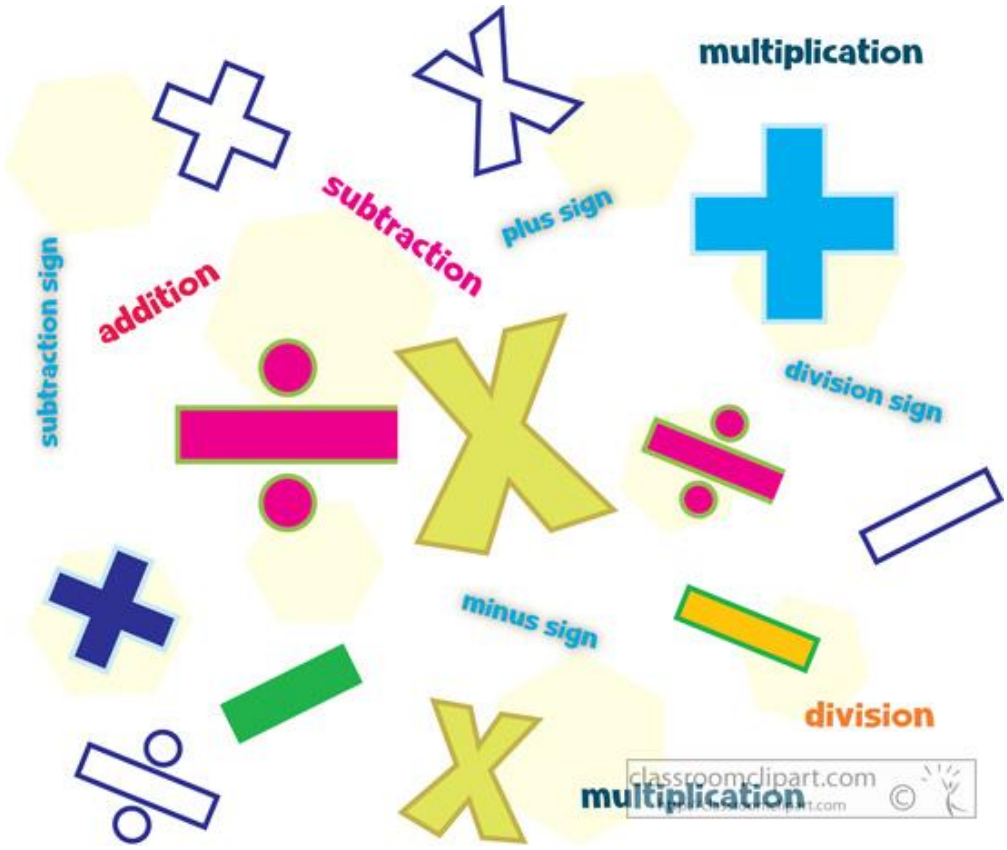
Sheriff Hutton Primary School

Calculation Progression



2014 Maths Curriculum

Produced in collaboration with the Easingwold Area Partnership

Key Milestones – 2014 maths curriculum

Maths requires skills and knowledge to be firmly in place before the next steps can be taken. For some children this will take longer than others. Listed below are some key milestones which your child will need to master before moving onto the next stage.

Foundation Stage

- **1 more than, 1 less than any number up to and including 20**
- Adding 2 single digit numbers using objects
- Subtracting 2 single digit numbers using objects
- Solve problems using **doubling**
- Solve problems using **halving**
- Solve problems using **sharing**

Year 1

- Recognise + , - , and = signs
- Know all number bonds to 20 and facts within 20
- Add 1 and 2 digit numbers to 20 including 0
- Subtract 1 and 2 digit numbers to 20 including 0
- Understand that number sentences can be shown in several forms e.g. 7 = ? – 9
- Solve 1 step problems using objects, pictures and arrays
- **Count in 2s, 5's and 10's – link with multiplication**
- **Group objects into 2's, 5's and 10's – link with division**

Year 2

- Solve problems using objects, pictures, numbers and measures
- Show an increased knowledge of mental and written methods
- Know all number facts to 20 fluently
- Understand and use number facts up to 100
- Add 2 digit numbers to 1 digit numbers
- Add 2 digit numbers to 2 digit numbers
- Add 3 digit numbers to 1 digit numbers
- Use inverse (opposite) to check answers
- **Know 2, 5 and 10 tables fluently including division facts**
- Recognise odd and even numbers
- Use x , ÷ , and = symbols
- Solve multiplication and division problems using objects, arrays, repeated addition and known multiplication facts.
- Group and share objects and numbers
- **Double and half numbers with ease and recognise the link to the 4 times tables**

Year 3

- Mentally add and subtract
    - 3 digit numbers and 1's
    - 3 digit numbers and 10's
    - 3 digit numbers and 100's
- Use place value knowledge to partition numbers

- Use a formal written method to add and subtract 2 and 3 digit numbers – using practical apparatus first
- Estimate answers and use inverse (opposite actions) to check
- Solve problems using number facts and place value knowledge
- **Know multiplication and division facts for 3, 4, and 8 times tables fluently**
- Multiply a 2 digit number by a 1 digit number

Year 4

- Use formal written methods for adding, subtracting and multiplying 4 digit numbers
- Estimate answers and use inverse (opposite actions) to check
- Solve 2 step problems deciding which operation to use
- **Know multiplication and division facts for all numbers up to and including 12 x 12 fluently**
- Multiply 3 numbers together
- Find factor pairs
- Use a formal written method to multiply 2 and 3 digit numbers by 1 digit numbers
- Use a number line as a way of recording ‘chunking’ when dividing

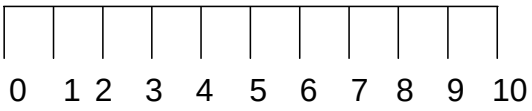
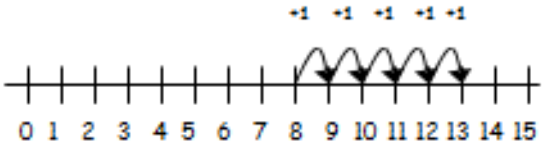
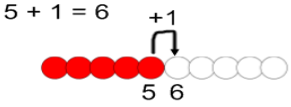
Year 5

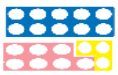
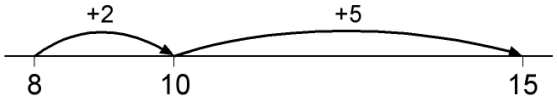
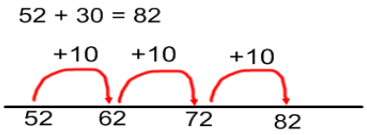
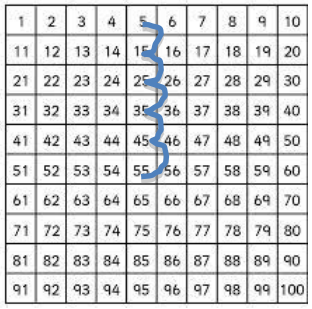
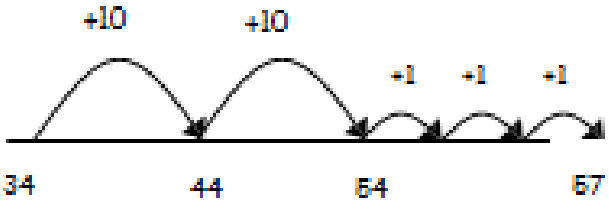
- Add, subtract and multiply 4 digit and larger numbers using a compacted formal written method
- Multiply and divide numbers including decimals by 10, 100 and 1000
- Use a short division method
- Add and subtract mentally using increasingly larger numbers
- Round answers to check accuracy
- Solve multistep problems deciding on method and operations
- Use knowledge of multiples and factor pairs
- Understand and use the terms prime, squared and cubed
- Recall prime numbers to 19
- Work out if a number is prime up to 100

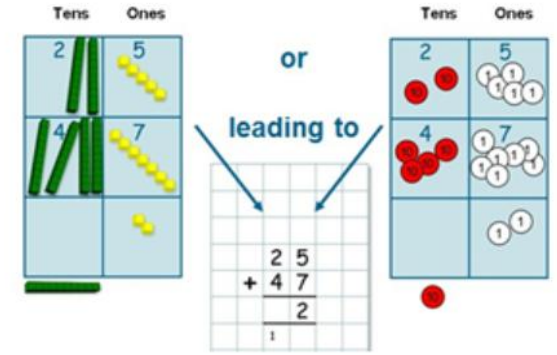
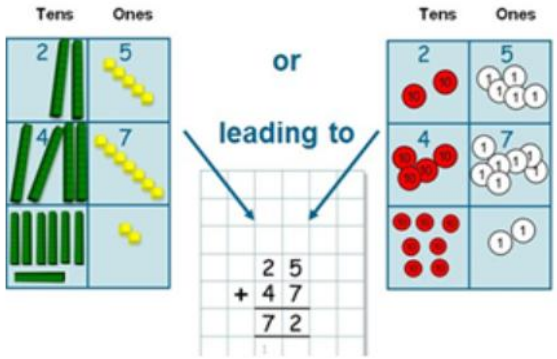
Year 6

- Use knowledge of the order of operation to be able to carry out a calculation
    - B - brackets
    - O - ordinals
    - D - divide
    - M - multiply
    - A - add
    - S – subtract
- Carry out long multiplication using a formal written method
- Carry out long division using a formal written method

+ Addition +

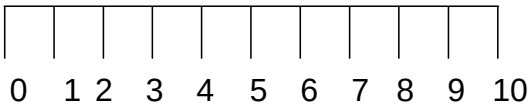
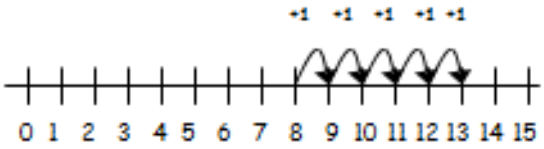
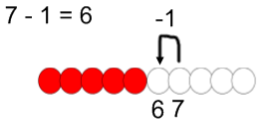
STEP	Concept & images	Comments
1 *Early addition*	Combining groups of objects to find the total 	Put all objects together and count… Find total of 2 groups using objects in hoops… Then total of 2 groups using objects and numerals in hoops… Then… total of 2 groups using objects and hoops and recording as a number sentence… Then without hoops, with objects and record as a number sentence
2 *Relating groups of objects to number line*	'Informal number line' / number sentences  As above, alongside a calculation  Children should experience a range of representations of number lines, such as the progression listed below. Number track 1 2 3 4 5 6 7 8 9 10 • Number line, all numbers labelled  • Number line, 5s and 10s labelled • Number line, 10s labelled • Number lines, marked but unlabelled 8 + 5 = 13 	Look at number sentences. Use objects on sheets to find answer Then… Look at number sentences – use objects provided to find the answer Look at number sentences: what do we have to do? Use objects to find an answer
3 *Locating numbers on a number line & adding one more.*	Add one onto a number 	Find 5 on number track, then add one Encourage children to locate the first number and count on from there, rather than starting at zero.

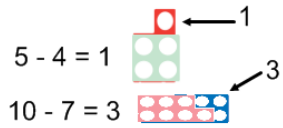
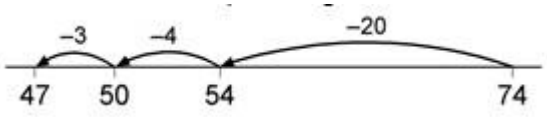
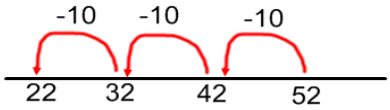
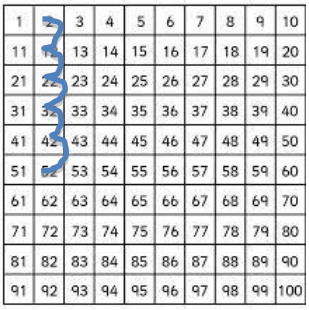
4 *Number bonds **up to** 10.*	How many ways of splitting up a number? 10 = ? + ? 9 = ? + ? 8 = ? + ? Etc 5 = 4 + 1  10 = 7 + 3  Recognise that number sentences can be represented in several forms: 9 + 7 = 16 16 – 7 = 9 7 = ▭ - 9	In order to calculate effectively children must know all the bonds for numbers up to ten. This will enable them to **jump** on the number line rather than *count*. Using a bead bar is also an effective way to showing how to split smaller numbers up **KS1 children to also model this using jumps on a number line in order to lead to step 5.**
5 *Using number bonds to add on the number line.*	Bridge 10 (e.g. 8 + 7 =15) 8 + 7 = 15 Seven is partitioned into 2 and 5; 2 creating a number bond to 10 with the 8 and then the 5 is added to the 10.  	Emphasise JUMP on number line, NOT counting! Use number bonds to jump to the next ten on the number line. Then add what is left in one jump.
6 *Using number line or hundred square to jump in tens from any 2-digit number.*	Adding multiples of 10  	Starting from any 2-digit number children must be able to jump in steps of ten. *Focus on what happens to the tens and units as you count.* *Focus on tricky parts: counting over 100, counting back past 20 in the teen numbers*.
7 *Adding on the number line or hundred square.*	TU + TU 34 + 23 = 57  	This puts together the two previous ways of adding on a number line. THE NUMBER LINE REPRESENTS THE JUMPS IN YOUR HEAD! *If adding near multiples of ten, more confident pupils can do adding a ten and adjusting:* *43 + 19, = 43 + 20 = 63 -1 = 62*

8 *Column addition for adding pairs of 3 digit numbers.*	HTU + HTU using partitioning 347 + 122 = 300 40 7 +100 20 2 400 60 9 = 469 **THEN, GO BEYOND 10 in U column etc.** 159 + 264 = 100 50 9 +200 60 4 300 110 13 = 423 This will be introduced using practical equipment first.    	Start by partitioning the numbers so the children understand what each column represents. Children should only use this when adding together 3-digit numbers and preferably when the units add to more than ten. (Although to introduce concept using simpler numbers is a good idea)
9 *Compact Column addition*	347 + 122 347 Then 347 Then, with exchanging 159 +122 +122 + 264 9 469 423 60 11 400 469	As the children become more confident in column addition they can gradually start to use the compact method for speed. **It is vital that they still understand that the small '1' represents tens or hundreds.**

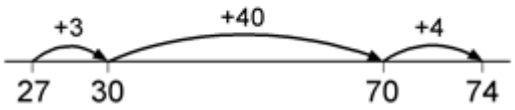
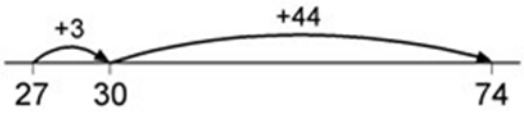
10 *Compact Column addition with decimals*	Same number of decimal places 78.5 km +54.6 km 133.1 km 11 Then, different number of decimal places 124.9 + 7.25 132.15 11	As with the compact column addition strategy it is vital that children understand what each column represents in terms of value.

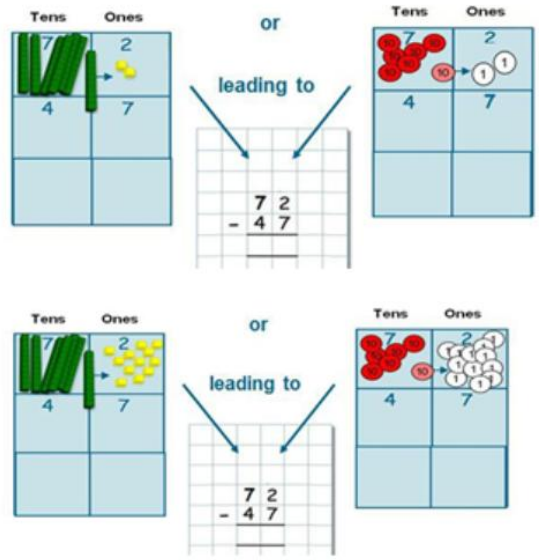
–Subtraction –

STEP	Concept & images	Comments
1 Early subtraction	Take away a number of objects from the group, count what's left 	Then… start with group of objects and record the numeral. Take some away, record and count what's left (record) '6 take away 3 is 3 OR 3 less than 6 is 3'
2 Relating groups of objects to number lines	Introduce – and = symbols Include vocabulary: 'difference' Relate to number line  Children should experience a range of representations of number lines, such as the progression listed below. Number track 1 2 3 4 5 6 7 8 9 10 • Number line, all numbers labelled  • Number line, 5s and 10s labelled • Number line, 10s labelled • Number lines, marked but unlabelled 8 + 5 = 13 	Emphasise JUMPING on number line, not counting Then… look at a number line: what do we need to do?
3 Locating numbers on a number line and finding one less.	Take away one from a number 	Find 5 on number track, then SUBTRACT one Encourage children to locate the first number and count back from there, rather than starting at zero.

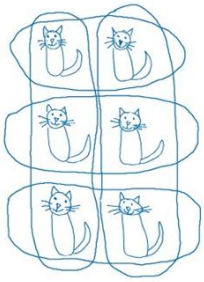
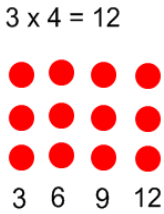
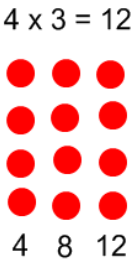
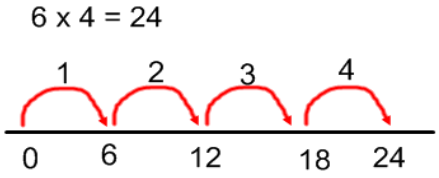
4 Number bonds **up to** 10.	Inverse use of number bonds(the opposite of step 3 for addition)  	Model with numicon In order to calculate effectively children must know all the bonds for numbers up to ten. This will enable them to **jump** back on the number line rather than *count*. **KS1 children to also model this using jumps on a number line in order to lead to step 5.**
5 Using number bonds to jump back on a number line.	Jumping back (Bridging 10) 15 – 7 = 8 The seven is partitioned into 5 (to allow count back to 10) and two.  74 – 27 = 47 worked by counting back:  	Emphasise JUMP on number line, NOT counting! Use number bonds to jump back to the previous ten on the number line. Then subtract what is left in one jump. Use number bonds.
6. Using number line or hundred square to jump back from any number in steps of ten.	Jumping back in tens using number line. 52 - 30 = 22  Jumping back in tens using a hundred square. 	Starting from any 2-digit number children must be able to jump back in steps of ten. *Focus on what happens to the tens and units as you count.* *Focus on tricky parts: counting over 100, counting back past 20 in the teen numbers*.

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

7 **Subtracting on the number line by counting up (finding the difference)** **Key method which children must be able to use**	74 – 27 =  The 'jumps' should be added, either mentally or with jottings according to confidence, beginning with the largest number e.g. 40 + 4 + 3. or  	Emphasise looking at HOW CLOSE NUMBERS ARE before using a number line. The children should question: Is it a good idea to take away? **OR** Is it a good idea to find the difference? THE NUMBER LINE REPRESENTS THE JUMPS IN YOUR HEAD! *If subtracting near multiples of ten, more confident pupils can do subtracting a ten and adjusting:* *43 - 19, = 43 - 20 = 23 +1 = 24*
8 Column subtraction	Easy column subtraction to practise layout. 73 Then 567 - 41 - 342 32 225	Don't use number line for HTU – HTU (only exception is something like 1,000 – 279, which would involve too many exchanges) Ideally children should only be using column method when practising decomposition.
9 Column subtraction using decomposition.	HTU – HTU Using decomposition 500 30 6 - 200 10 5 300 20 1 = 321 Then 'exchange' This will be introduced using practical equipment first. 	Starting with the expanded method is the best way to get children to understand what is happening when using column subtraction. Get them to understand that if you can't subtract the units exchange a ten, and so forth. **Key vocabulary is the word 'exchange' not 'borrow' or 'carry' as the value of the numbers remains the same.** **MISCONCEPTION:** Children often try to swap the units if they can't subtract them properly first so model this carefully.

	72 - 47  Leading to… 400 120 10 ~~500~~ ~~30~~ 1 - 200 70 7 200 50 4 = 254	
10 Compact column subtraction	Compact column subtraction 2 1 1 ~~3~~ 7 - 2 9 1 0 8 Then… 1 4 2 1 ~~5~~ ~~3~~ 6 - 2 7 7 2 5 9	As the children become more confident in column subtraction they can gradually start to use the compact method for speed. **It is vital that they still understand that the '1' written above represents tens or hundreds.**
11 Compact column subtraction with decimals.	With decimals 1 6 1 1 ~~7~~ ~~2~~ . 5 km - 4 . 6 km 6 7 . 9 km	As with the compact column subtraction strategy it is vital that children understand what each column represents in terms of value.

X Multiplication X

STEP	Concept & images	Comments
1 Repeated addition	5 x 3 = 15 is the same as 5 + 5 + 5 = 15  2 + 2 + 2 + 2 + 2 = 10	The main concept to get across is that when you multiply you are repeatedly adding the same number again and again. Counters can be used to illustrate this clearly.
2 Simple Multiplication	Array 3 groups of 2 And 2 groups of 3    Number line  	Read out the calculations as: 3x4 '3, multiplied 4 times' Understand that this is a group of 3, repeated 4 times. Use an array to model the concept. Emphasise that children don't count individual dots, but count up in the appropriate steps. This can lead onto children representing their counting on a number line.
3 Doubling	8 x 2 = 16 *(double the units)* 24 x 2 = 48 *(double the tens, double the units, combine)*	It is important that doubling and halving are taught independently to other mental strategies for multiplying and dividing. It is not appropriate for children to use arrays or number lines to multiply by 2. Children should be able to double, even large numbers through partitioning, mentally.

<table>
<tr><td></td><td>8 x 4 = 32
(can use double, then double again)</td><td></td></tr>
<tr><td>4
Moving digits</td><td>Multiply by 10 / 100
7.9 x 100 = 790

H T U . tenths
7 . 9
7 9 x 10 (digits move one column to left)
7 9 0 x 100 (digits move two columns to left)</td><td>Similar to doubling, children should be able to multiply by ten mentally. They need to do this in order to solve larger multiplication calculations effectively.

Emphasise the DIGITS MOVE, not adding on a zero when x by 10 (otherwise, when working with money, children will put £1.75 x 10 = £1.750!!!)</td></tr>
<tr><td>5
Grid Method TU x U</td><td>Can introduce informally using partitioning

‘13 x 6 is the same as 10 x 6 and 3 x 6
(60 + 18) = 78’

… Then Grid Method

<table><tr><td>x</td><td>10</td><td>3</td></tr><tr><td>6</td><td>60</td><td>18</td></tr></table>
13 x 6 = 78</td><td>The grid method allows children to use known number facts to solve multiplication problems.</td></tr>
<tr><td>6
Standard Method</td><td>Work towards standard method
24
x 3
12 (3x4)
60 (3x20)
72</td><td>The standard method encourages children to use known multiplication facts when solving larger multiplication calculations.

This will also help them when dividing.</td></tr>
<tr><td>7
Compact Standard Method</td><td>Compact (standard method)

24
x 3
72
1</td><td>Children can begin to use the compact methods when they are comfortable with solving the multiplications mentally.</td></tr>
</table>

8
Grid Method
TU X TU

24 x 14 =

x	**20**	**4**
10	200	40
4	80	16

200
80 +
40
16
6
130+
200
336

HTU X T

342 x 36 =

x	**300**	**40**	**2**
30	9000	1200	60
6	1800	240	12
	10800	1440	72

10800
1440 +
72
12312
11

The grid method leads into…

9
Compact Long Multiplication

126
x 14
1000
200
+ 60
400
80
24
4
160
+600
1000
1764

x	100	20	6
10	1000	200	60
4	400	80	24

Which leads into…

126
x 14
1260
504
1764

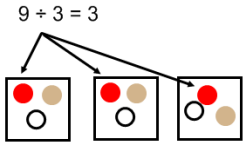
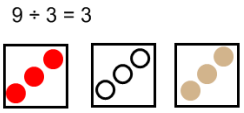
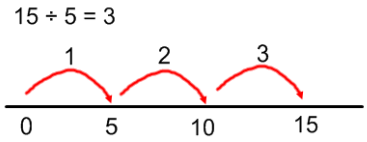
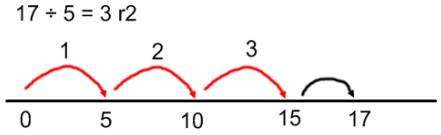
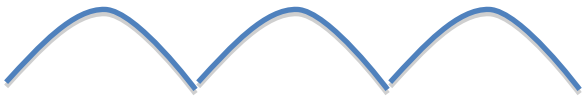
<table>
<tr>
<td>9
Multiplying
Decimals</td>
<td>14.53 x 4 = 58.12

<table>
<tr><td>x</td><td>10</td><td>4</td><td>0.5</td><td>0.03</td></tr>
<tr><td>4</td><td>40</td><td>16</td><td>2</td><td>0.12</td></tr>
</table>

OR

14.53
x 4
58.12
12 1</td>
<td></td>
</tr>
</table>

÷ Division ÷

STEP	Concept & images	Comments
1 Sharing	SHARING 'Is it fair?' 	USE COUNTERS OF DIFFERENT COLOURS When sharing you know how many groups you will have; you are working out how many will be in each group. Focus on grouping
2 Grouping	As GROUPING – link to times tables facts 12 ÷ 4 = 3 (groups) 	When solving division through grouping, you know how many items are in each group; you are working out how many groups there will be. As this relies more on times tables knowledge, it is better to use this strategy than sharing. Children should understand that even when solving a 'sharing' problem, they can solve it quicker through grouping.
3 Grouping on the number line	Grouping using number line 15 ÷ 5 = 3 	Encourage children to read the question as: *'I have 15, how many 5s?'* They can then use times tables knowledge to solve the problem, using number lines to record their thinking.
4 Grouping on the number line with remainders	Finding a remainder 17 ÷ 5 = 3 r 2 	Encourage children to read the question as: 'I have 17, how many 5s?' How many WHOLE groups of 5 can they count in 17? What's left over? *This is the remainder.*
5 Moving digits	Dividing by 10 / 100 79 ÷ 10 = 7.9 H T U . tenths 7 9 7 . 9 ÷ 10 (digits move one column to right) 0 . 7 9 ÷ 100 (digits move two columns to right)	
6 Further partitioning to solve TU÷U	Use 'further' partitioning on a number line/chunking.  10 x 4 40 5 x 4 60 1 x 4 64 = 16	Further partitioning allows children to break a large number down so that they can use known multiplication facts to help solve the division. Eventually further partitioning may not be necessary as children become more confident seeing the multiplication facts they can use.

7 Standard method	Standard 'Goes Into' Method This will be introduced using practical equipment first.  14 r 2 2 5 | 72 Then 164 r 3 (or 3/6) 3 2 6 | 987	Using the standard 'goes into' method allows children to use known multiplication facts mentally and reduce the jottings needed to record their thoughts.
8 Decimal Divisions	With decimals: Use standard method 87.5 ÷ 7 = 12 . 5 1 3 7 | 8 7 . 5	
9 Long division	425 ÷ 25 = 17 017 25 | 425 −0 0 x 25 = 0 42 −25 1 x 25 = 25 175 −175 7 x 25 = 175 000	

Useful Vocabulary

Bridging- You can make it easier to use numbers if you work out what should be added or taken away to bring you to a 10 or multiple of 10. Then add or subtract the other number separately.

Calculate- To work out

Complements- Number bonds to 10 and100 e.g. complements of 10 are 2+8 or 4+6, complements of 100 are 46+54, 22+78…

Decomposition- To partition numbers in different ways to allow subtraction to take place when the subtracting number is larger than the starting number e.g. 700+80+4 is the same as 700+70+14. (what you may know as borrowing)
Difference – One number subtracted from another gives you the difference between them.

Difference- To find the difference between 2 numbers, you need to take the smaller number away from the larger one. E.g. the difference between 10 and 4 is 6

Factors- A factor is a whole number which will divide exactly into another whole number. E.g. 3 is a factor of 12

Inverse operation- If you have a sum with a missing gap, you can use the inverse operation to solve it. E.g. + and – are the inverse of each other and x and ÷ are the inverse of each other
To solve 124 + _____ = 200 you could turn it to 200 – 124 = 76

Mean- To find the mean you must have a set of results. You then need to find the total of the results and divide it by the number of results you have,
e.g. Here are a set of test marks
Paul 22, Sally 26,Tim 31,David 33
To find the mean of these scores add them all together (112) and then divide by 4 (28) so the mean score is 28

Median- When the data is arranged in order of size the median is the one in the middle.

Mode- Is the number which appears most frequently in a collection of data.

Multiple- Multiples are whole numbers that a larger number can be made of by adding lots of the smaller number together. E.g. 12 is a multiple of 3

Number Bond- Pairs of numbers which make a number e.g. the number bonds for 10 are 10 and 0, 9 and 1, 8 and 2, 7 and 3, 6 and 4, and 5 and 5

Ordinals- Whole numbers

Partitioning- Splitting a number into tens and units e.g. 56 = 50 + 6

Percentages- Means out of 100 so 20% is the same as 20/100. To find 20% of 50 you divide by 100 and times by 20

Prime numbers - Are numbers which will divide exactly only by themselves and 1. These are the prime numbers to 30 - 2 3 5 7 11 13 17 19 23 29

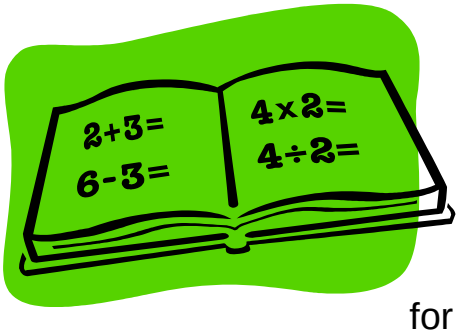
Product- The answer when something has been multiplied. e.g. the product of 3 and 4 is 12

Square number- The total when a number is multiplied by itself.
E.g. 1x1=1; 2x2 = 4, 3x3 = 9
Square numbers to 100 are 1 4 9 16 25 36 49 64 81 100

Sum- To find the sum of a group of numbers, you add the numbers together.

Helping your child at home

DO:



- Let them have a go on their own if they ask you, BUT ..... let your child know that you are around to give help if they would like it.
- Listen to your child; let them teach you their method.
- Make practice fun, for example card games.
- Put aside a regular 10 minutes several times a week for them to tell you what they are working on.
- Try to find opportunities to show them maths being used at home or shopping, e.g. measuring quantities of food, using money etc.
- Use mathematical vocabulary that you children know and bring home rather than terms you may remember e.g. borrowing when subtracting is no longer a term used as nothing is ever repaid!

- **Practise KIRFs and times tables regularly – the sooner children know them the easier maths becomes…**

Name _____

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

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100