Mathematics and Numeracy Calculation Policy

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Signed: Date:

Review date: October 2020

Numeracy & Mathematics
Calculation Policy

Policy Statement
Numeracy/ Mathematics should be an integral part of all lessons with focus on children building functional 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 sets of items together

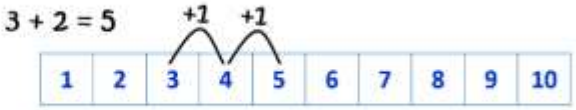
Find one more than a number

Adding using fingers and other practical resources

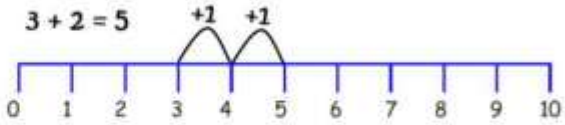
Introduction of symbols to form number sentences

3 + 2 = 5

Develop understanding of addition as Counting



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

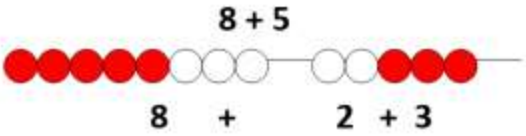


Stage 2

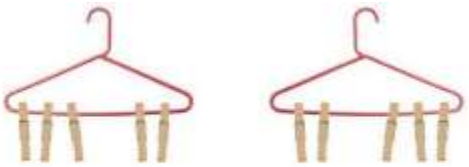
Developing knowledge and understanding of number bonds to10

e.g.

Using bead strings to count on by bridging through 10



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



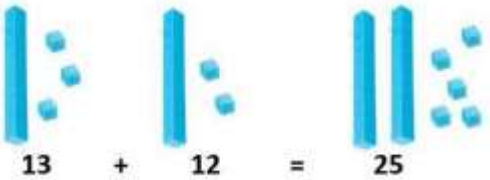
Vary position of missing numbers in a number sentence

$2 + \square = 5$

$\square + 4 = 7$

Counting on in jumps of one using a hundred square

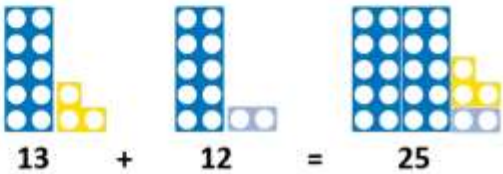
Dienes' Apparatus



Counting Straws

Addition of 2-digit numbers using practical resources

Numicon



32 + 26

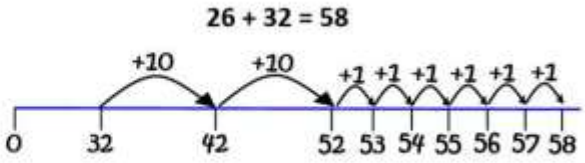
Counting on in jumps of ten and one using a hundred square

Vary position of missing numbers in a number sentence

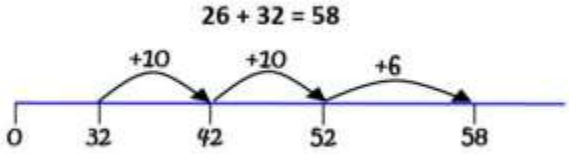
$$21 + \square = 43$$

$$\square + 32 = 58$$

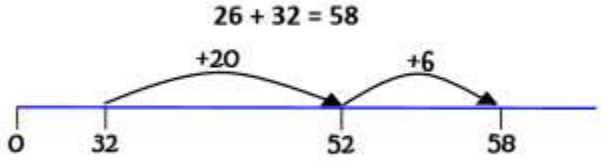
Addition using a blank number line (putting biggest number first)



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

T O T O

26 + 32

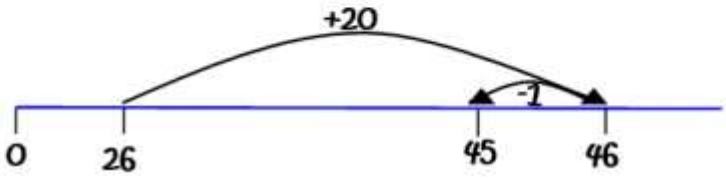
50 + 8 = 58

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

26 + 19 = 45

Adding by compensation

26 + 20 = 46 **46 – 1 = 45**



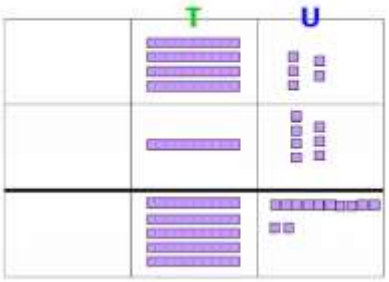
Stage 3

Begin to use expanded written methods

45 + 17

T	U	
40	5	
+ 10	7	
50 + 12		62

Introduce practically, e.g.



Introduce practically, e.g.

Progress to expanded written methods involving hundreds

145 + 127

	H	T	U	
	100	40	5	
+	100	20	7	
	200	+ 60	+ 12	272

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
	4	1	2
	1	1	

Addition using the compact written method progressing to thousands

3364 + 247

	H	T	U
	3	3	64
+		2	47
	3	6	11
	1	1	

Addition involving decimals using compact written methods

3.56 + 2.47

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

Addition with negative numbers

-15 + 6 = -9

Stage 1

Subtraction -

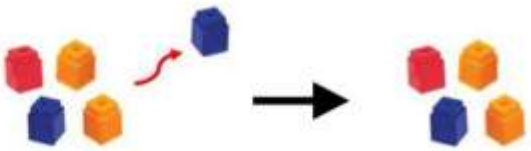
subtract
subtraction
take away
take

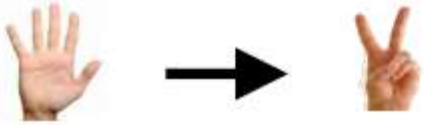
less
less than
minus
reduce

fewer
count back
difference
how many left

Take away from groups of items

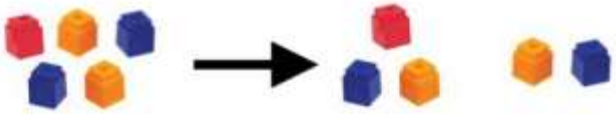
Find one less than a number





Take away using fingers and other practical resources

(e.g. for 5 - 3)



cover

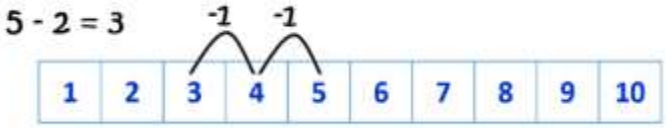
Taking away by crossing out

5 – 2 = 3

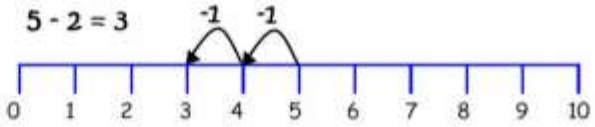
Introduction of Symbols to form number sentences

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

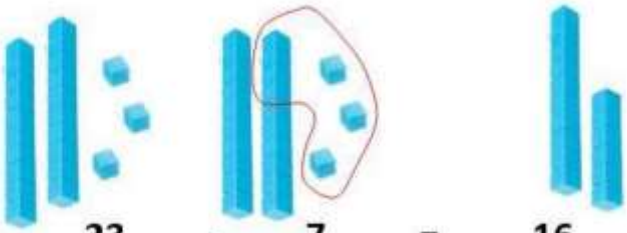
27 - 6

Using bead strings to count Back by bridging through 10

13 - 5

13 - 3 - 2

Dienes' Apparatus



23 - 7 = 16

Subtraction using practical resources

Counting Straws

25 - 13 = 12

Numicon

25 - 13 = 12

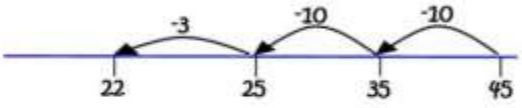
Counting back in jumps of ten and one using a hundred square

58 - 26

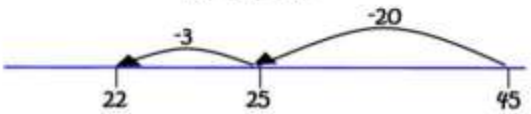
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Counting back on a number line

45 - 23 = 22

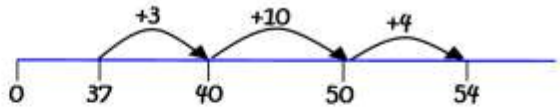


45 - 23 = 22



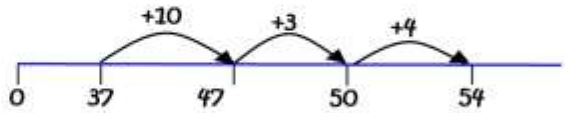
Finding a difference by counting on using a numberline

54 - 37 = 17



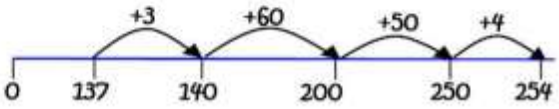
or

54 - 37 = 17



...progressing to hundreds for more able children

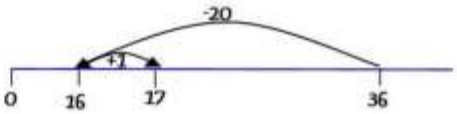
254 - 137 = 17



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

36 - 19 = 17

36 - 20 = 16 16 + 1 = 17



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

66

take away 54

leaves

Subtraction using expanded written method using exchange

81 - 57

...recorded as

T	U		T	U		T	U
80	1	→	70	11		70 80	1 1
- 50	7		- 50	7		- 50	7
			20+4	→ 24		20+4	→ 24

Subtraction using compact Written method

81 – 57

	T	U
	^{7}8	^{1}1
-	5	7
	2	4

403 – 127

Subtraction using compact written method exchanging across columns

	T	U
	^{3}~~4~~ ^{9}~~0~~	3
-	1	2 7
	2	7 6

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

£2.31 - £1.53

	£^{1}~~2~~.^{12}~~3~~^{1}1
	£1.53
	£0.78

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

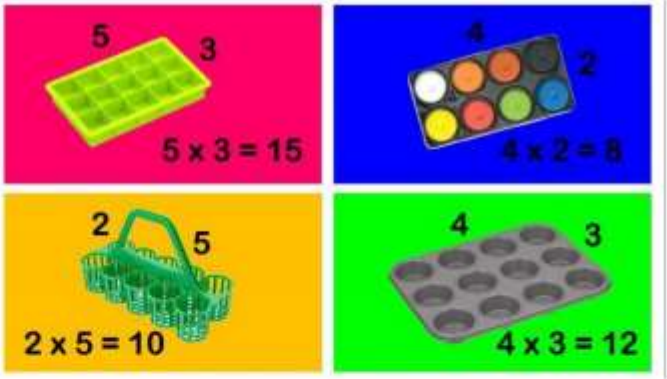
Counting in jumps – finding patterns using a hundred square

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

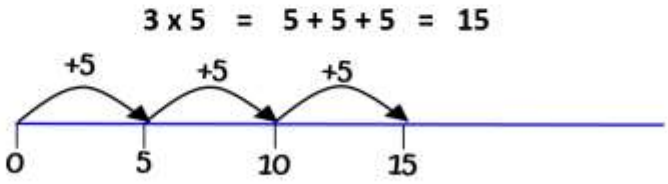
Stage 2

Repeated addition using practical resources

Arrays – using practical resources

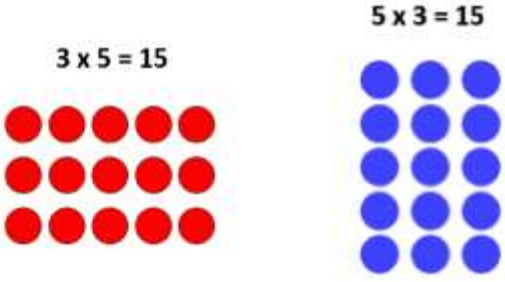


Multiplication by repeated addition



Using arrays

Drawing arrays using dots



Stage 3

Grid Method

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

x	20	3
4	80	24

80 + 24 = 104

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

Grid Method

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

x	100	20	3
6	600	120	18

= 738

Multiplying two 2-digit numbers:

x	20	3
40	800	120
2	40	6

→ 920

→ 46

966

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

Expanded Column Method

246 x 7

42 (6 x 7)

280 (40 x 7)

1400 (200 x 7)

1722

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

Expanded Column Method

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

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

Contracted Column Method

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

Division ÷

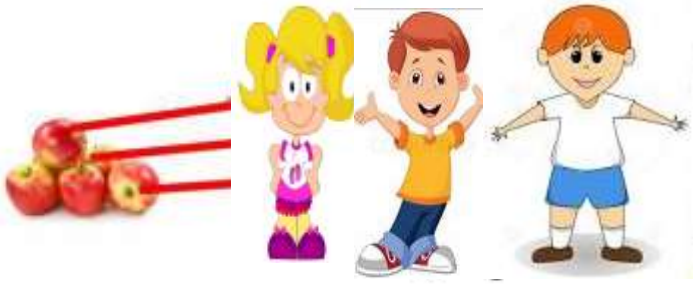
divide
division
share

group
sort
remainder
left over

how many lots of
repeated subtraction
split

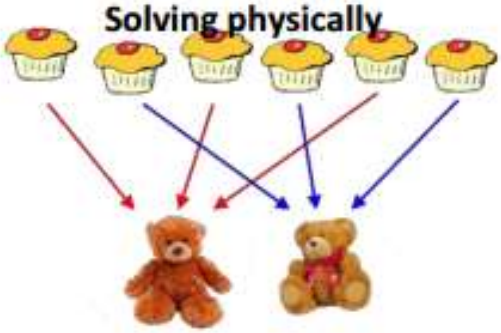
Stage 1

Sharing between children



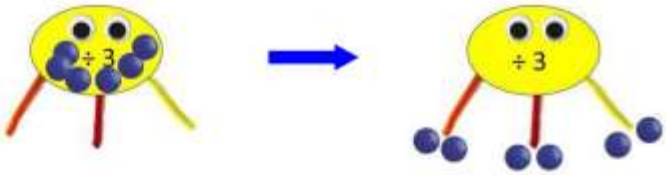
Sharing equally

Solving physically

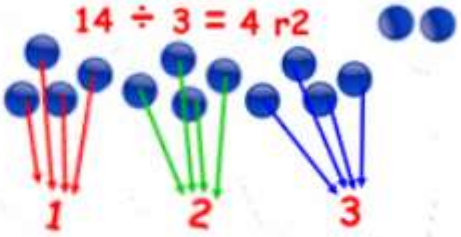


Stage 2

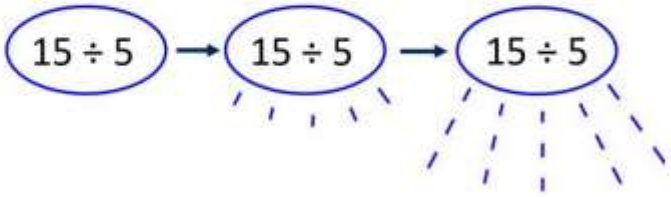
Sharing Spiders



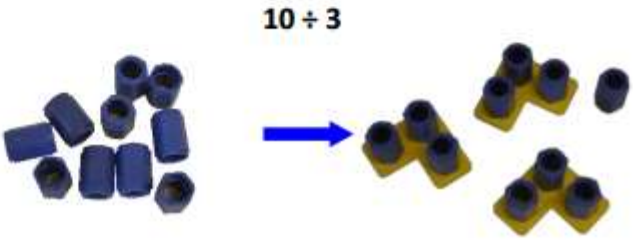
Sharing using e.g. counters



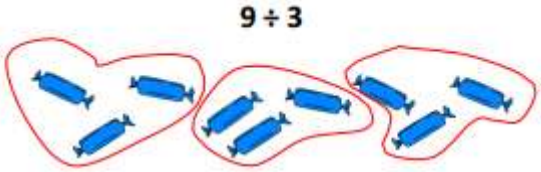
Sharing Showers



Grouping using Numicon



Grouping

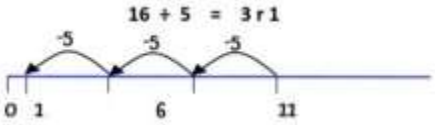


Division using practical resources

e.g. How many 4's in 15?

Repeated Subtraction

Using a number line:



Stage 3

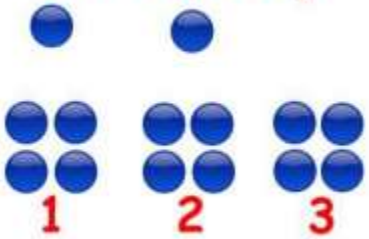
72 ÷ 4:

Dividing by partitioning

40 ÷ 4 = 10
32 ÷ 4 = 8

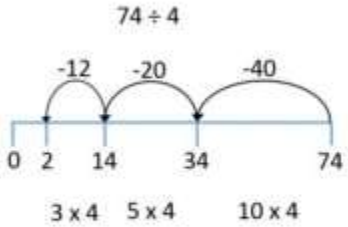
Sharing representing remainders as fractions

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



Using a number line to take off chunks

Repeated subtraction of chunks



74 ÷ 4 = 10 + 5 + 3 r2
74 ÷ 4 = 18 r2

Repeated subtraction of chunks, e.g.

148 ÷ 4:

Division by chunking

1 x 4 = 4
2 x 4 = 8
4 x 4 = 16
10 x 4 = 40
7 x 4 = 28

148	
-40	(10 x 4)
108	
-40	(10 x 4)
68	
-40	(10 x 4)
28	
-28	(7 x 4)
0	

148 ÷ 4 = 10 + 10 + 10 + 7
148 ÷ 4 = 37

Repeated subtraction of chunks, e.g.

534 ÷ 17:

Division by chunking

1 x 17 = 17
2 x 17 = 34
4 x 17 = 68
10 x 17 = 170
5 x 17 = 85
20 x 17 = 340

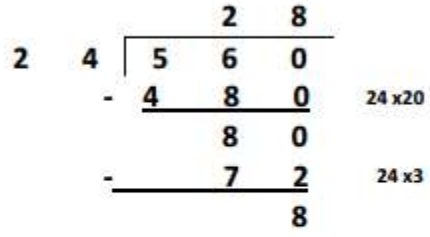
534	
-340	(20 x 17)
194	
-170	(10 x 17)
24	
-17	(1 x 17)
7	

534 ÷ 17 = 20 + 10 + 1 r7

534 ÷ 17 = 31 r7

560 ÷ 24:

Long division



560 ÷24= 28 r8

318 ÷ 6

Compact short division

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

318 ÷ 3 = 53

560 ÷ 24

Compact short division showing answer with a remainder

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

318 ÷ 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 total10.

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.