0 + 10 = 10
1 + 9 = 10
2 + 8 = 10
3 + 7 = 10
4 + 6 = 10
5 + 5 = 10

0 + 100 = 100
10 + 90 = 100
20 + 80 = 100
30 + 70 = 100
40 + 60 = 100
50 + 50 = 100

0 + 1 = 1.0
0.1 + 0.9 = 1
0.2 + 0.8 = 1
0.3 + 0.7 = 1
0.4 + 0.6 = 1
0.5 + 0.5 = 1

0.25 + 0.75 = 1.00
0.26 + 0.74 = 1
0.27 + 0.73 = 1
0.28 + 0.72 = 1
0.29 + 0.71 = 1
0.3(0) + 0.7(0) = 1

0 + 7 = 7
7 + 0 = 7
1 + 6 = 7
6 + 1 = 7
2 + 5 = 7
5 + 2 = 7
3 + 4 = 7
4 + 3 = 7

All ways to make a 1 digit or 2 digit number (known facts).

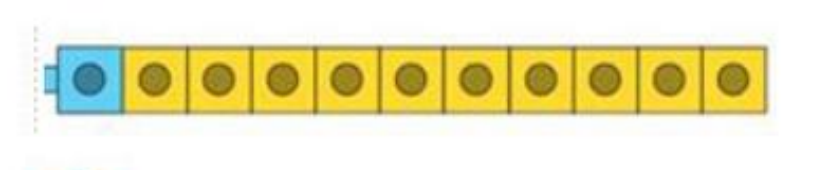
Year 5 and 6, continue to work with missing values and inverse, i.e.
427 = 65 + ?
or 1000 - ? = 734

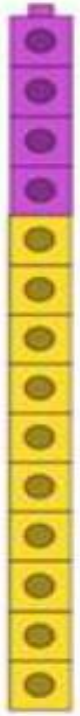
Year 5 and 6 continue to work on fact families and working systematically.

Near doubles...
187 + 185 = 185 x 2 + 2

Using known facts to derive known facts,
i.e. 'If I know 7 + 3 = 10, then I also know 70 + 30 = 100, 0.7 + 0.3 = 1'.

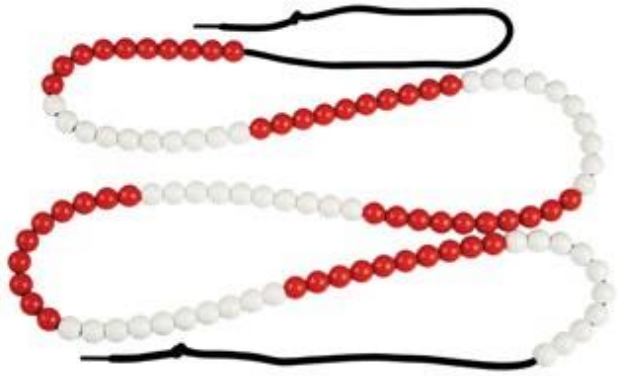
CONCRETE – PICTORIAL – ABSTRACT (Y5&Y6)





Cubes

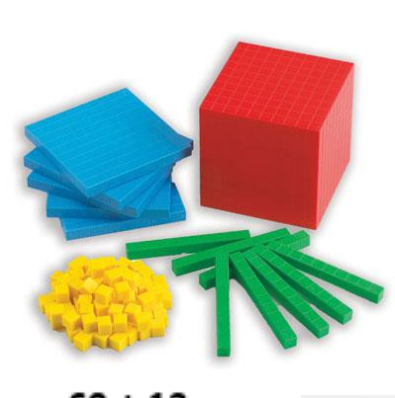
Beadstring

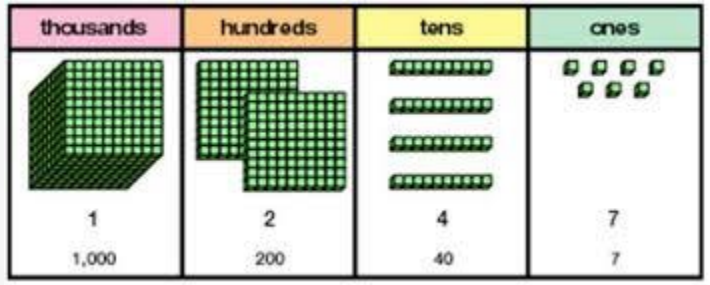


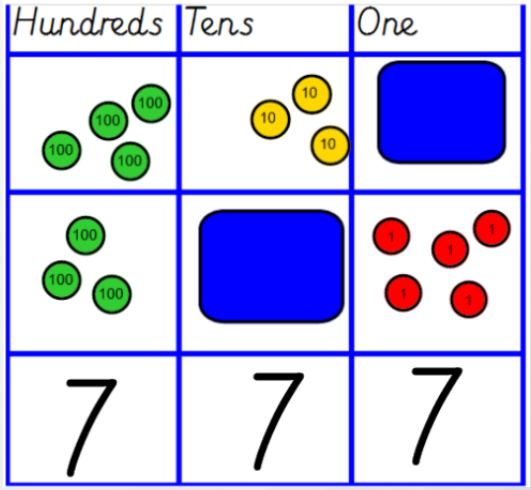
To compare strategies and methods for efficiency.

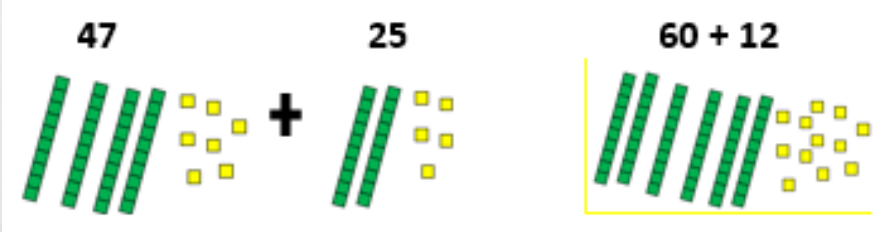
CONCRETE – PICTORIAL – ABSTRACT (Y5&Y6)

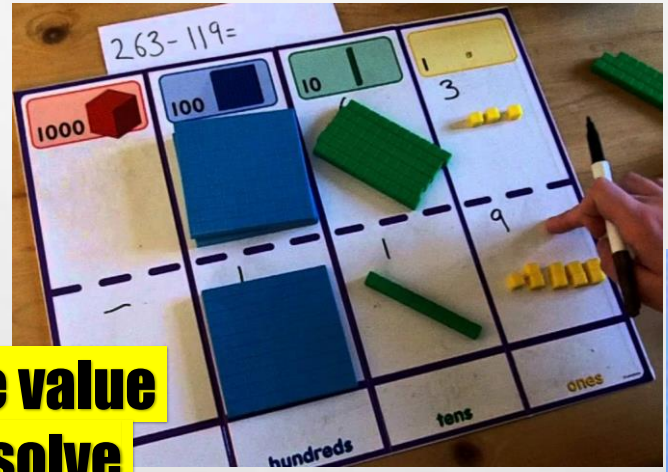
Dienes
&
Place Value Counters

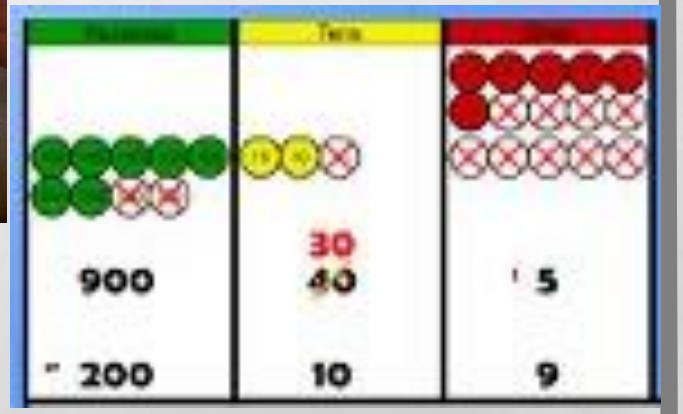












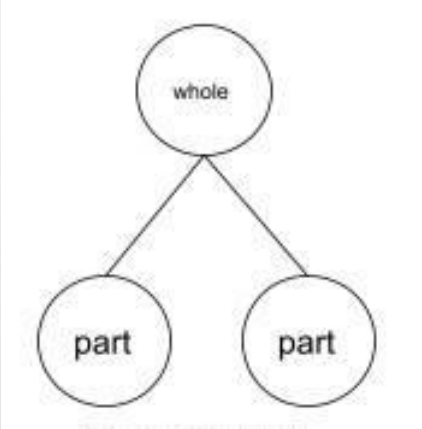
Year 5 and 6 continue to use dienes and place value counters to regroup, calculate and problem solve, i.e. 254 = 200+50+4 = 100+150+4 = 102+151+1

***Dienes parts are used for different (smaller) values in Year 6, when calculating with decimals.**

Year 5 work on numbers up to 100,000. Year 6 work with numbers beyond 1,000,000.

CONCRETE – PICTORIAL – ABSTRACT (Y5&Y6)

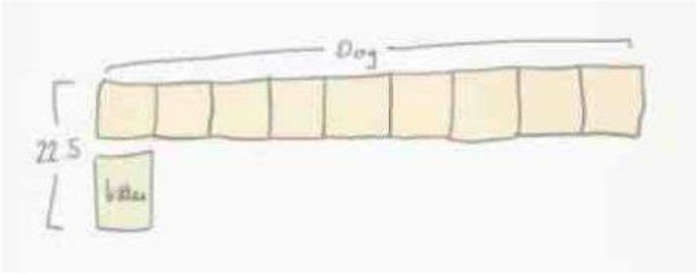
Part Whole Model
Bar Model



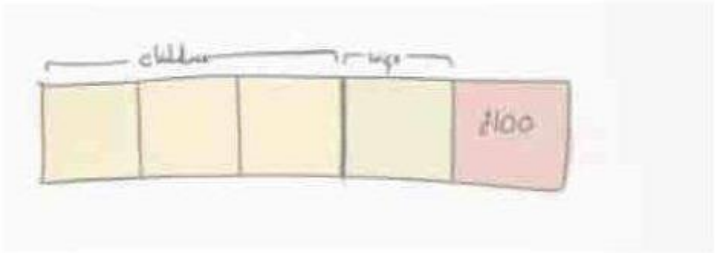
Whole	
Part	Part

Bar model

A vet weighs a large dog and a kitten. The large dog weighs 9 times more than the kitten. Altogether they weigh 22.5kg. What does the dog weigh?

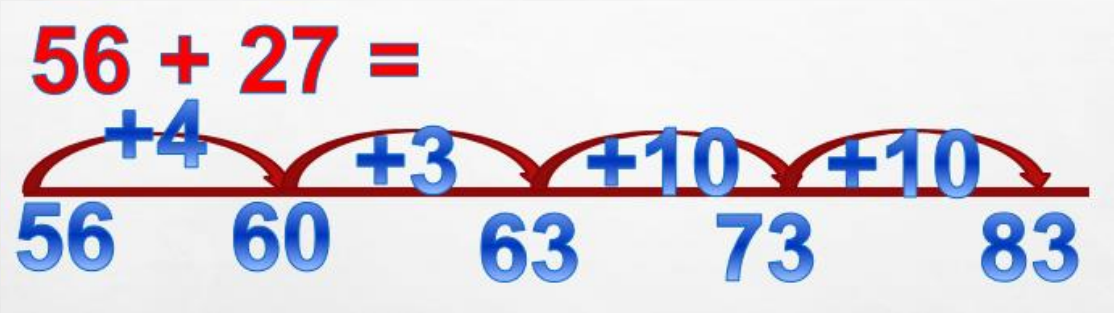


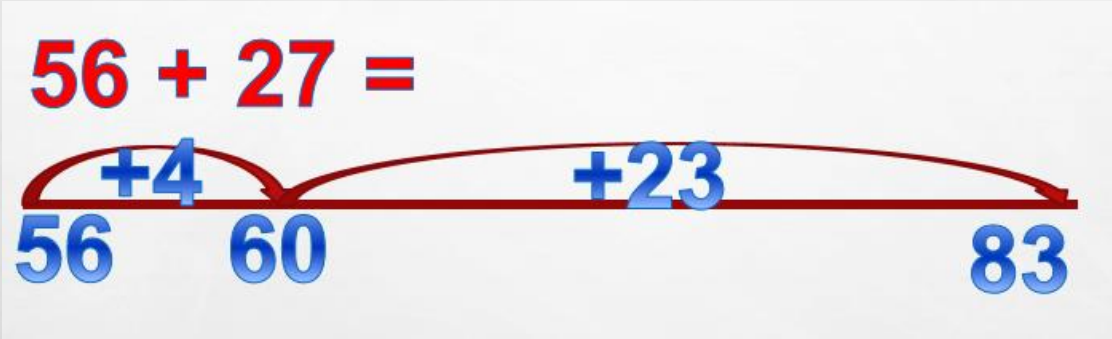
Filip and his family were on a day out. He gave his two children $\frac{3}{5}$ of his money. He gave his wife $\frac{1}{2}$ of the remaining money. He had £100 left, so how much did he have to begin with?



ABSTRACT (Y5&Y6)

Number lines - Addition





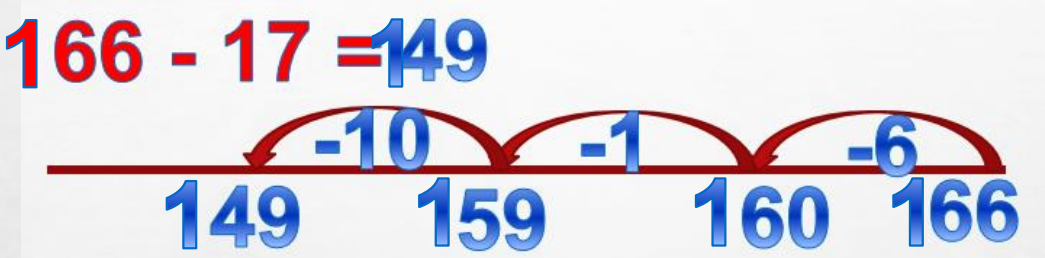
Continued method from Year 4

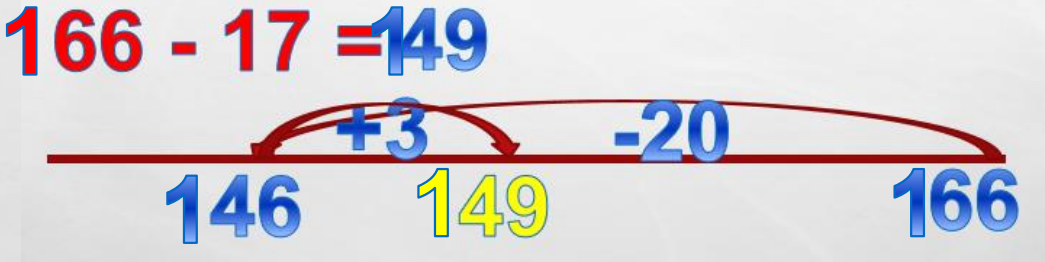
Partitioning thousands, hundreds, tens and ones etc
Adding smallest value first
Using make 10 (number bonds)
Rounding and adjusting

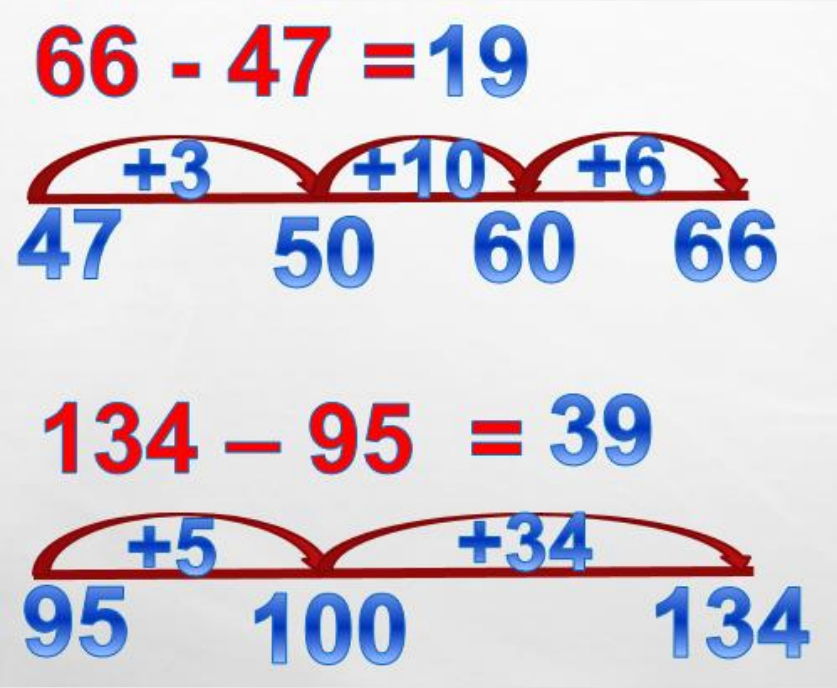
Efficiency

ABSTRACT (Y3&Y4)

Number lines - Subtraction







Counting back
Staring from the larger value
Partitioning the values being subtracted
Using number bonds to get to a boundary
Rounding and adjusting

Efficiency

Counting on
(when numbers are similar/close in value)
Start with smaller value number
Working out the difference (count the jumps)
Partitioning the values being subtracted
Using number bonds to get to a boundary

ABSTRACT (Y5&Y6)

Partitioning

H T O H T O TH H T O

589 + 643 =

500 + 600 = 1,100

80 + 40 = 120

9 + 3 = 12

1,100 + 120 + 12 = 1,232

'If I know 5 and 6 makes 11, then I know 500 and 600 make 1,100.'

H T O H T O H T O

246 - 157 =

246 - 100 = 146

146 - 40 = 106

106 - 10 = 96

96 - 6 = 90

90 - 1 = 89

We do not partition BOTH numbers for subtraction because...

46 – 37 =

40 – 30 =

6 – 7 =

there are not enough ones here and we go into negative numbers.

ABSTRACT (Y5&Y6)

Expanded column - Addition

856 + 123 =

800 + 50 + 6
+
100 + 20 + 3

900 + 70 + 9

979

856 + 376 =

800 + 50 + 6
+
300 + 70 + 6

1,100 + 120 + 12

1,232

Efficiency

ABSTRACT (Y5&Y6)

Short column - Addition

	H	T	O
	8	5	6 +
	1	2	3
	9	7	9

	H	T	O
		1	1
	8	5	6 +
	3	7	6
1,	2	3	2

Expanded column is an important stepping stone to short column due to the importance of understanding exchanging.

ABSTRACT (Y5&Y6)

Expanded column - Subtraction

856 - 123 =

800 + 50 + 6 -
100 + 20 + 3

700 + 30 + 3

733

856 - 278 =

700 140
~~800~~ + ~~50~~ + 16 -
200 + 70 + 8

500 + 70 + 8

578

Efficiency

This can also be done without the + symbols, as some children find this confusing because it is subtraction.

8.6 - 1.3 =

8 + 0.6
1 + 0.3 -

7 + 0.3

7.3

8.6 - 4.7 =

7
~~8~~ + 1.6
4 + 0.7 -

3 + 0.9

3.9

ABSTRACT (Y5&6)

Short column - Subtraction

H	T	O
8	5	6 -
1	2	3
7	3	3

H	T	O
~~8~~ 7	~~5~~ 14	16 -
2	7	8
5	7	8

Expanded column is an important stepping stone to short column due to the importance of understanding exchanging.

YOUR TURN

Have a go at calculating these equations using different methods (both informal (mental concrete or pictorial) or formal (written abstract).

<u>Challenge): Which is the most efficient method?</u>

<u>YEAR FIVE & SIX</u>

125 + 129	1,623 + 156	1,125 - 989	1,629 – 106
1,115 + 128	1,292 + 1,015	2,115 - 128	1,042 - 315
9,181 + 3,153	18,782 + 5,439	9,121 - 1,358	11,081 - 3,436

YEAR FIVE – MASTERY - ADDITION

Children know and can explain:

- **What is the same and what is different about different calculation methods for the same equation;**
- **The important role of inverse for checking accuracy;**
- **Whether to round to the nearest ten, hundred, thousand etc in order to estimate an answer;**
- **How using the associative law can help when adding three or more numbers: 367 + 275 + 525 is probably best thought of as 367 + (275 + 525) rather than (367 + 275) + 525); and**
- **Which calculation method to use, supported by being able to take apart and combine numbers in many ways. For example, calculating 8·78 + 5·26 might involve calculating 8·75 + 5·25 and then adjusting the answer.**

Mastery	Mastery with Greater Depth
Choose digits to go in the empty boxes to make these number sentences true. 14 781 – 6 □ 53 = 8528 23·12 + 22· □ = 45·23	Can you use five of the digits 1 to 9 to make this number sentence true? □ □ · □ + □ · □ = 31·7 Can you find other sets of five of the digits 1 to 9 that make the sentence true?
Two numbers have a difference of 2·38. The smaller number is 3·12. What is the bigger number? Two numbers have a difference of 2·3. They are both less than 10. What could the numbers be?	Two numbers have a difference of 2·38. What could the numbers be if: ■ the two numbers add up to 6? ■ one of the numbers is three times as big as the other number? Two numbers have a difference of 2·3. To the nearest 10, they are both 10. What could the numbers be?

YEAR SIX – MASTERY - ADDITION

Children know and can explain:

- **What is the same and what is different about different calculation methods for the same equation;**
- **Which calculation method to use, supported by being able to take apart and combine numbers in many ways. For example, calculating 8·78 + 5·26 might involve calculating 8·75 + 5·25 and then adjusting the answer;**
- **How the associative rule helps when adding three or more numbers: 367 + 275 + 525 is probably best thought of as 367 + (275 + 525) rather than (367 + 275) + 525; and**
- **Addition investigations, for example 'two numbers have a difference of 2·38. What could the numbers be if: the two numbers add up to 6? One of the numbers is three times as big as the other number?'**

Mastery	Mastery with Greater Depth
Calculate 36·2 + 19·8 ■ with a formal written column method ■ with a mental method, explaining your reasoning.	Jasmine and Kamal have been asked to work out 5748 + 893 and 5748 – 893. Jasmine says, '893 is 7 less than 900, and 900 is 100 less than 1000, so I can work out the addition by adding on 1000 and then taking away 100 and then taking away 7.' What answer does Jasmine get, and is she correct? Kamal says, '893 is 7 less than 900, and 900 is 100 less than 1000, so I can work out the subtraction by taking away 1000 and then taking away 100 and then taking away 7.' What answer does Kamal get, and is he correct? If you disagree with either Jasmine or Kamal, can you correct their reasoning?

YEAR FIVE – MASTERY - SUBTRACTION

Children know and can explain:

- **What is the same and what is different about different calculation methods for the same equation;**
- **The important role of inverse for checking accuracy;**
- **Whether to round to the nearest ten, hundred, thousand etc in order to estimate an answer;**
- **How using the associative law can help when adding three or more numbers: 367 + 275 + 525 is probably best thought of as 367 + (275 + 525) rather than (367 + 275) + 525); and**
- **Which calculation method to use is supported by being able to take apart and combine numbers in many ways. For example, calculating 8·78 + 5·26 might involve calculating 8·75 + 5·25 and then adjusting the answer.**

Mastery	Mastery with Greater Depth
Calculate 36·2 + 19·8 ▪ with a formal written column method ▪ with a mental method, explaining your reasoning.	Jasmine and Kamal have been asked to work out 5748 + 893 and 5748 – 893. Jasmine says, '893 is 7 less than 900, and 900 is 100 less than 1000, so I can work out the addition by adding on 1000 and then taking away 100 and then taking away 7.' What answer does Jasmine get, and is she correct? Kamal says, '893 is 7 less than 900, and 900 is 100 less than 1000, so I can work out the subtraction by taking away 1000 and then taking away 100 and then taking away 7.' What answer does Kamal get, and is he correct? If you disagree with either Jasmine or Kamal, can you correct their reasoning?

YEAR SIX – MASTERY - SUBTRACTION

Children know and can explain:

- **What is the same and what is different about different calculation methods for the same equation;**
- **The important role of inverse for checking accuracy;**
- **Whether to round to the nearest ten, hundred, thousand etc in order to estimate an answer;**
- **How using the associative law can help when adding three or more numbers: 367 + 275 + 525 is probably best thought of as 367 + (275 + 525) rather than (367 + 275) + 525); and**
- **Which calculation method to use is supported by being able to take apart and combine numbers in many ways. For example, calculating 8·78 + 5·26 might involve calculating 8·75 + 5·25 and then adjusting the answer.**

Mastery	Mastery with Greater Depth
Choose digits to go in the empty boxes to make these number sentences true. 14 781 – 6 $\square$ 53 = 8528 23·12 + 22· $\square$ = 45·23	Can you use five of the digits 1 to 9 to make this number sentence true? $\square\square\cdot\square+\square\cdot\square=31{\cdot}7$ Can you find other sets of five of the digits 1 to 9 that make the sentence true?

MULTIPLICATION AND DIVISION

Written methods taught…

Year Four – Number Lines, Partitioning, Grid, Compact Multiplication, Long Division, Short Division (remainders)

Year Five – Same as Year Four, Decimals and Two Digit multiplication

+ knowing which is the most efficient method (knowing when to use a method and why)

Year Six – Same as Year Five and Two Digit division

+ knowing which is the most efficient method (knowing when to use a method and why)

… but there are many mental methods that support these.

NUMBER SENSE

Number sense

Known facts

Sequence

Patterns

Commutativity

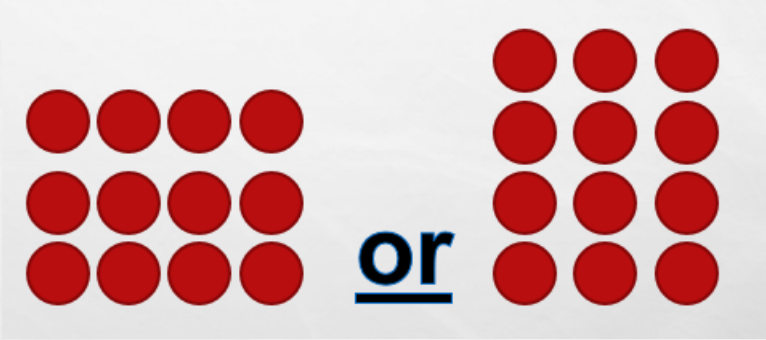
6 x 7 = 42
60 x 7 = 420
6 x 70 = 420
60 x 70 = 4,200
600 x 7 = 4,200
6 x 700 = 4,200
0.6 x 7 = 4.2
6 x 0.7 = 4.2
0.6 x 0.7 = 0.42 etc

Year 5 and 6, continue to work with missing values and inverse, i.e.
390 = 65 x ?
or 1000 ÷ ? = 333.333

Year 5 and 6 continue to work on fact families and working systematically.

Using known facts to derive known facts

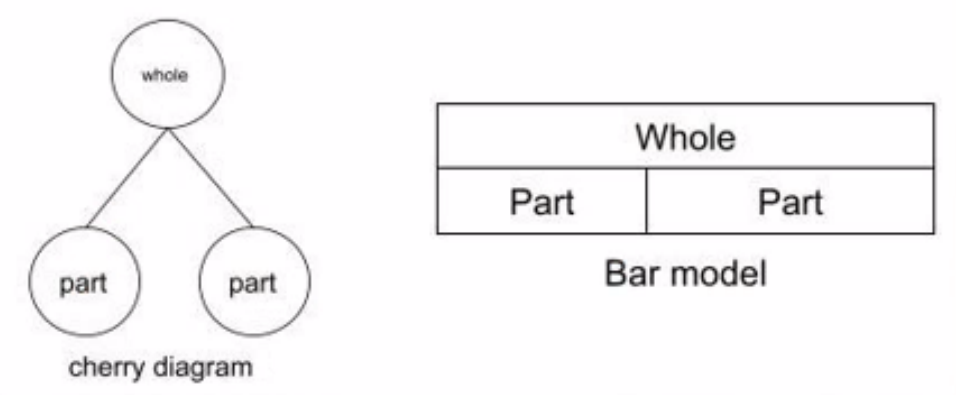
CONCRETE – PICTORIAL – ABSTRACT (Y5&Y6)

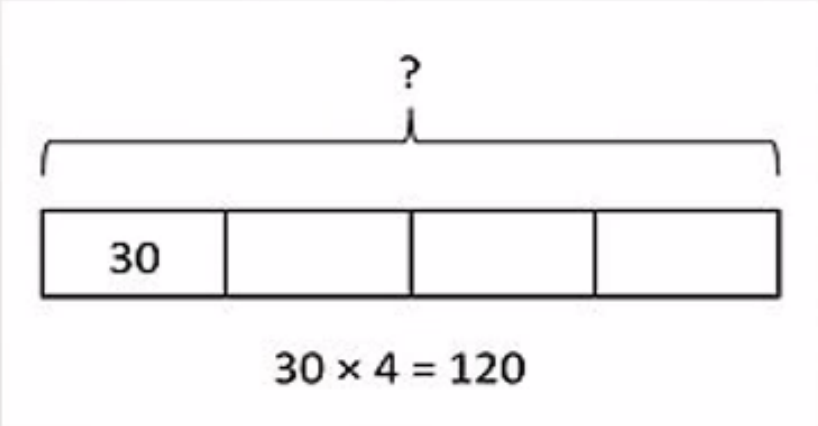


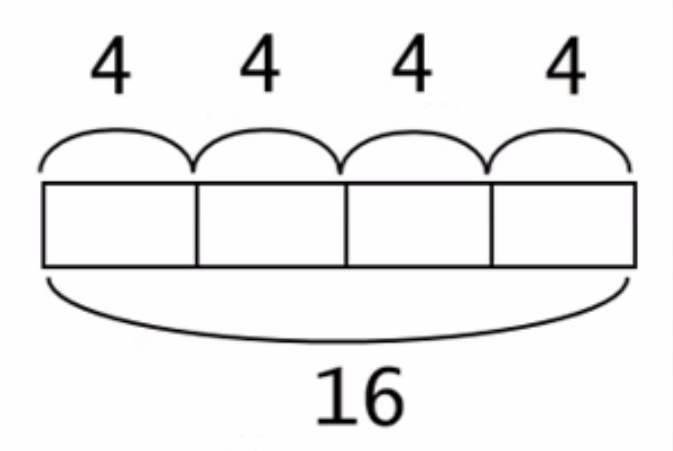
Arrays

Efficiency

Part Whole Model
Bar Model



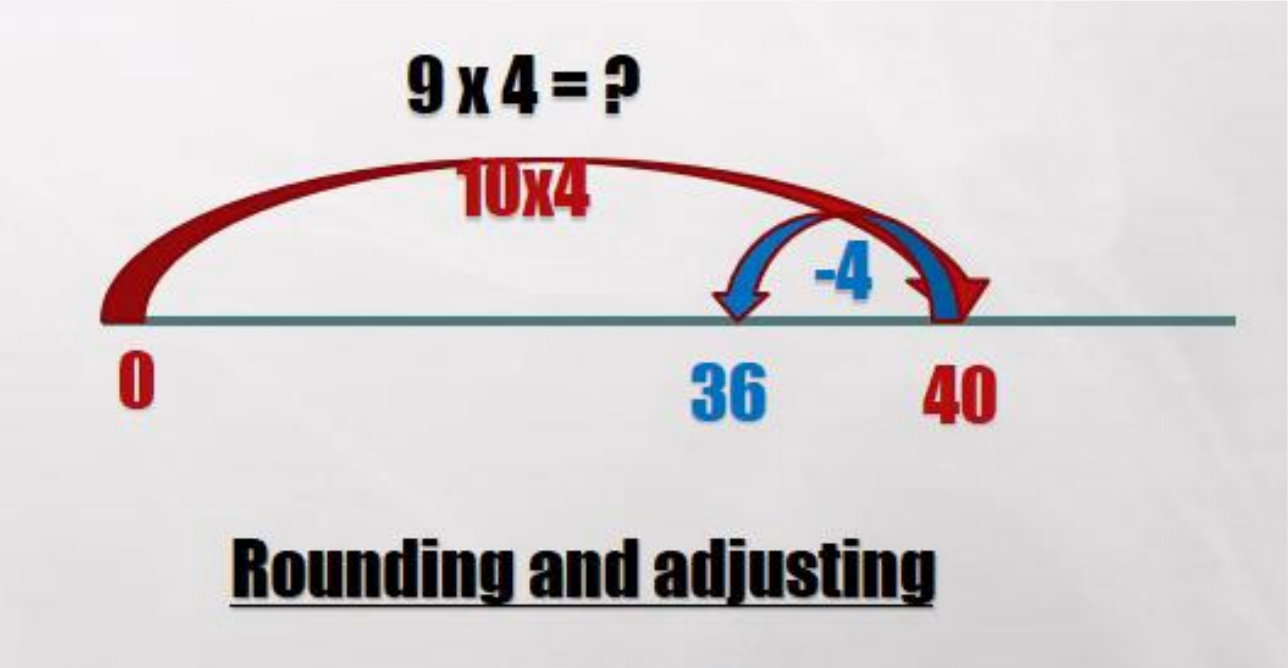




CONCRETE – PICTORIAL – ABSTRACT (Y5&Y6)

Number Lines

Inverse



ABSTRACT (Y5&Y6)

Partitioning

35 x 4 =

30 x 4 = 120

5 x 4 = 20

120 + 20 = 140

260 ÷ 5 =

100 ÷ 5 = 2 0

100 ÷ 5 = 2 0

60 ÷ 5 = 1 2

5 2

44 ÷ 6 =

30 ÷ 6 = 5

12 ÷ 6 = 2

7r2

Making links, i.e.

7r2 = 7 2/6 = 7 1/3

ABSTRACT (Y5&Y6)

Grid Method

22 x 35 =

x	30	5
20	20 x 3 x 10 600	2 x 5 x 10 100
2	2 x 3 x 10 60	2 x 5 10

600 + 100 + 60 + 10 = 770

Expanded Multiplication

	4	8
x		8
	6	4
3	2	0
3	8	4

Lay out your calculation in a grid.

Work out 8 × 8 and write the answer here.

Work out 40 × 8 and write the answer here.

Add them together and write your answer here.

Expanded Division

```
      2 5 r3
7 | 1 7 8
    1 4 ↓      (2 x 7)  r3
      3 8
      3 5      (5 x 7)  r3
        3
```

Year 5 are shown 2 digit multiplication towards the end of the year (next slide).
Year 6 will turn remainders into decimals and work with 2 digit division (next slide).

ABSTRACT (Y5&Y6)

Expanded 2 digit multiplication

```
   23
  x12
  ---
    6
   40
   30
  200
  ---
  276
```

ABSTRACT (Y6)

Expanded 2 digit division (decimals)

```
        3 1 . 5
12 | 3 7 8 . 0
     3 6
     ---
       1 8
       1 2
       ---
         6 0
```

(3 x 12) r1

(1 x 12) r6

(5 x 12)

ABSTRACT (Y5&Y6)

ABSTRACT (Y6)

Short Multiplication and Short Division

```
   5 6
   2 4   x
 -------
 2 2 4
+
1, 1 2 0
 -------
1, 3 4 4
```

```
      1  2  4  r2
3 | 3  7  14
```

```
   3 2 1
     1 2   x
 -------
   6 4 2
+
3,2 1 0
 -------
3,8 5 2
```

```
      1  2  4  r2
3 | 3  7  14
      ↓
      1  2  4.6̇6
3 | 3  7  14.20 20
```

Recurring

```
        3  1  r6
12 | 3 37 18
        ↓
        3  1.5
12 | 3 37 18.60
```

YOUR TURN

Have a go at calculating these equations using different methods (both informal (mental concrete or pictorial) or formal (written abstract).

<u>Challenge): Which is the most efficient method?</u>

<u>YEAR FIVE & SIX</u>

18 X 5	23 X 9	120 ÷ 40	72 ÷ 4
120 X 35	24 X 24	484 ÷ 4	128 ÷ 8
3.2 X 1.2	241 X 14	234 ÷ 7	376 ÷ 13

YEAR FIVE – MASTERY - MULTIPLICATION

Children should know and understand:

- The mathematical rules behind standard written calculation methods to know efficient methods of calculation;
- That multiplication involves a number of partial products. For example, 36 × 24 is made up of four partial products 30 × 20, 30 × 4, 6 × 20, 6 × 4;
- That there are connections between factors, multiples and prime numbers and between fractions, division and ratios;
- Multiplication investigations, for example: 8 x 24 = 192, how many other pairs of numbers can you write that have the product of 192?; And
- What happens mathematically to numbers when multiplying and dividing, i.e. 'When you multiply a number by 10 you just add a nought and when you multiply by 100 you add two noughts.' Do you agree? Explain your answer.

Mastery	Mastery with Greater Depth
It is correct that 273 × 32 = 8736. Use this fact to work out: ■ 27·3 × 3·2 ■ 2·73 × 32 000 ■ 873·6 ÷ 0·32 ■ 87·36 ÷ 27·3 ■ 8736 ÷ 16 ■ 4368 ÷ 1·6	Which calculation is the odd one out? ■ 753 × 1·8 ■ (75·3 × 3) × 6 ■ 753 + 753 ÷ 5 × 4 ■ 7·53 × 1800 ■ 753 × 2 – 753 × 0·2 ■ 750 × 1·8 + 3 × 1·8 Explain your reasoning.

YEAR SIX – MASTERY - MULTIPLICATION

Children should know and understand:

- The mathematical rules behind standard written calculation methods to know efficient methods of calculation;
- That multiplication involves a number of partial products. For example, 36 × 24 is made up of four partial products 30 × 20, 30 × 4, 6 × 20, 6 × 4;
- That there are connections between factors, multiples and prime numbers and between fractions, division and ratios;
- Multiplication investigations, for example: knowing that for1,912 + 1,888 you can just double 1,900 which is 3,800; and
- What happens mathematically to numbers when multiplying and dividing, i.e. 'When you multiply a number by 10 you just add a nought and when you multiply by 100 you add two noughts.' Do you agree? Explain your answer.

Mastery			Mastery with Greater Depth
Find numbers to complete these number sentences.			Fill in the missing numbers to make these number sentences true.
736 ÷ 23 = ☐	☐ × 100 = 2400	☐ × 100 = 10 × ☐	☐ × ☐ = 864
7360 ÷ 230 = ☐	25 × ☐ = 200	25 × ☐ = 4 × ☐	☐ × ☐ × ☐ = 864
230 × 24 = ☐	23 × ☐ = 161	23 × ☐ = 161 × ☐	
240 × 23 = ☐	24 × ☐ = 168	24 × ☐ = 168 × ☐	
1668 ÷ 8 = ☐	161 ÷ ☐ = 23	161 ÷ ☐ = 23 × ☐	
208·5 × 8 = ☐	☐ ÷ 25 = 9	☐ ÷ 25 = 9 × ☐	

YEAR FIVE – MASTERY - DIVISION

Children should know and understand:

- The mathematical rules behind standard written calculation methods to know efficient methods of calculation;
- That multiplication involves a number of partial products. For example, 36 × 24 is made up of four partial products 30 × 20, 30 × 4, 6 × 20, 6 × 4;
- That there are connections between factors, multiples and prime numbers and between fractions, division and ratios;
- Division investigations, for example: I am thinking of a number. When it is divided by 9, the remainder is 3. When it is divided by 2, the remainder is 1. When it is divided by 5, the remainder is 4. What is my number?; And
- What happens mathematically to numbers when multiplying and dividing, i.e. 'When you multiply a number by 10 you just add a nought and when you multiply by 100 you add two noughts.' Do you agree? Explain your answer.

Mastery			Mastery with Greater Depth
Find numbers to complete these number sentences.			Fill in the missing numbers to make these number sentences true.
736 ÷ 23 = ☐	☐ × 100 = 2400	☐ × 100 = 10 × ☐	☐ × ☐ = 864
7360 ÷ 230 = ☐	25 × ☐ = 200	25 × ☐ = 4 × ☐	☐ × ☐ × ☐ = 864
230 × 24 = ☐	23 × ☐ = 161	23 × ☐ = 161 × ☐	
240 × 23 = ☐	24 × ☐ = 168	24 × ☐ = 168 × ☐	
1668 ÷ 8 = ☐	161 ÷ ☐ = 23	161 ÷ ☐ = 23 × ☐	
208·5 × 8 = ☐	☐ ÷ 25 = 9	☐ ÷ 25 = 9 × ☐	

YEAR SIX – MASTERY - DIVISION

Children should know and understand:

- **The mathematical rules behind standard written calculation methods to know efficient methods of calculation;**
- **That multiplication involves a number of partial products. For example, 36 × 24 is made up of four partial products 30 × 20, 30 × 4, 6 × 20, 6 × 4;**
- **That there are connections between factors, multiples and prime numbers and between fractions, division and ratios;**
- **Division investigations, for example: using the number 4,236 how many numbers up to 20 does it divide by without a remainder? Is there a pattern?; And**
- **What happens mathematically to numbers when multiplying and dividing, i.e. Without doing a written method, I know 7,350 ÷ 7 will not have a remainder. Is this correct?**

Mastery	Mastery with Greater Depth
It is correct that 273 × 32 = 8736. Use this fact to work out: ■ 27·3 × 3·2 ■ 2·73 × 32 000 ■ 873·6 ÷ 0·32 ■ 87·36 ÷ 27·3 ■ 8736 ÷ 16 ■ 4368 ÷ 1·6	Which calculation is the odd one out? ■ 753 × 1·8 ■ (75·3 × 3) × 6 ■ 753 + 753 ÷ 5 × 4 ■ 7·53 × 1800 ■ 753 × 2 – 753 × 0·2 ■ 750 × 1·8 + 3 × 1·8 Explain your reasoning.
Work out: ■ 8·4 × 3 + 8·4 × 7 ■ 6·7 × 5 – 0·67 × 50 ■ 93 × 0·2 + 0·8 × 93 ■ 7·2 × 4 + 3·6 × 8	In each pair of calculations, which one would you prefer to work out? ■ (a) 35 × 0·3 + 35 × 0·7 **or** (b) 3·5 × 0·3 + 35 × 7 ■ (c) 6·4 × 1·27 – 64 × 0·1 **or** (d) 6·4 × 1·27 – 64 × 0·027 ■ (e) 52·4 ÷ 0·7 + 524 ÷ 7 **or** (f) 52·4 ÷ 0·7 – 524 ÷ 7 ■ (g) 31·2 ÷ 3 – 2·4 ÷ 6 **or** (h) 31·2 ÷ 3 – 1·2 ÷ 0·3 Explain your choices.

Did you know... ?
Do you teach...?

TIMES TABLES

Five times table

- Cut in half, then times 10
  Example: 5x6: Cut 6 in half to get 3, then times 10 for **30**
- Or times 10 then cut in half
  Example: 5x9: 9 times 10 is 90, then cut in half for **45**
- Also the last digit goes 5, 0, 5, 0, - like this: **5**, 1**0**...

Six times table

- Multiply by 5 and add your number on once more
- When you multiply 6 by an even number, they both end in the same digit.
  Examples: 6×**2**=1**2**, 6×**4**=2**4**, 6×**6**=3**6**, etc

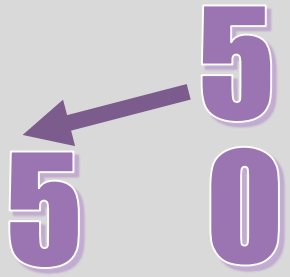
Eight times table

- Double, double, double!
  Example: 8×6: double 6 is 12, double 12 is 24, double 24 is **48**
- Multiply by ten, multiply by two and take the second number away from the first number.

Nine times table

10x your number and then minus your number once.
Example: 9×6 = 10×6−6 = 60−6 = 54

Ten times table



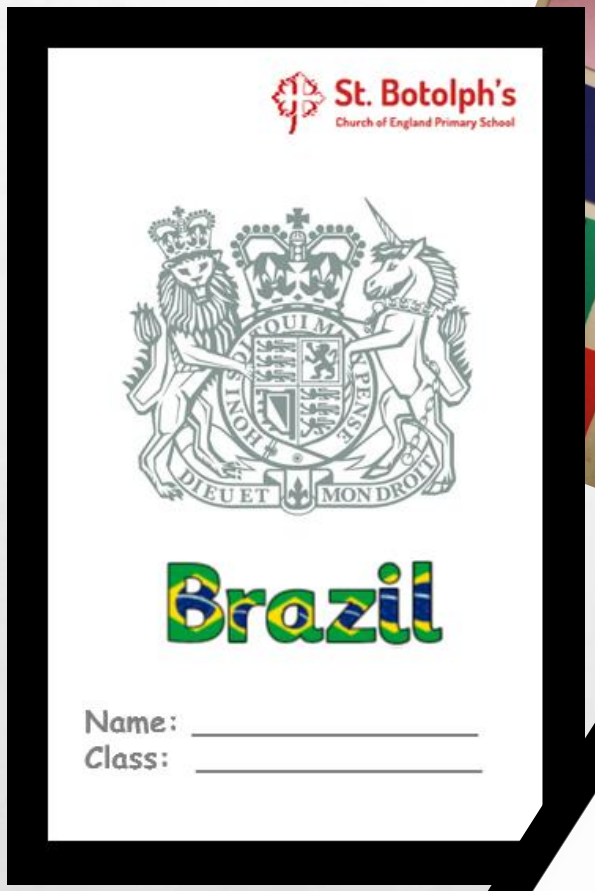
- Multiplying (move **all** digits to left) and Dividing (to the right)
- 10 (move once as one zero), 100 (twice as two zeroes) etc

Twelve times table

- is 10× plus 2×
  Example: 12×**4** = **40**+**8** = 48
- Double 6x

Learn OUT of sequence (as well as in sequence) + timed (when ready)

2 x	12 x	18 ÷ 9 =	108 ÷ 9 =
4 x	1 x	36 ÷ 9 =	9 ÷ 9 =
8 x	3 x	72 ÷ 9 =	27 ÷ 9 =
5 x	0 x	45 ÷ 9 =	0 ÷ 9 =
10 x	7 x	90 ÷ 9 =	63 ÷ 9 =
9 x	5 x	81 ÷ 9 =	45 ÷ 9 =
3 x	2 x	27 ÷ 9 =	18 ÷ 9 =
6 x	11 x	54 ÷ 9 =	99 ÷ 9 =
12 x	10 x	108 ÷ 9 =	90 ÷ 9 =
1 x	6 x	9 ÷ 9 =	54 ÷ 9 =
0 x	4 x	0 ÷ 9 =	36 ÷ 9 =
11 x	9 x	99 ÷ 9 =	81 ÷ 9 =
7 x	8 x	63 ÷ 9 =	72 ÷ 9 =



Passports

Different destinations

+

Different maths objectives

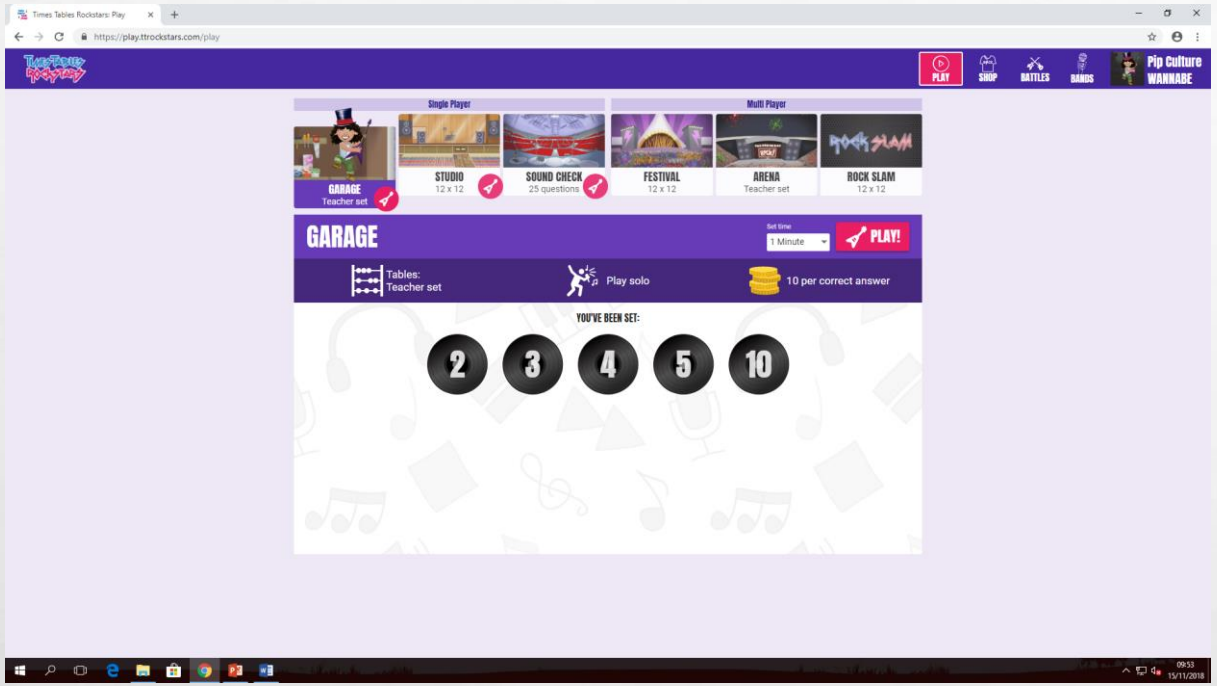
=

Travel around the world, mastering arithmetic skills (and much more)!

+

Prizes/rewards

Apps (Year 2 - 6)



doodlemaths

SUMMARY

- There is lots to remember – think about the poor children!
- Progressions are essential in facilitating an understanding of place value and mathematical process.
- A ‘rush’ through the progressions will hinder long term progress.