



Mathematics and Numeracy Calculation Policy

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Nominated Governor:

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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



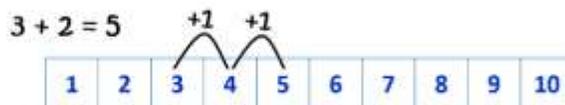
Adding using
fingers and
other practical
resources



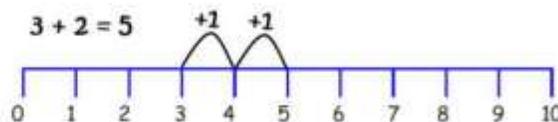
Introduction
of symbols to
form number
sentences

$$3 + 2 = 5$$

Develop understanding of addition as Counting



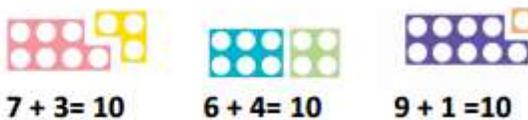
Develop understanding of addition as counting steps along a *numberline*



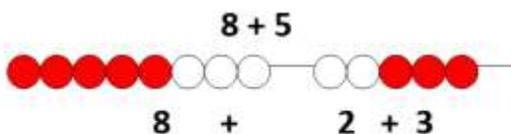
Stage 2

Developing knowledge and understanding of number bonds to 10

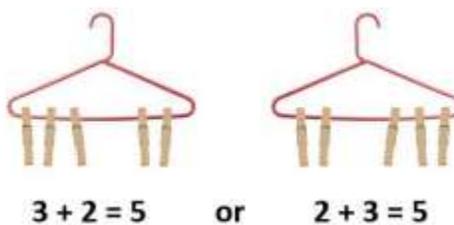
e.g.



Using bead strings to count on by bridging through 10



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



Vary position of missing numbers in a number sentence

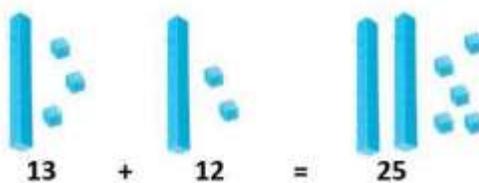
$$2 + \square = 5$$

$$\square + 4 = 7$$

Counting on in jumps of one using a hundred square

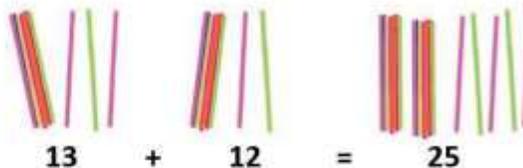
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Dienes' Apparatus

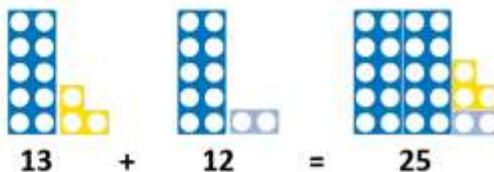


Counting Straws

Addition of 2-digit numbers using practical resources



Numicon



$$32 + 26$$

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

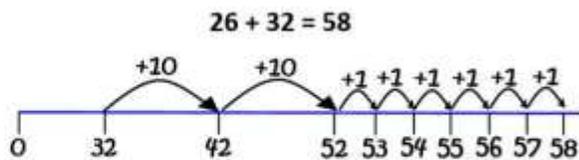
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Vary position
of missing
numbers in a
number
sentence

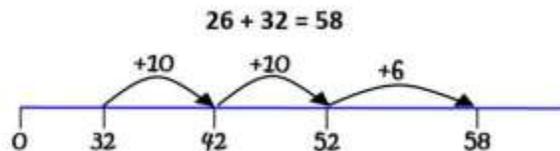
$$21 + \square = 43$$

$$\square + 32 = 58$$

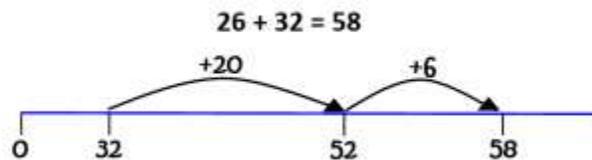
Addition using
a blank
number line
(putting
biggest
number first)



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



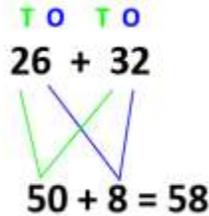
Using a blank
number line,
adding the
tens in one
jump and the
ones in one
jump



Adding by partitioning into tens and ones

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

Adding by partitioning into tens and ones



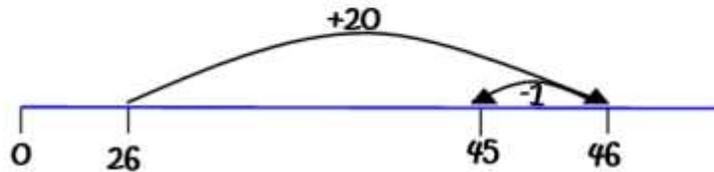
e.g. adding 9 / 19 / 29 or 8 / 28 / 38

$$26 + 19 = 45$$

Adding by compensation

$$26 + 20 = 46$$

$$46 - 1 = 45$$



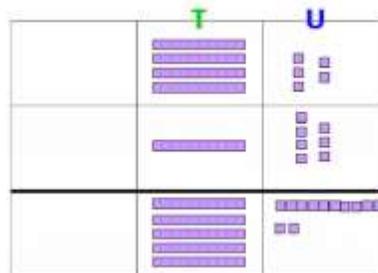
Stage 3

$$45 + 17$$

Introduce practically, e.g.

Begin to use expanded written methods

$$\begin{array}{r} \text{T} \quad \text{U} \\ 40 \quad 5 \\ + 10 \quad 7 \\ \hline 50 + 12 \quad 62 \end{array}$$



Introduce practically, e.g.

Progress to expanded written methods involving hundreds

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

T U

Reinforce understanding with use of arrow cards



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

$$264 + 148$$

$$\begin{array}{r} \text{HTU} \\ 264 \\ + 148 \\ \hline 412 \\ \hline 1 \quad 1 \end{array}$$

Addition using the compact written method progressing to thousands

$$3364 + 247$$

$$\begin{array}{r} \text{HTU} \\ 3364 \\ + \quad 247 \\ \hline 3611 \\ \hline 1 \quad 1 \end{array}$$

Addition involving decimals using compact written methods

$$3.56 + 2.47$$

$$\begin{array}{r} 3.56 \\ + 2.47 \\ \hline 6.03 \\ \hline 1 \quad 1 \end{array}$$

Addition with negative numbers

$$-15 + 6 = -9$$

Stage 1

Subtraction -



subtract
subtraction
take away
take

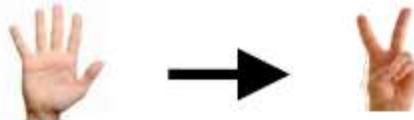
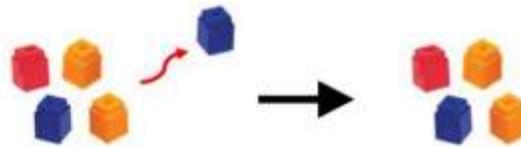
less
less than
minus
reduce

fewer
count back
difference
how many left

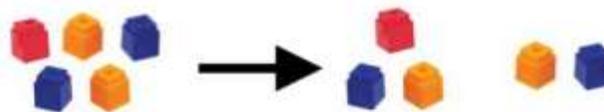
Take away from groups of items



Find one less than a number

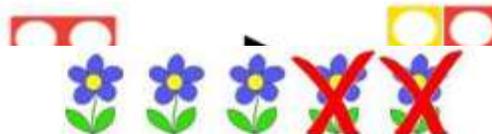


Take away using fingers and other practical resources



(e.g. for 5 - 3)

Taking away by crossing out

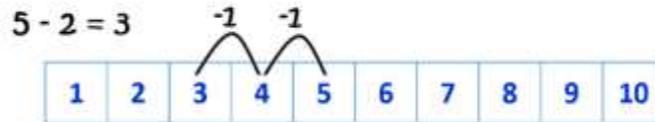


$$5 - 2 = 3$$

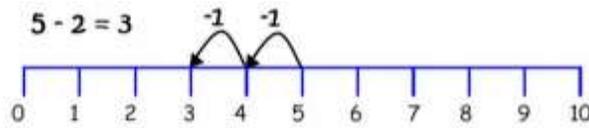
Introduction of Symbols to form number sentences

$$5 - 2 = 3$$

Counting back on a number track



Counting back on a numbered numberline

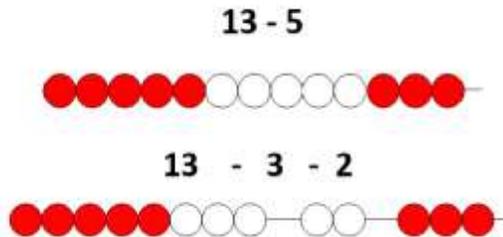


Stage 2

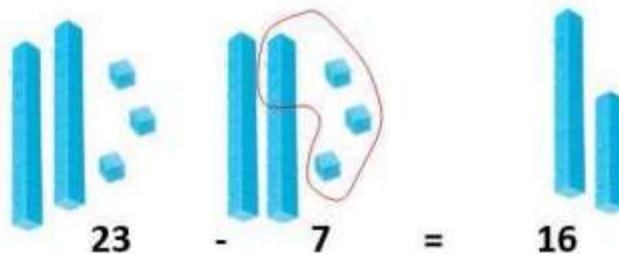
Counting back in jumps of one using a hundred square



Using bead strings to count back by bridging through 10

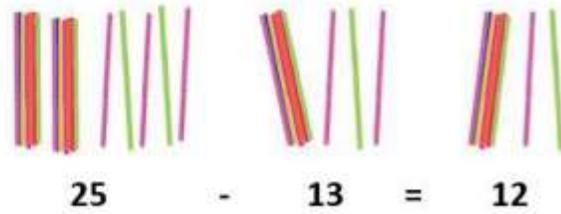


Dienes' Apparatus

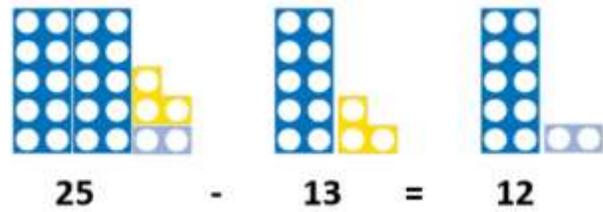


Subtraction
using
practical
resources

Counting Straws



Numicon



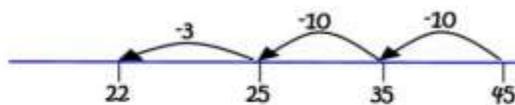
Counting back
in jumps of ten
and one using a
hundred square

58 - 26

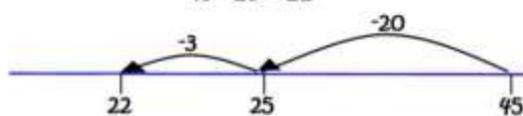


Counting back on a number line

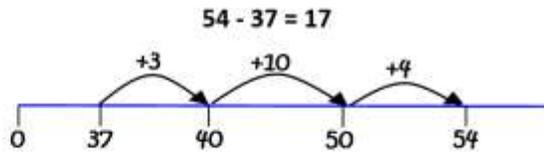
45 - 23 = 22



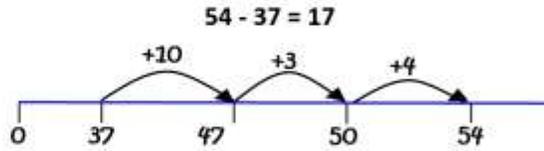
45 - 23 = 22



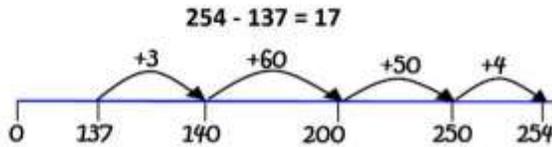
Finding a difference by counting on using a numberline



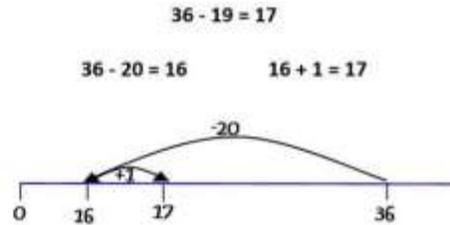
or



...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

$66 - 54$

	T	U	
	60	6	
-	50	4	
	10+2	→ 12	

Introduce practically, e.g



led as

S
E
L Subtraction using compact Written method

$81 - 57$

	T	U	
	78	11	
-	57		
	24		

→ 24

Subtraction
using compact
written method
exchanging
across columns

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

T U

³4⁹0~~3~~

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

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

¹2¹²1~~31~~

Subtraction
using negative
numbers

$$-12 - 4 = -16$$

Multiplication x



times
multiply
multiplication

lots of
repeated addition

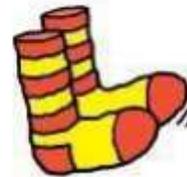
array
groups of
product

Stage 1

Grouping
objects into
equal groups



e.g. pairs of socks

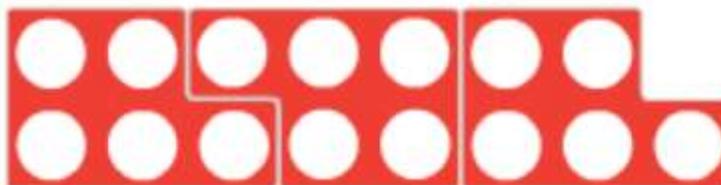


Counting in
jumps – finding
patterns using a
hundred square

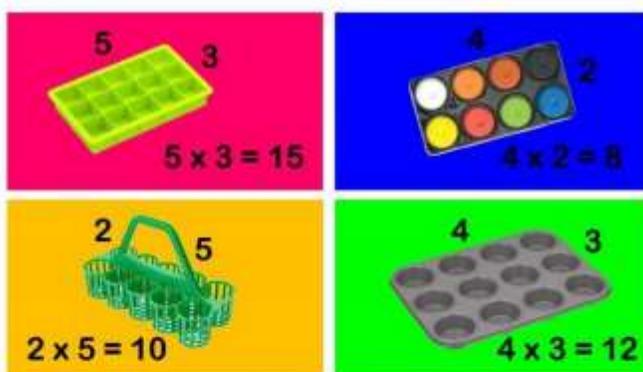
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Stage 2

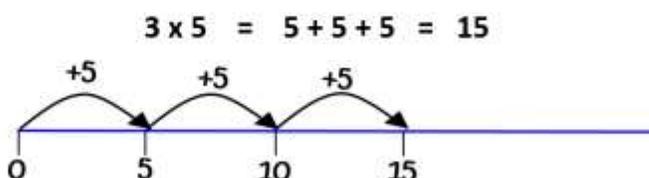
Repeated addition using practical resources



Arrays – using practical resources

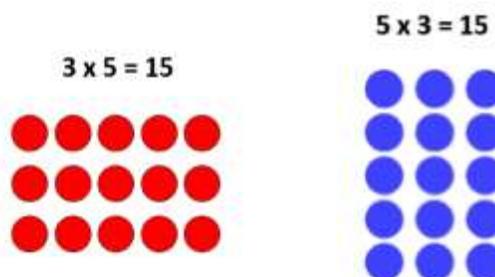


Multiplication by repeated addition



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	→ <u>46</u>
			966

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

	246	
	x 7	
	42	(6 x 7)
	280	(40 x 7)
	<u>1400</u>	(200 x 7)
	1722	
Expanded Column Method		

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

Expanded
Column Method

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

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

Contracted
Column Method

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

Division ÷



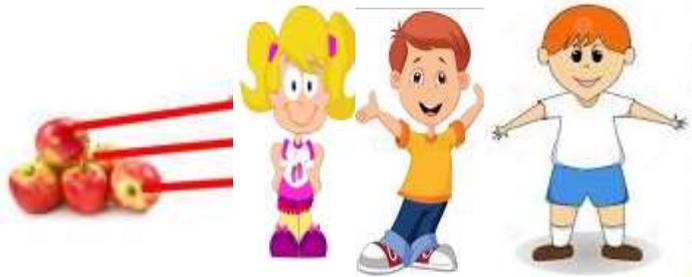
divide
division
share

group
sort
remainder
left over

how many lots of
repeated subtraction
split

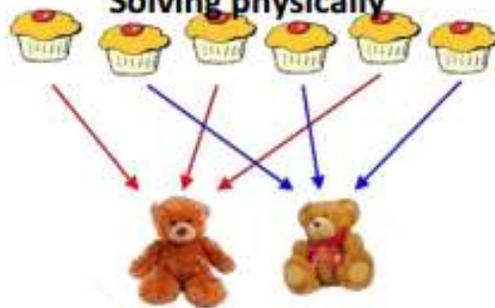
Stage 1

Sharing between children



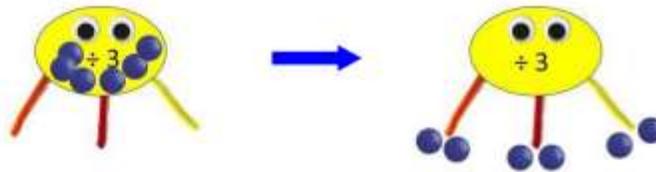
Sharing
equally

Solving physically

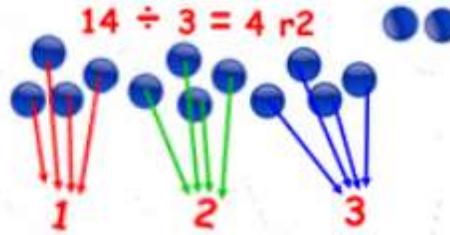


Stage 2

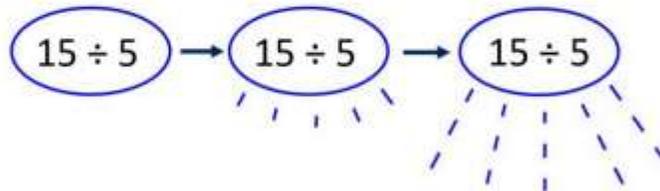
Sharing Spiders



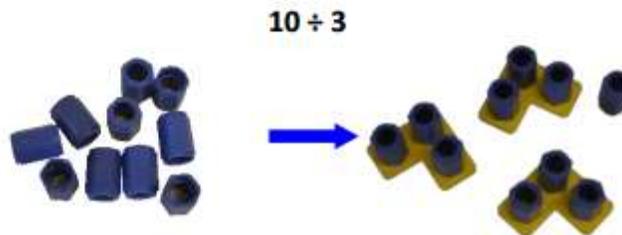
Sharing using e.g. counters



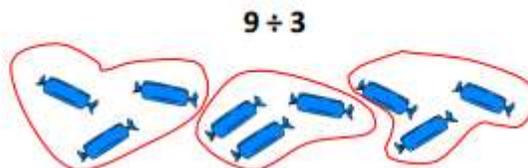
Sharing Showers



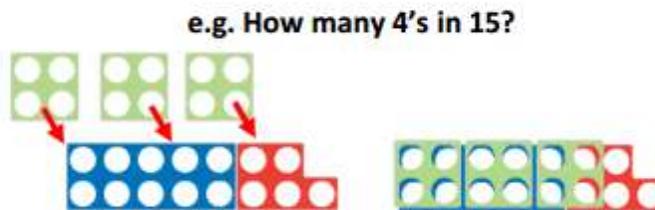
Grouping using Numicon



Grouping

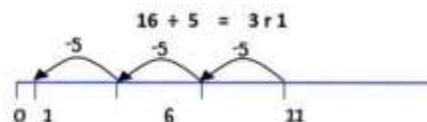


Division using practical resources



Repeated Subtraction

Using a number line:



Stage 3

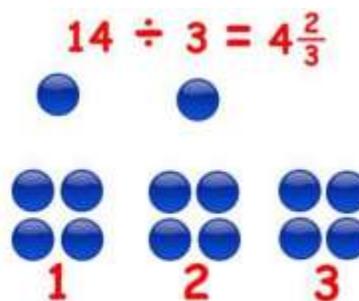
Dividing by partitioning

$72 \div 4:$

$40 \div 4 = 10$

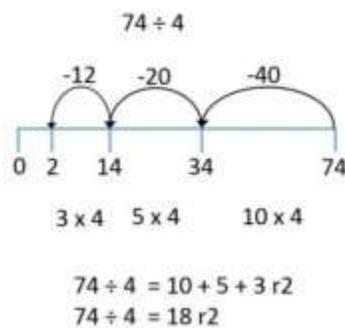
$32 \div 4 = 8$

Sharing representing remainders as fractions



Using a number line to take off chunks

Repeated subtraction of chunks



Repeated subtraction of chunks, e.g.

Division by chunking

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

$148 \div 4:$

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

$1 \times 17 = 17$
$2 \times 17 = 34$
$4 \times 17 = 68$
$10 \times 17 = 170$
$5 \times 17 = 85$
$20 \times 17 = 340$

534	(20 x 17)
<u>-340</u>	
194	(10 x 17)
<u>-170</u>	
24	(1 x 17)
<u>-17</u>	
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
		-	<u>4</u>	<u>8</u>	<u>0</u>
			8	0	
		-	<u>7</u>	<u>2</u>	
				8	

24×20

24×3

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

$$318 \div 6$$

Compact short
division

$$6 \overline{) \begin{array}{r} 0 \ 5 \ 3 \\ 3 \ 3 \ 1 \ 1 \ 8 \end{array}}$$

$$318 \div 3 = 53$$

$$560 \div 24$$

Compact short
division
showing answer
with a
remainder

$$24 \overline{) \begin{array}{r} 0 \ 2 \ 3 \ r8 \\ 5 \ 5 \ 6 \ 8 \ 0 \end{array}}$$

$$318 \div 3 = 53$$

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.