HARLESCOTT JUNIOR SCHOOL

CALCULATION POLICY

FEBRUARY 2015
To be reviewed FEBRUARY 2017

At Harlescott Junior School we aim to teach our children to be competent mathematicians. Children will learn methods which enable them to carry out calculations as effectively and accurately as possible, while also using correct terminology, vocabulary and a range of models to fully understand the concepts of their methods. This policy will enable children to improve the fluency of their calculations and will undertake regular problem solving and reasoning challenges to expand their knowledge of maths and understanding mathematical links in the curriculum. Children will also be expected to correctly spell terminology associated with mathematics.

This policy has been written using a combination of advice from The National Centre for Excellence in the Teaching of Mathematics, school staff's expertise and knowledge, as well as using the objectives and guidance (Maths Appendix A) of the 2014 National Curriculum.

Addition

Year 3a – Partitioning into tens and units, and hundred once secure:

Count on by partitioning the second number.

247 + 24 =

247 + 20 + 4 = 271

247 + 125 =

247 + 100 + 20 + 5 = 372

Children may wish to make additional notes to support their working such as:

247 + 100 = 347 + 20 = 367 + 5 = 372

Year 3b – Partitioning in columns and using models, towards a written columnar method:

247 + 125 =

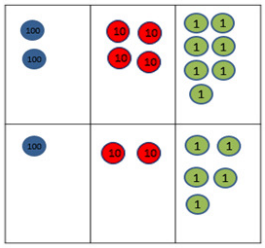
200 + 40 + 7

100 + 20 + 5

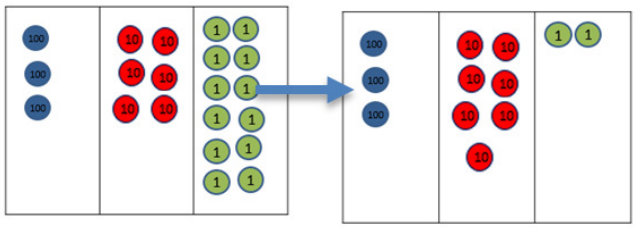
300 + 60 + 12 = 372

Use of a range of models and images will allow children to gain understanding of the exchange between tens and ones, as well as tens and hundreds.

Question:



Answer:



Year 4a: Expanded column method (less focus on need for models):

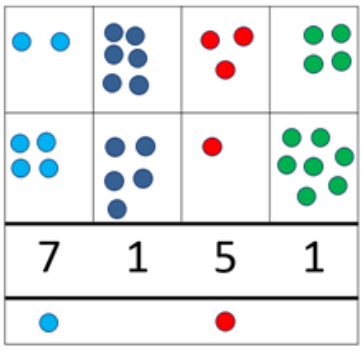
117 + 245 =

100 + 10 + 7

200 + 40 + 5

300 50 12 = 362

Year 4b: Columnar method up to using 4 digits (using models to reinforce the method):



1739 + 3624 =

	1	7	3	9
+	3	6	2	4
	5	3	6	3
	1		1	

At this point more confident children may be exposed to decimals through money (also up to 4 digits).

Year 5a: Columnar method with more than four digits, including solving multi-step problems which involve both subtraction and addition.

A football stadium can hold 20,000 fans. There were 2,739 fans in the away supporters end and 12,402 fans in the home supporters end. How many seats were empty in the ground?

(The first step of the problem will require an addition calculation).

2,739 + 12,402 =

	1	2	4	0	2
+		2	7	3	9
	1	5	1	4	1
		1		1	

Year 5b: Columnar method with up to 5 digits, and 2 decimal places.

264.12 + 18.99 =

2	6	4	.	1	2
	1	8	.	9	9
2	8	3	.	1	1
	1	1		1	

Year 6: Children use the methods of Year 5 : In Year 6 children should be able to further apply these methods to problem solving, and reasoning questions to embed their understanding and apply their method to other areas of the maths curriculum. Children should be very confident in the columnar method by Year 6, including two step problems involving any operation.

Subtraction

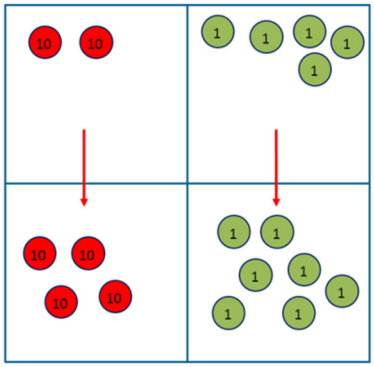
Year 3a - Subtract two digit numbers using a columnar method with no decomposition:

75 – 42 =

	70	**5**	
-	**40**	**2**	
	30	**3**	**= 33**

Year 3b – Subtract a two digit number using a columnar method, including decomposition, using models to explain the effect of decomposition.

72 – 47 =

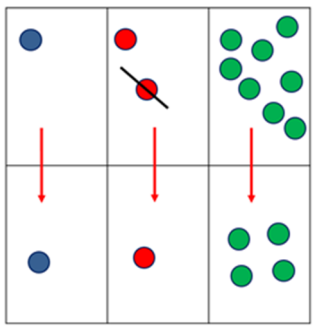


$$\begin{array}{rr} & {\scriptstyle 60}\ {\scriptstyle 1} \\ & \cancel{70}\ 2 \\ - & 40\ \ 7 \\ \hline & 20\ \ 5 \end{array}$$

Year 3c – Subtract 3 digit numbers using a columnar method including decomposition:

232 – 114=

$$\begin{array}{rrrr} & & {\scriptstyle 2} & \\ & 2 & \cancel{3} & {}^{1}2 \\ - & 1 & 1 & 4 \\ \hline & 1 & 1 & 8 \end{array}$$



Year 4a – Consolidation of expanded columnar addition with four digit numbers:

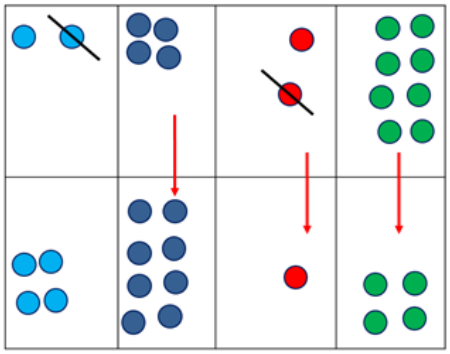
A modelled method using place value counters could be used alongside this if still required (see Year 3b).

2374 – 1465 =

	1000		60	
	~~2000~~	300	~~70~~	4
-	1000	400	60	5
	0	900	0	9

Year 4b – columnar method with four digit numbers:

Can initially be modelled using place value counters. Children use columnar method without counters as confidence in method is consolidated.



5 1 2 1

~~6~~ ~~2~~ ~~3~~ 2

- 4814

1418

Year 5a – Columnar method with more than four digits, including solving multi-step problems which involve both subtraction and addition.

A football stadium can hold 20,000 fans. There were 2,739 fans in the away supporters end and 12,402 fans in the home supporters end. How many seats were empty in the ground?

(The first step of the problem will require an addition calculation as shown in addition Year 5a.)

20,000 – 15,141 =

	1	9	9	9	
	~~2~~	~~0~~	~~0~~	~~0~~	0
-	1	5	1	4	1
	0	4	8	5	9

Year 5b: Columnar method with up to 5 digits, and 2 decimal places:

252.49 – 16.25 =

		4				
	2	5̸	2 .		4	9
-		1	6 .		2	5
	2	3	6 .		2	4

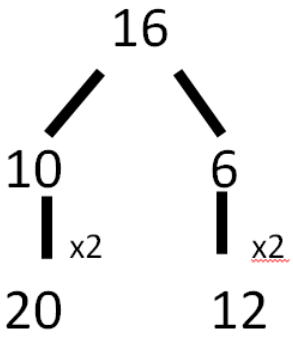
Year 6: Children use the methods of Year 5 : In Year 6 children should be able to further apply these methods to problem solving, and reasoning questions to embed their understanding and apply their method to other areas of the maths curriculum. Children should be very confident in the columnar method by Year 6, including two step problems involving any operation.

Multiplication

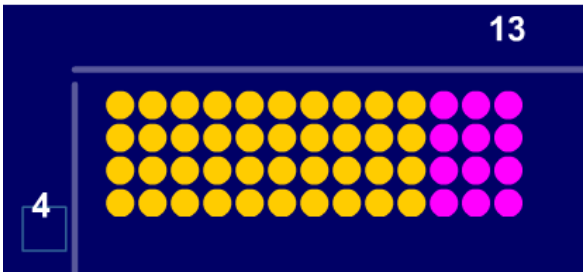
Year 3a - Continue mental mathematical knowledge of times tables and their inverse links using missing number problems (continuing throughout all Years with increasing difficulty):

7 x 2 =	= 2 x 7
7 x = 14	14 = x 7
x 2 = 14	14 = 2 x
x ◯ = 14	14 = x ◯

Year 3b - Partitioning of simple two digit x one digit numbers:



Year 3c – Developing written methods for TU X U using arrays in the grid method. Children can begin using counters and Dienes; progressing onto using dots on paper, eventually confident children using basic grid without the need for images.

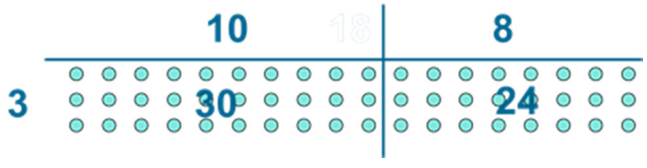


13 X 4 = 52

10 x 4 = 40

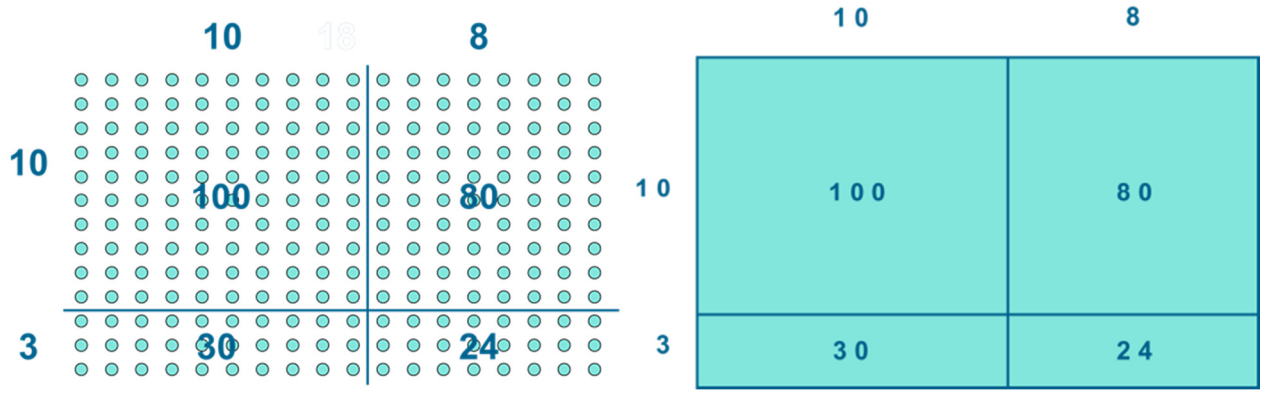
3 x 4 = 12

18 x 3 =



Developing onto:

Year 4a - Two digit by two digit multiplication, and three digit by one digit using a grid. Children to experiment with models of arrays in a grid and to then use the grid on paper without the use of an array:



Year 4b - Four digit by one digit multiplication using short multiplication:

342 × 7 becomes

	3	4	2
×			7
2	3	9	4
	2	1	

Answer: 2394

2741 × 6 becomes

	2	7	4	1
×				6
1	6	4	4	6
	4	2		

Answer: 16 446

Year 5 - Up to four digit by two digit multiplication using long multiplication (variation by children can be used freely in the positioning of the carrying):

124 × 26 becomes

	1	2	
	1	2	4
×		2	6
	7	4	4
2	4	8	0
3	2	2	4
1	1		

Answer: 3224

316 X 23 = 7268

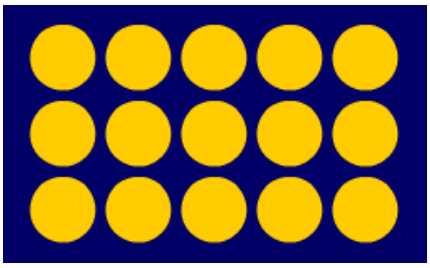
		3	1 6
×		2	3
		9	4 8
	6	3	2 0
	7	2	6 8

Year 6: Children use the methods of Year 5: In Year 6 children should be able to further apply these methods to problem solving, and reasoning questions to embed their understanding and apply their method to other areas of the maths curriculum. Children should be very confident in both short and long multiplication by Year 6, including two step problems involving any operation.

Division

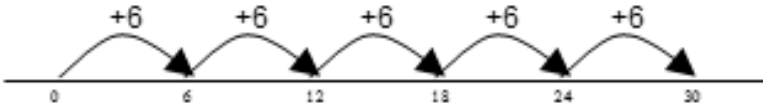
Year 3 - Arrays and Grouping:

15 ÷ 5 = 3 **15 ÷ 3 = 5**



Grouping:

How many 6's in 30? Grouping into sixes can be modelled as:

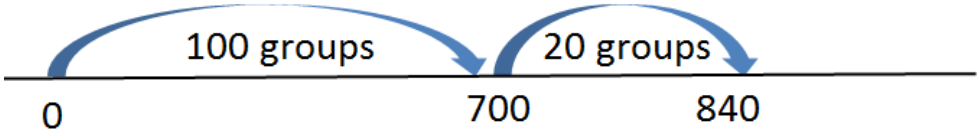


By the end of Year three children will be able to inverse times table facts to be able to confidently carry out division of 3,4 and 8's.

Year 4 – Using a number line with up to over 100 times the divisor:

e.g. 840 ÷ 7 = 120

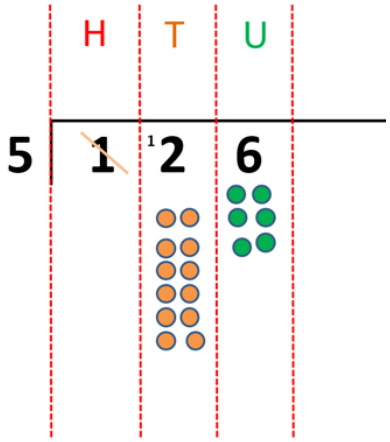
Jottings
7 x 100 = 700
7 x 10 = 70
7 x 20 = 140



Children will learn to solve division problems with and without remainders. Any remainder should be attempted to either be rounded up or down dependent upon the context of the word problem being solved. Children should be taught to be familiar with division worded problems as soon as fluent in the above method.

By the end of Year four children will be able to inverse times table facts up to 12 x 12.

Year 5 – Short division – initially using models, then moving onto standard written method:



98 ÷ 7 becomes

$$\begin{array}{r} 1\ 4 \\ 7\overline{)\,9\ 8} \\ \quad 2 \end{array}$$

Answer: 14

432 ÷ 5 becomes

$$\begin{array}{r} 8\ \ 6\ \ r\,2 \\ 5\overline{)\,4\ 3\ \ 2} \\ \quad\ \ 3 \end{array}$$

Answer: 86 remainder 2

At Year five children will learn to turn their remainder into a fraction of the divisor. Eg. In the above example 432 ÷ 5 = 86 remainder 2, children will turn the remainder into 2/5 (two fifths). Once again children will expand their experiences of division word problems and give contextualised thought to the meaning of the remainder.

Year 6 – Both short and long division dependent on the size of the calculation:

Children will continue to learn the short division method as shown in Year five. Also at Year six children will learn the long division method (below). Children will need to be taught to, and in turn, decide for themselves, which method to use depending on the number of digits in the divisor.

Dividing by one digit = short division.

Dividing by two or more digits = long division.

Long division:

432 ÷ 15 becomes

		2	8	r 12
1	5	4	3	2
		3	0	0
		1	3	2
		1	2	0
			1	2

(15 x 20)

(15 x 8)

432 ÷ 15 becomes

		2	8	
1	5	4	3	2
		3	0	0
		1	3	2
		1	2	0
			1	2

15×20

15×8

$\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$

Children will progress further than Year five by learning to change their fraction remainder into a decimal. The final example would change from 28 r 4/5, to instead become 28.8.

By the end of Year six, children will be confident in both long and short division and be able to apply their meothd to any multi step word problem, involving any other mathematical operation.