



Mathematics and Numeracy Calculation Policy

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June 2017

Nominated Governor:

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Review date: June 2019

Numeracy & Mathematics Calculation Policy

Policy Statement

Numeracy/ Mathematics should be an integral part of all lessons with focus on children achieving a high standard of numeracy skills to become as independent as possible when leaving school.

Environment

Heltwate School provides a rich learning environment in which all children can learn and achieve, alongside enjoying their education and time spent here. Resources are well planned and used to support all levels of ability. Expectations are high to ensure behaviours in class allow for all children to learn.

Introduction

The following calculations policy has been written in line with the programmes of study taken from the National Curriculum for Mathematics (2014). This policy provides guidance on the calculation strategies, methods and progression. It aims to help parents to help their children, as well as provide guidelines for teachers to provide consistency in the teaching of mathematics across the school. Although not exhaustive, it outlines the key strategies taught across our school.

Our Aims

Through the Mathematics National Curriculum, we aim to ensure that all pupils:

1. Develop the basic mathematical skills through varied and frequent practice with increasingly complex problems over time.
2. Reason mathematically by following a line of enquiry
3. Can solve problems by applying their mathematics to a variety of routine and non-routine problems including breaking down problems into a series of simpler steps and persevering in seeking solutions.

This policy will ensure consistency and progression in our approach to the learning and teaching of calculations across the school. It will enable our children, teachers and parents to work in partnership, developing an efficient, reliable, formal written method of calculation for all operations and to use these methods accurately with confidence for understanding.

Written Calculations Stages of Development

Children should only progress to these stages if they are ready. In the same respect some children may be ready to move on quicker – although it is important that children are secure with the method they are working on before moving onto the next stage.

See attached pages for details of the stages to be taught.

Addition +



add
and
plus
sum

more than
addition
count on
total
increase

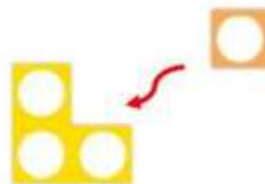
join
bigger
together
more

Stage 1

Begin to
relate
addition to
combining



Find one more
than a
number



Adding using
fingers and
other practical
resources

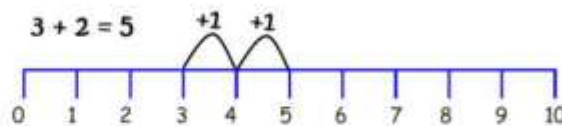
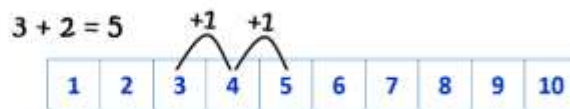


Introduction
of symbols to
form number
sentences

$$3 + 2 = 5$$

Develop understanding of addition as Counting

Develop understanding of addition as counting steps along a *numberline*



Stage 2

Developing knowledge and understanding of number bonds to 10

e.g.



$$7 + 3 = 10$$

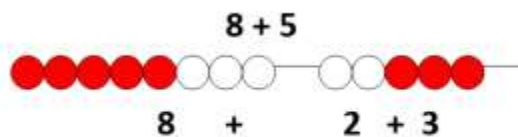


$$6 + 4 = 10$$



$$9 + 1 = 10$$

Using bead strings to count on by bridging through 10



Understand that addition is commutative (can be done in any order)



$$3 + 2 = 5$$



$$2 + 3 = 5$$

Vary position
of missing
numbers in a
number
sentence

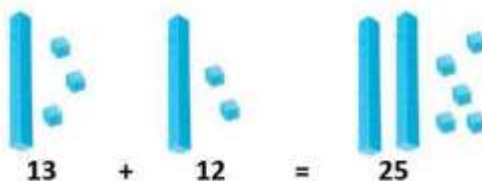
$$2 + \square = 5$$

$$\square + 4 = 7$$

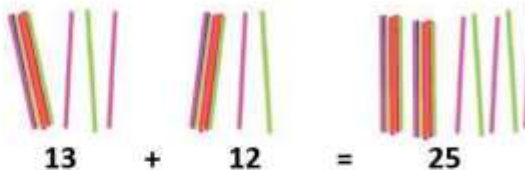
Counting on in
jumps of one
using a
hundred
square

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Dienes' Apparatus

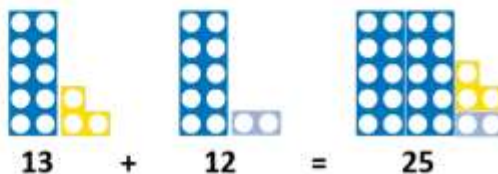


Counting Straws



Addition of 2-
digit numbers
using practical
resources

Numicon



$$32 + 26$$

Counting on in
jumps of ten
and one using
a hundred
square

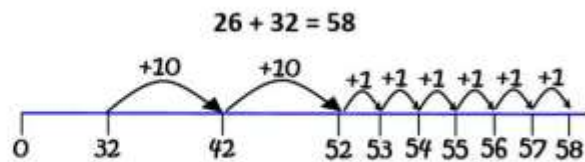
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Vary position
of missing
numbers in a
number
sentence

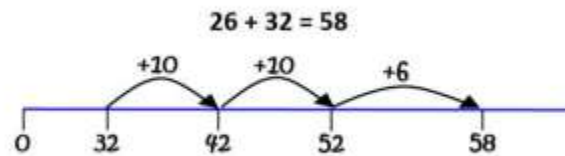
$$21 + \square = 43$$

$$\square + 32 = 58$$

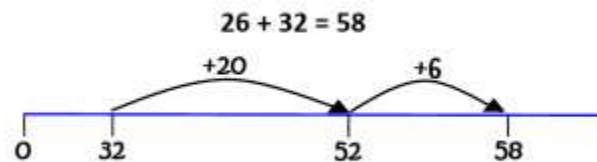
Addition using
a blank
number line
(putting
biggest
number first)



Using a blank
number line, add
the ones in one
jump (using the
known fact
 $6 + 2 = 8$)



Using a blank
number line,
adding the
tens in one
jump and the
ones in one
jump



Adding by partitioning into tens and ones

$$26 + 32 = 20 + 30 + 6 + 2 = 58$$

Adding by partitioning into tens and ones

$$\begin{array}{cc} \text{T} & \text{O} & \text{T} & \text{O} \\ 26 & + & 32 \\ \hline 50 & + & 8 = 58 \end{array}$$

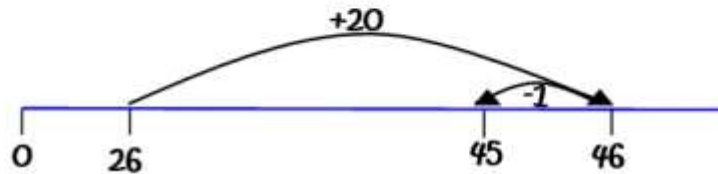
e.g. adding 9 / 19 / 29 or 8 / 28 / 38

$$26 + 19 = 45$$

Adding by compensation

$$26 + 20 = 46$$

$$46 - 1 = 45$$



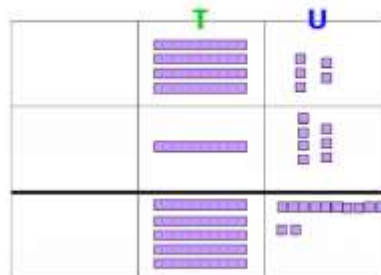
Stage 3

$$45 + 17$$

Introduce practically, e.g.

Begin to use expanded written methods

$$\begin{array}{cc} \text{T} & \text{U} \\ 40 & 5 \\ + 10 & 7 \\ \hline 50 & + 12 = 62 \end{array}$$



Introduce practically, e.g.

Progress to expanded written methods involving hundreds

$$\begin{array}{ccc} \text{H} & \text{T} & \text{U} \\ 100 & 40 & 5 \\ + 100 & 20 & 7 \\ \hline 200 & + 60 & + 12 = 272 \end{array}$$

T U

Reinforce understanding with use of arrow cards



Addition using the compact written method involving carrying, adding the ones first

$$264 + 148$$

	H	T	U
	2	6	4
+	1	4	8
<hr/>			
	4	1	2
<hr/>			
	1	1	

$$3364 + 247$$

	H	T	U
	3	3	64
+		2	47
<hr/>			
	3	6	11
<hr/>			
	1	1	

Addition involving decimals using compact written methods

$$3.56 + 2.47$$

	3	.	5	6
+	2	.	4	7
<hr/>				
	6	.	0	3
<hr/>				
	1		1	

Addition with
negative
numbers

$$-15 + 6 = -9$$

Stage 1

Subtraction -



subtract
subtraction
take away
take

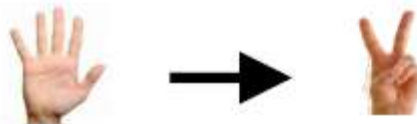
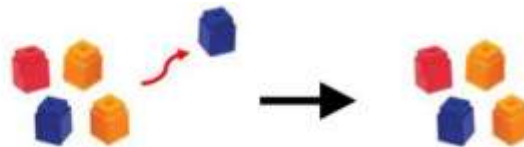
less
less than
minus
reduce

fewer
count back
difference
how many left

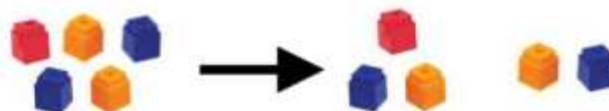
Take away from
groups of items



Find one less
than a number

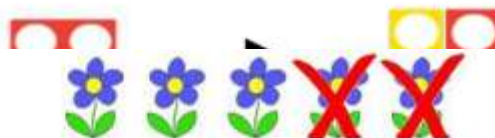


Take away
using fingers
and other
practical
resources



(e.g. for 5 - 3)

Taking away by
crossing out

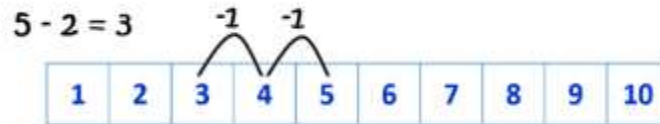


$$5 - 2 = 3$$

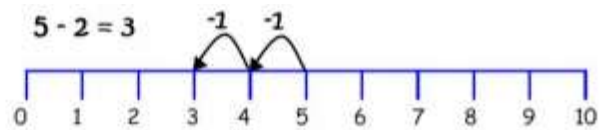
Introduction of
Symbols to form
number sentences

$$5 - 2 = 3$$

Counting back
on a number
track



Counting back
on a numbered
numberline

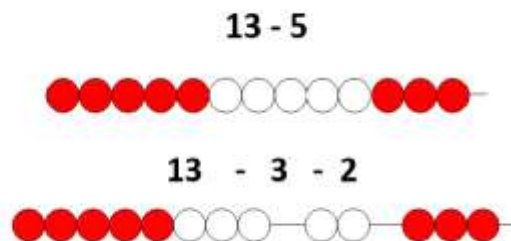


Stage 2

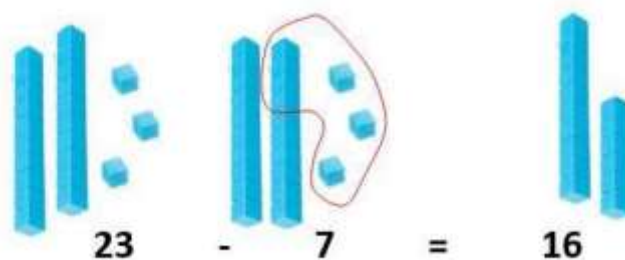
Counting back
in jumps of one
using a hundred
square



Using bead
strings to count
Back by
bridging
through 10

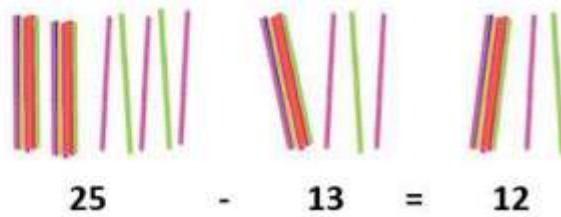


Dienes' Apparatus

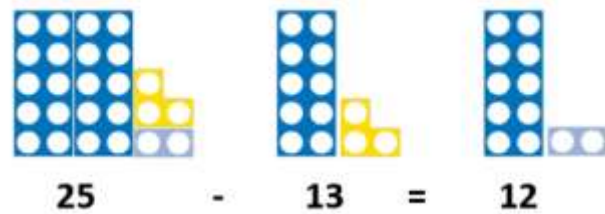


Subtraction
using
practical
resources

Counting Straws



Numicon



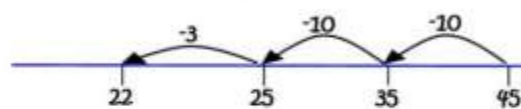
58 - 26



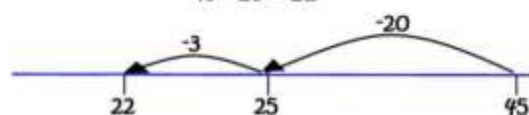
Counting back
in jumps of ten
and one using a
hundred square

Counting back on a number line

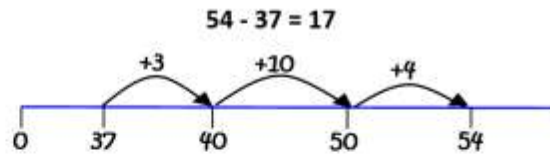
$$45 - 23 = 22$$



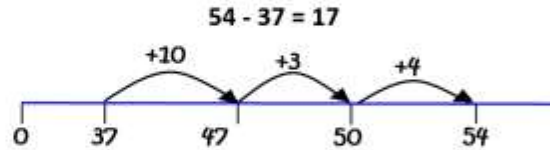
$$45 - 23 = 22$$



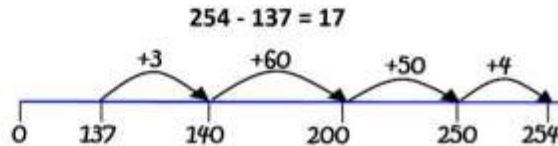
Finding a difference by counting on using a numberline



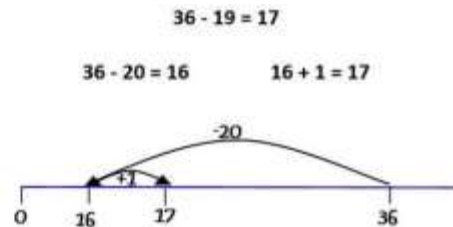
or



...progressing to hundreds for more able children



Subtracting 9 / 19 / 29 or 8 / 28 / 38 by compensation



Stage 3

Subtraction using expanded written methods in a vertical layout

$$\begin{array}{r}
 \text{T} \quad \text{U} \\
 60 \quad 6 \\
 - 50 \quad 4 \\
 \hline
 10+2 \quad \rightarrow 12
 \end{array}$$

Introduce practically, e.g



led as

Subtraction using compact Written method

$$\begin{array}{r}
 \text{T} \quad \text{U} \\
 7 \quad 8 \quad 11 \\
 - 5 \quad 7 \\
 \hline
 2 \quad 4
 \end{array}$$

→ 24

Subtraction
using compact
written method
exchanging
across columns

$$\begin{array}{r}
 403 \\
 - 127 \\
 \hline
 276
 \end{array}$$

Diagram illustrating the compact written method for subtraction with borrowing across columns. The number 403 is written above 127. A red diagonal line is drawn from the 4 in the hundreds column to the 0 in the tens column, with a '3' written above the 0. Another red diagonal line is drawn from the 0 in the tens column to the 3 in the units column, with a '9' written above the 3. The result 276 is written below the line.

Subtraction of
decimal
numbers to 2
decimal places
using compact
written method

$$\begin{array}{r}
 £2.31 \\
 - £1.53 \\
 \hline
 £0.78
 \end{array}$$

Diagram illustrating the compact written method for subtraction of decimal numbers. The number £2.31 is written above £1.53. A red diagonal line is drawn from the 2 in the pounds column to the 3 in the tenths column, with a '1' written above the 3. Another red diagonal line is drawn from the 3 in the tenths column to the 1 in the hundredths column, with a '12' written above the 1. The result £0.78 is written below the line.

Subtraction
using negative
numbers

$$-12 - 4 = -16$$

Multiplication x



times
multiply
multiplication

lots of
repeated addition

array
groups of
product

Stage 1

Grouping
objects into
equal groups



e.g. pairs of socks

Counting in
jumps – finding
patterns using a
hundred square

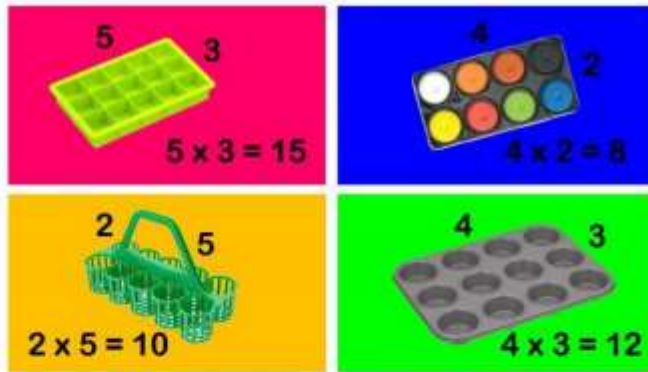
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Stage 2

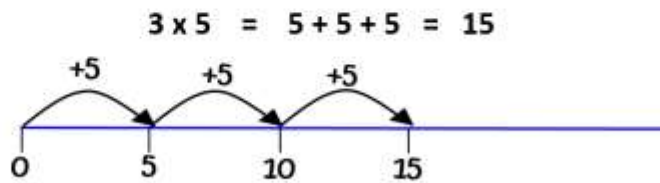
Repeated
addition using
practical
resources



Arrays – using
practical
resources

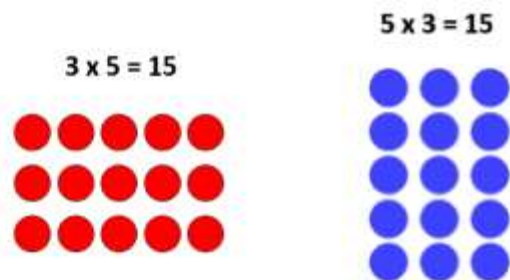


Multiplication
by repeated
addition



Drawing arrays using dots

Using arrays



Multiplying a 2-digit number by a 1-digit number:

Grid Method

x	20	3
4	80	24

$80 + 24 = 104$

Stage 3

It is important that children know that when multiplying by ten it is not just a matter of adding a zero! The digits move left, and a place holder (0) may have to be inserted.

Multiplying a 2-digit number by a 1-digit number:

x	20	3	
8	160	24	160 + 24 = 184

Multiplying a 3-digit number by a 1-digit number:

Grid Method

x	100	20	3	
6	600	120	18	= 738

Multiplying two 2-digit numbers:

x	20	3	
40	800	120	→ 920
2	40	6	→ 46
			966

Multiplying a 3-digit number by a 1-digit number:

	246	
	x 7	
	42	(6 x 7)
	280	(40 x 7)
	1400	(200 x 7)
	1722	
Expanded Column Method		

Multiplying a 2-digit number by a 1-digit number:

Expanded
Column Method

$$\begin{array}{r} 23 \\ \times 7 \\ \hline 21 \\ 140 \\ \hline 161 \end{array} \quad \begin{array}{l} (3 \times 7) \\ (20 \times 7) \end{array}$$

Multiplying a 3 or 4-digit number by a 1-digit number:

Contracted
Column Method

$$\begin{array}{r} 246 \\ \times 7 \\ \hline 1722 \\ 34 \end{array}$$

Division ÷



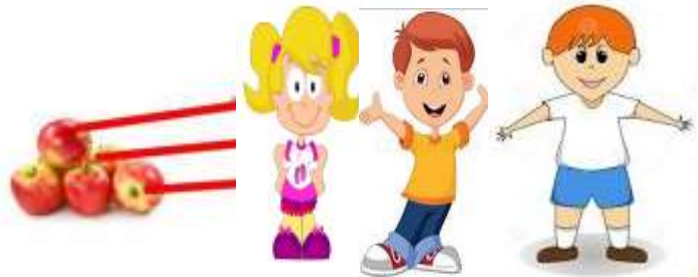
divide
division
share

group
sort
remainder
left over

how many lots of
repeated subtraction
split

Stage 1

Sharing between children



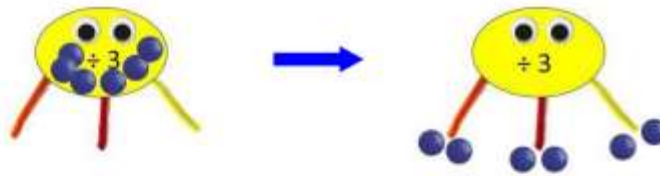
Sharing
equally

Solving physically

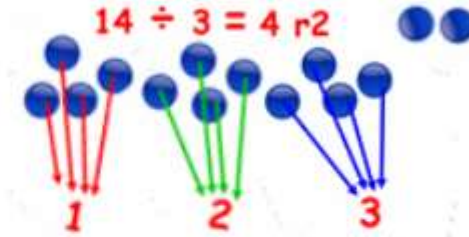


Stage 2

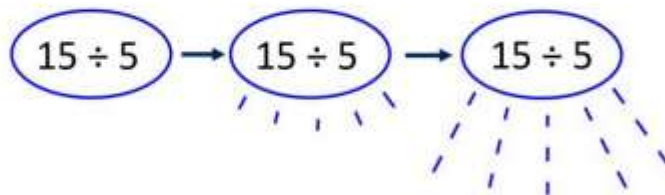
Sharing Spiders



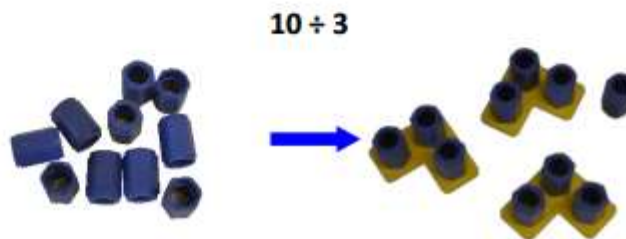
Sharing using
e.g. counters



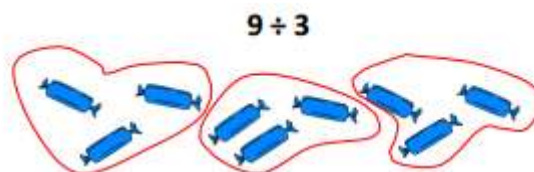
Sharing
Showers



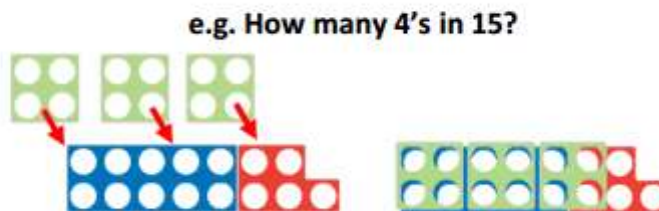
Grouping using
Numicon



Grouping

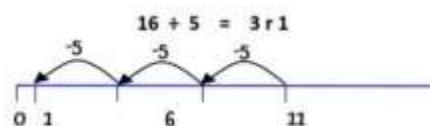


Division using
practical
resources



Repeated
Subtraction

Using a number line:



Stage 3

Dividing by partitioning

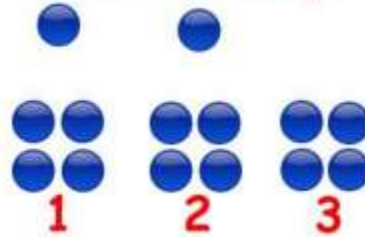
$$72 \div 4:$$

$$40 \div 4 = 10$$

$$32 \div 4 = 8$$

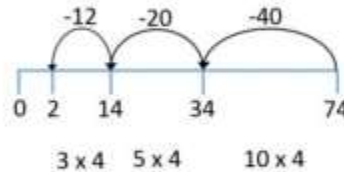
$$14 \div 3 = 4\frac{2}{3}$$

Sharing representing remainders as fractions



Using a number line to take off chunks

$$74 \div 4$$



Repeated subtraction of chunks

$$74 \div 4 = 10 + 5 + 3 \text{ r}2$$

$$74 \div 4 = 18 \text{ r}2$$

Repeated subtraction of chunks, e.g.

$$148 \div 4:$$

Division by chunking

$1 \times 4 = 4$
$2 \times 4 = 8$
$4 \times 4 = 16$
$10 \times 4 = 40$
$7 \times 4 = 28$

148	
<u>-40</u>	(10 x 4)
108	
<u>-40</u>	(10 x 4)
68	
<u>-40</u>	(10 x 4)
28	
<u>-28</u>	(7 x 4)
0	
$148 \div 4$	$= 10 + 10 + 10 + 7$
$148 \div 4$	$= 37$

Repeated subtraction of chunks, e.g.

$$534 \div 17:$$

Division by
chunking

$1 \times 17 = 17$	534	(20×17)
$2 \times 17 = 34$	$\underline{-340}$	
$4 \times 17 = 68$	194	(10×17)
$10 \times 17 = 170$	$\underline{-170}$	
$5 \times 17 = 85$	24	(1×17)
$20 \times 17 = 340$	$\underline{-17}$	
	7	

$$534 \div 17 = 20 + 10 + 1 \text{ r}7$$

$$534 \div 17 = 31 \text{ r}7$$

$$560 \div 24:$$

Long division

			2	8	
2	4		5	6	0
	-		4	8	0
				8	0
	-			7	2
					8

24 x20

24 x3

$$560 \div 24 = 28 \text{ r}8$$

$$318 \div 6$$

Compact short
division

$$6 \overline{) \begin{array}{cccc} 0 & 5 & 3 & \\ 3 & ^3 & 1 & ^1 & 8 \end{array}}$$

$$318 \div 3 = 53$$

$$560 \div 24$$

Compact short
division
showing answer
with a
remainder

$$24 \overline{) \begin{array}{cccc} 0 & 2 & 3 & \\ 5 & ^5 & 6 & ^8 & 0 \end{array}} \text{ r}8$$

$$318 \div 3 = 53$$

Glossary

Array- An ordered collection of counters, numbers etc. in rows and columns.

Commutativity- Multiplication and division are both commutative as they can be done in any order. Division and subtraction are not commutative.

Difference- The amount by which one number or value is greater than another, obtained by subtracting the smaller from the larger.

Hundred Square -The numbers 1 – 100 arranged in uniform rows and columns to aid the understanding of number and to assist with calculations.

Inverse operation - The inverse operation is that which reverses the effect of the other one. Addition and subtraction are inverse operations. Multiplication and division are inverse operations.

Logical - Using an approach that is structured, logical, clear and organised to solve a given problem or calculation.

Manipulatives - Manipulatives are objects which are designed so that a learner can perceive some mathematical concept by manipulating them. The use of manipulatives provides a way for children to learn concepts in a developmentally appropriate, hands-on way.

Mental Methods - Using methods and strategies in your head to solve a given problem.

Multiple - When two numbers are multiplied together, the result is called a multiple.

Number bonds - A pair of numbers with a particular total e.g. number bonds to ten are all pairs of whole numbers with the total 10.

Number sentence - A mathematical sentence involving numbers. For example: $3 + 6 = 9$.

Number line - A line where numbers are represented by points up on it.

Partition - To split a number into component parts. For example: the two-digit number 38 can be partitioned into $30 + 8$ or $19 + 19$.

Place Value - The value of a digit that relates to its position or place in a number. For example: in 1482 the digits represent 1 thousand, 4 hundreds, 8 tens and 2 ones respectively.

Product - The result of multiplying two or numbers together.

Remainders:- What is 'left over' when one number cannot be exactly divided by another.