

Calculations Guidance

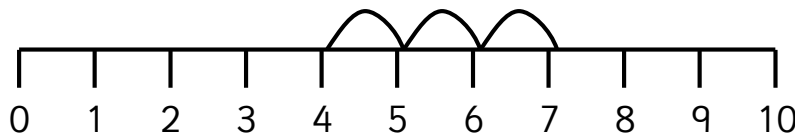
Dear Parents,

We hope the following information is useful in explaining how calculations are taught in our school according to the requirements of the National Curriculum 2014. Children's skills, experiences and understanding of calculation will be assessed on entry and at regular points through the year. It is vital that children do not move on to the next stage before they have a secure understanding. If you have any questions please talk to your child's teacher. See appendix for pictures of calculation equipment.

Addition

Reception

- Relate addition to combining/joining two groups of objects, finding one more than a given number, lots of vocabulary.
- Relate addition to counting up, counting on. Practical activities and discussion and use of Numicon and other resources to support hands on problem solving e.g. ice cube trays, egg boxes.
- Begin to recall simple number facts from memory e.g. $2+1$, $3+2$, $5+5$, $1+9$
- Introduction to the use of a number line for addition e.g. $4 + 3$ start on 4 and count on 3 jumps



Year One

- Read, write and interpret mathematical statements involving addition (+) and equals (=) signs
- Add one-digit and two-digit numbers to 20, including zero
- Solve one-step problems that involve addition using concrete objects and pictorial representations, and missing number problems such as $7 = ? - 9$.
- Recall of number facts/bonds to 10 and 20.
- Lots more counting on and continued use of resources to support problem solving.
- Continue the use of number lines for addition - start with the biggest number when counting on and add the smallest number e.g. $4 + 7$ start on 7 and count on 4
- Begin to partition and add 2 digit numbers and ones/tens
- Numicon will support these calculations.

Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line*

Year Two

- Use empty number lines, concrete equipment, hundred squares etc. to build confidence and fluency in
 mental addition skills
- Recall bonds to 20 and bonds of tens to 100 ($30 + 70$ etc.)
- Add a 2-digit number and ones (e.g. $27 + 6$)
- Add a 2-digit number and tens (e.g. $23 + 40$)
- Add three single-digit numbers (e.g. $5 + 9 + 7$)

- Adding two, two digit numbers, first within the tens boundary then crossing the tens boundary using straw bundles, dienes or arrow cards to support workings if required:

$23 + 34$

2	0	+	3	
+	3	0	+	4
<hr/>				
5	0	+	7	
				= <u>57</u>

$58 + 43$

5	0	+	8	
4	0	+	3	
<hr/>				
9	0	+	11	
				= <u>101</u>

Key vocabulary: as prior plus... sum, tens, units, partition, addition, column, tens boundary

Year Three

- Add numbers with up to 3-digits
- Introduce the **expanded column addition** method, initially using calculation mats and resources to support calculations as required: e.g. place value counters

	2	3	6
+		7	3
<hr/>			
			9
	1	0	0
	2	0	0
<hr/>			
	3	0	9

Then extend to:

236
<hr/>
+ 73
<hr/>
309
<hr/>
1

Key vocabulary: as prior plus... hundreds boundary, increase, vertical, carry, expanded, compact

Year Four

- Add numbers with up to 4 digits, including extending to money and measure problems

	3	5	1	7
+		3	9	6
<hr/>				
	3	9	1	3

Ensure children have a secure understanding of place value

e.g. 500 + 300 not 5 + 3

10 + 90 not 1 + 9

Key vocabulary: as prior plus... thousands, hundreds, digits, inverse

Year Five

- Add numbers with more than 4 digits including money, measures and decimals with different numbers of decimal places.

$$\begin{array}{r}
 \text{€ } 23.59 \\
 + \text{€ } 7.55 \\
 \hline
 \text{€ } 31.14
 \end{array}$$

$$\begin{array}{r}
 19.01 \\
 3.65 \\
 + 0.70 \\
 \hline
 23.36
 \end{array}$$

Include numbers with zero place value holder, a zero could be added to support calculations



Ensure decimal points are aligned

Key vocabulary: *as prior plus...* decimal places, decimal point, tenths, hundredths, thousandths

Year Six

- Add several numbers of increasing complexity

$$\begin{array}{r}
 81,059 \\
 3,668 \\
 15,301 \\
 + 20,551 \\
 \hline
 120,579
 \end{array}$$

$$\begin{array}{r}
 23.361 \\
 9.08 \\
 59.77 \\
 + 1.3 \\
 \hline
 93.511
 \end{array}$$

Subtraction

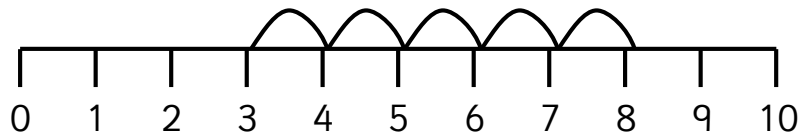
Reception

- Understand subtraction as taking away, and counting on to calculate answers.
- Lots of practical work, making up stories etc.
- Working towards finding the difference between numbers using objects and Numicon.
- Introduction of the number line to support calculations - see below

Year One

- Develop understanding of vocabulary: -'finding the difference between' 'how many more make.....' Numicon can support this understanding and comparing cube towers can help develop this concept.
- Use a number line to help with the calculation. At first use a numbered number line:-

$8 - 3 =$ what is the difference between 8 and 3? When finding the difference **always** start on the smaller number, in this case 3, and count the number of jumps to the large number, in this case 8



A number line can also be used to count back. As above $8 - 5 = 3$

Key vocabulary: *equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count on/back, how many left, how much less is_?*

Year Two

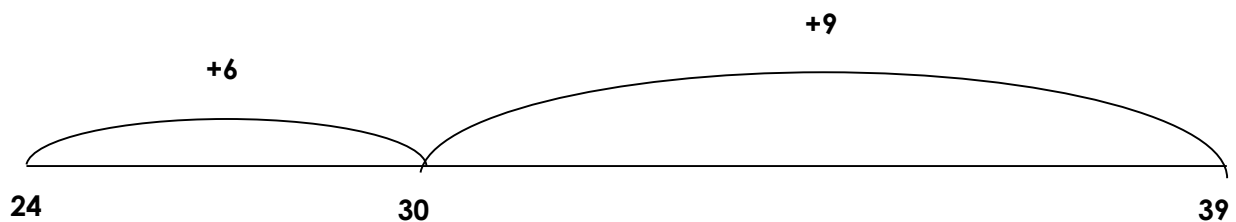
- Develop the use of an empty number line; keep using complimentary addition (i.e. counting on) to calculate subtraction. A hundred square could also be used to support this.
- Counting on to find the answer, children will find their own level of jumps whether it is in ones or tens!

$39 - 24$ i.e. find the difference between 39 and 24

Children always start on the smaller number, in this case 24.

The first jump is made from 24 to 30 (the next multiple of 10) by adding 6.

The second jump is made from 30 to 39 by adding 9



So, if we total up the number of jumps we get $6 + 9 = 15$ - Therefore the answer is $39 - 24 = 15$

- Relate subtraction of numbers to time, money, capacity and weight problems. Children should continue to show their working on an empty number line

Key vocabulary: *as prior plus... difference, strategy, partition, tens, units*

Year Three and Year Four

- Continue to develop and refine the empty number line

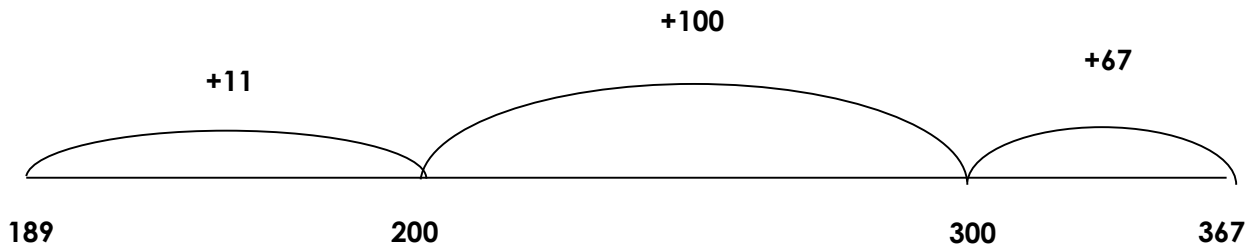
367 - 189

Children always start on the smaller number, in this case 189.

The first jump is made from 189 to 200 (the next multiple of 100) by adding 11.

The second jump is made from 200 to 300 by adding 100

The third jump is made from 300 to 367 by adding 67



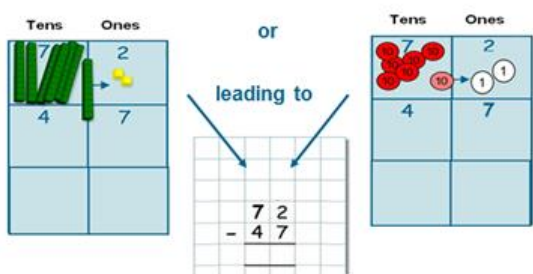
So when we total up the number of jumps we get

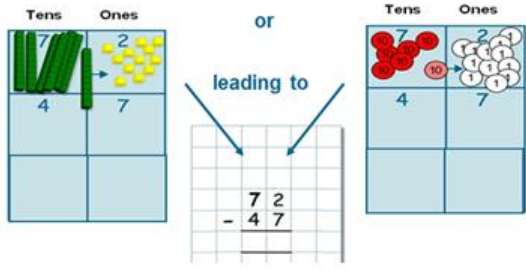
$$11 + 100 + 67 \text{ which is the same as } 100 + 67 + 11 = 178$$

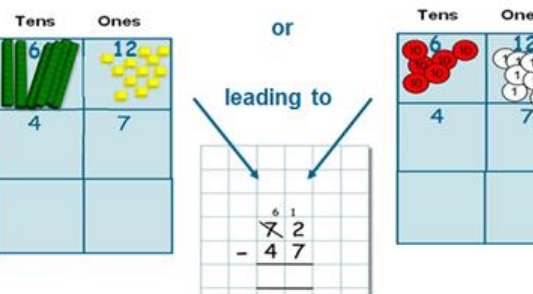
Therefore the answer is $367 - 189 = 178$

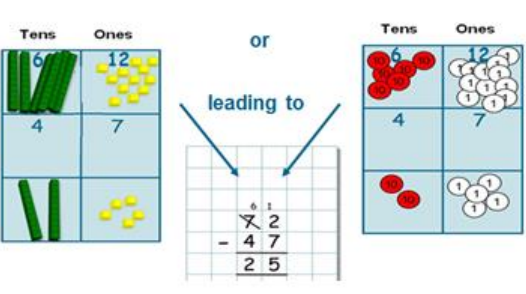
Exchanging - Formal method

Use equipment to support learning to use the vertical method and introduce exchanging. See diagrams

1) 

2) 

3) 

4) 

Key vocabulary: exchange, decrease, hundreds, value, digit, inverse

Year Five and Six

Continue to develop and refine the compact vertical method. Extend to 4 digit numbers and once secure apply to problems involving measures and decimals.

Key vocabulary: *tenths, hundredths, decimal point, decimal*

Multiplication

Reception

- Counting in tens, twos and fives.
- Adding together two equal groups (3 + 3) using apparatus e.g. toys and Numicon. Link to doubles.

Year One



$$2 + 2 + 2 + 2 + 2 = 10$$



$$5 + 5 + 5 + 5 + 5 + 5 = 30$$



$$2 \text{ lots of } 3 = 6 \text{ or}$$

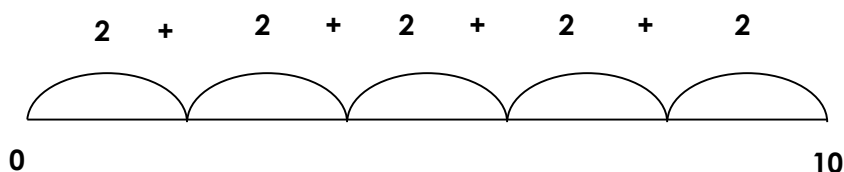
$$3 \text{ lots of } 2 = 6$$

- Use visual images to support understanding of repeated addition
- Counting equal group of objects in 2s, 5s and 10s.
- Present practical problem solving activities involving counting equal sets or groups, as above.
- Doubling, halving, and repeating addition (3 + 3 + 3).
- Rapid recall of number facts – Learning by Heart is vital.

Key vocabulary: *groups of, lots of, times, array, altogether, multiply, count*

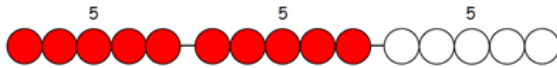
Year Two

- Understand the operation of multiplication as repeated addition, lots of:
 $2 + 2 + 2 + 2 + 2 = 10$
Which is the same as $5 \times 2 = 10$
- This can be shown on an empty number line too. 5 jumps of '2' which is the same as $5 \times 2 = 10$



- A bead string, 100 square or multiplication square can also help.

$$5 \times 3 = 5 + 5 + 5$$



Multiples of 2



Multiples of 5

- Use arrays to recognize the commutative law of multiplication e.g.



$$5 \times 3 = 3 + 3 + 3 + 3 = \underline{15}$$

$$5 \times 3 = 15 \quad 3 \times 5 = 5 + 5 + 5 = \underline{15}$$

$$3 \times 5 = 15$$

Key vocabulary: multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times...

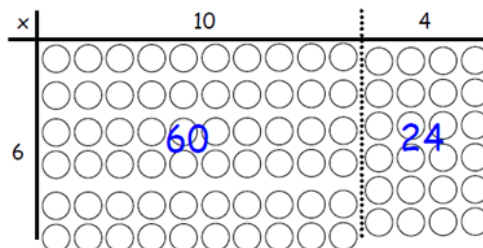
Year Three

- Rapid recall of number facts.
- Multiply a 2 digit number by a single digit. Partitioning two digit numbers - extending use of arrays and using arrow cards to support this.

e.g. 13×4



$$14 \times 6$$



Key vocabulary: partition, grid method, multiple, product, tens, units, value

Year Four

- Building on partitioning as above.
- Develop the grid method as the written method.

Eg. $136 \times 5 = 680$

X	100	30	6
5	500	150	30

$$\begin{array}{r} 500 \\ + 150 \\ + 30 \\ \hline 680 \end{array}$$

Year Four, Five and Six

Continue refining and practicing the grid method - extend to larger numbers

TU x TU

x	10	6
50	500	300
3	30	18

Then add the rows:

$$500 + 300 = 800$$

$$30 + 18 = 48$$

$$= 848$$

Once children are confident with the grid method and secure with place value then introduce expanded short method:

$$38 \times 7$$

$$\begin{array}{r}
 30 + 8 \\
 \times 7 \\
 \hline
 56 \quad 7 \times 8 \\
 210 \quad 7 \times 30 \\
 \hline
 266
 \end{array}$$

Then:

$$342 \times 7 \text{ becomes}$$

$$\begin{array}{r}
 342 \\
 \times 7 \\
 \hline
 2394 \\
 \hline
 21
 \end{array}$$

Answer: 2394

Leading to expanded long multiplication:

TU x TU

$$\begin{array}{r}
 53 \\
 \times 16 \\
 \hline
 18 \quad (6 \times 3) \\
 300 \quad (6 \times 50) \\
 30 \quad (10 \times 3) \\
 +500 \quad (10 \times 50) \\
 \hline
 848
 \end{array}$$

Then long multiplication:

$$\begin{array}{r}
 124 \times 26 \text{ becomes} \\
 \begin{array}{r}
 124 \\
 \times 26 \\
 \hline
 744 \\
 2480 \\
 \hline
 3224 \\
 \hline
 11
 \end{array}
 \end{array}$$

Answer: 3224

Key vocabulary: square, factor, integer, decimal, short/long multiplication, decimal, tenth, hundredth

Division

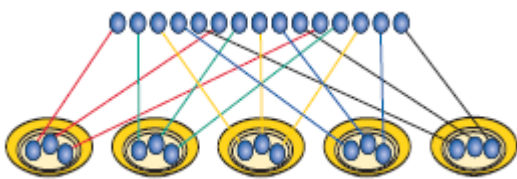
Reception

- Separate a given number into two equal groups - finding half of....
- Share out the number of

Year One

- Solve one-step problems involving division, by calculating the answer using concrete objects, pictorial representations arrays with the support of the teacher
- Through grouping and sharing small quantities, pupils begin to understand, division, and finding simple fractions of objects, numbers and quantities.

Sharing - 15 shared by 5

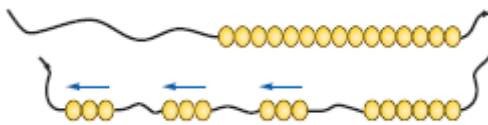


Grouping - How many groups of 4 can I make?



- They make connections between arrays, number patterns, and counting in twos, fives and tens.
- Introduce division as repeated addition e.g. how many times can I put out groups of 3 to make 15?

Use of a bead string:



How many 3s in 15?

Key vocabulary: *share, share equally, one each, two each..., group, groups of, lots of, array*

Year Two

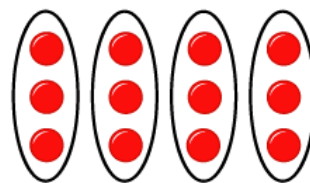
- Recall division facts for the 2, 5 and 10 multiplication tables
- Calculate mathematical statements for division within the multiplication tables and write them using division (\div) and equals (=) signs
- Recognize that division of one number by another cannot be done in any order
- Solve problems involving division, using materials, arrays, repeated addition, mental methods, and division facts, including problems in contexts.

Use of a number line:

$$15 \div 3 = 5$$



Array:



$$12 \div 3 = 4$$

This can also be seen as:

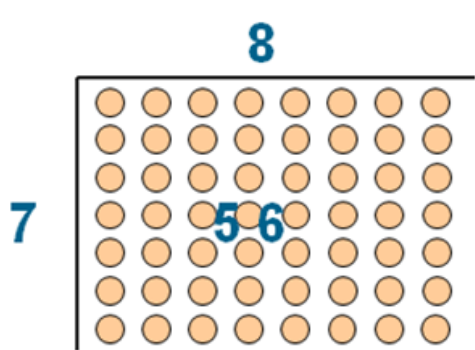
$$12 \div 4 = 3$$

Key vocabulary: *divide, divided by, divided into, division, grouping, number line, left, left over*

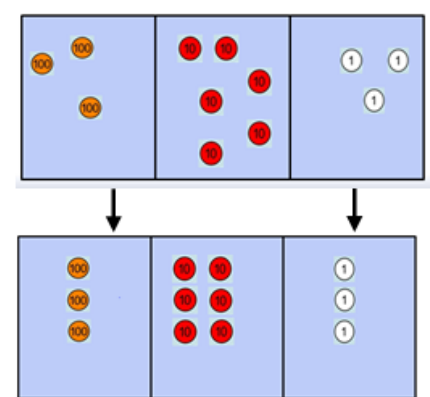
Year Three and Four

- Recall and use division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables (through doubling, connect the 2, 4 and 8s).
- Use of empty number line, repeated addition and jottings to calculate division
- Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods.
- Solve problems, in contexts, and including missing number problems for division.
- Pupils develop reliable written methods for division, starting with calculations of 2-digit numbers by 1-digit numbers and progressing to the formal written method of short division.

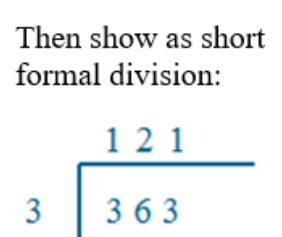
Linking arrays/multiplication facts:



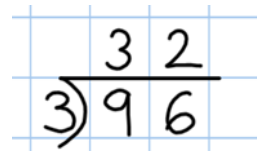
$363 \div 3$



Then show as short formal division:

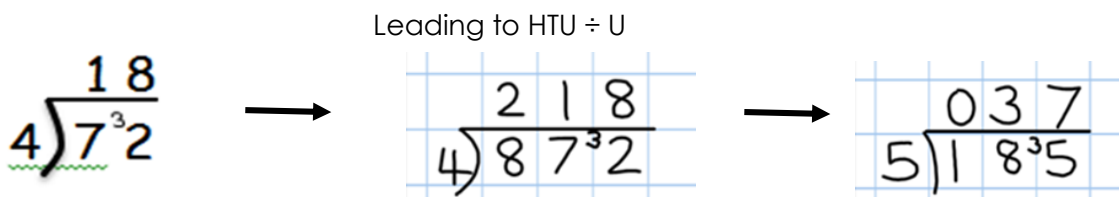


Finally to introduce short division with no remainders.



Then those where the children "carry over" a number:

Leading to HTU \div U

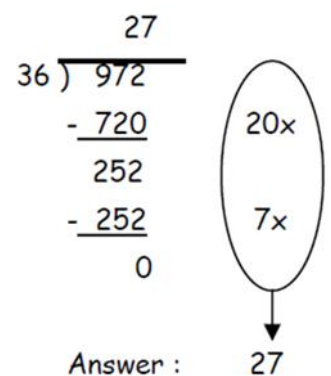


Key vocabulary: inverse, short division, carry, remainder, multiple, divisible by, factor

Year Five and Six

As previously - extend to 4 digits

Plus introduce long division by chunking:

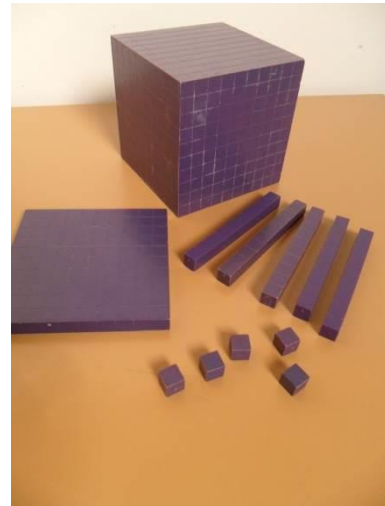


Key vocabulary: quotient, prime number, prime factors, composite number (non-prime), common factor

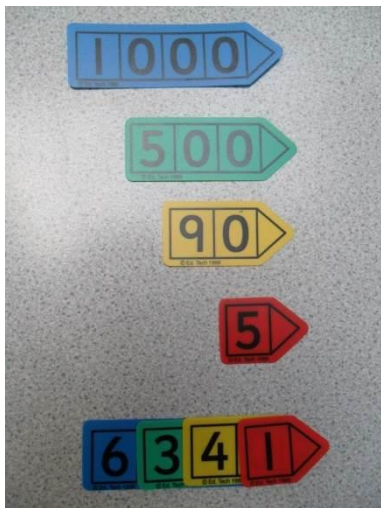
Appendix 1 - Maths resources



Numicon



Dienes apparatus - Th H T U



Arrow cards



Cuisenaire Rods



Place value counters