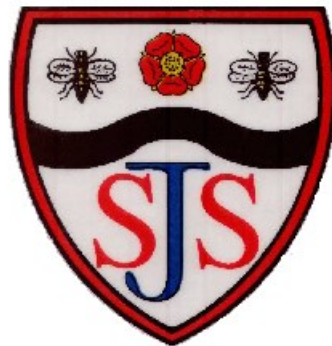


Shadsworth Junior School

Calculation Policy



The calculation policy has been written in line with the National Curriculum for Mathematics (2014). The aim of which is to help develop the three main aims of **Fluency, Reasoning and Problem Solving** underpinning the Mathematics Curriculum. It has been written to give children a logical progression of learning calculation when using the four operations. The document includes 'prior learning material of concrete resources, manipulatives and other models to help children learn new mathematical concepts.

The calculations policy is set out in accordance to age related expectations for each year group. However if children are not ready to move on then they ought to be taught at the stage they are currently working at as identified from teacher assessments.

It is important that calculations are given a real life context or problem solving approach to help children understand the purpose of calculation and when to use appropriate 'operations' and 'methods'.

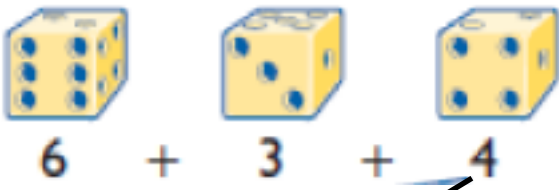
The aim of this policy is:

- to provide consistency and progression of the teaching of calculation across the school.
- to build on models and images to introduce and promote conceptual understanding for each year group.
- to provide guidance on the teaching of calculation skills for teaching staff, teaching assistants, parents and governors.

For problem solving we apply the **RUCSAC** approach as shown below:

Read the question **U**nderstand the question **C**hoose the operation
Solve the question **A**nsWER the question **C**heck the answer.

Addition - Prior Learning to Year 3



Encourage children to look for the number bond.

$$10 + 3 = 13$$

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

**36...46,
56, 66**

Use of a 100 square for adding in tens and ones

$$6 + 10 = 16$$

$$16 + 10 = 26$$

$$26 + 10 = 36$$

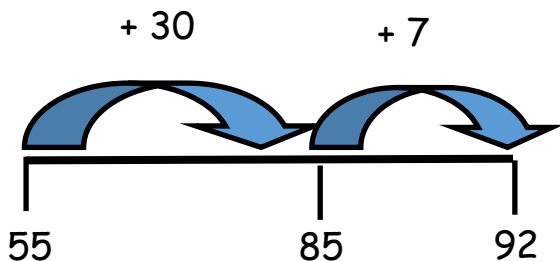
$$36 + 10 = 46$$

$$36 + 20 = 56$$

Using number lines

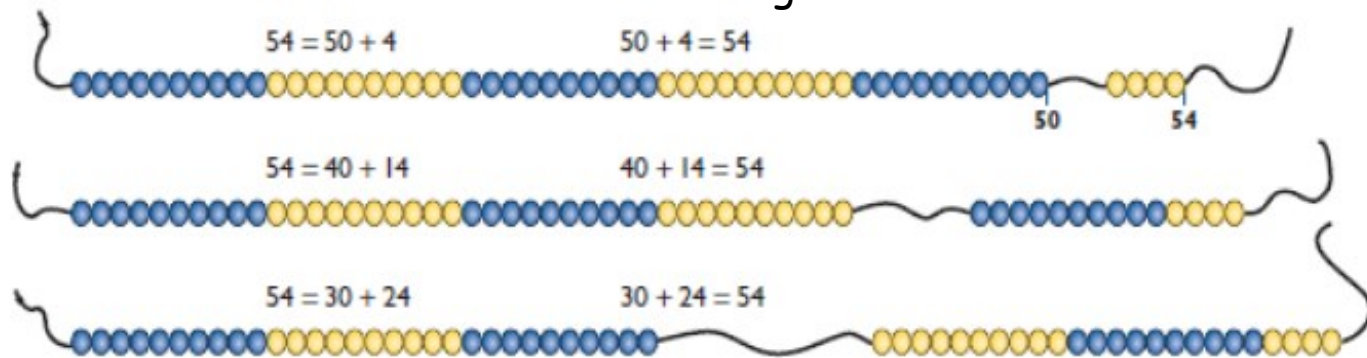
$$55 + 37$$

Estimate: $60 + 40 = 100$



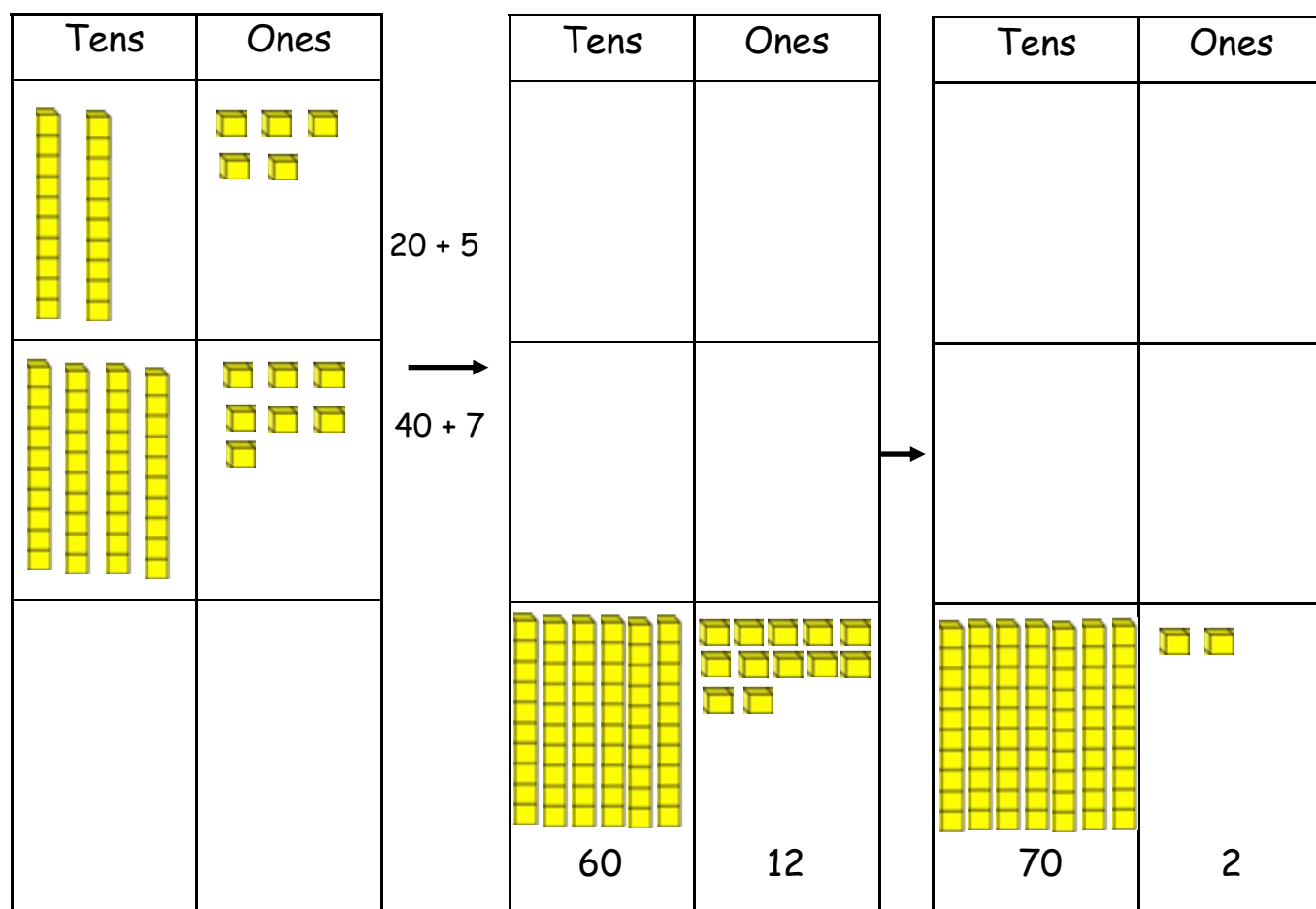
$$55 + 37 = 92$$

Addition - Prior Learning to Year 3



Children use the Tens and Ones chart to use Dienes apparatus vertically to prepare for column addition.

$$25 + 47 = 72$$



Recorded as :

$$20 + 5$$

$$\underline{40 + 7}$$

$$60 + 12 = 72$$

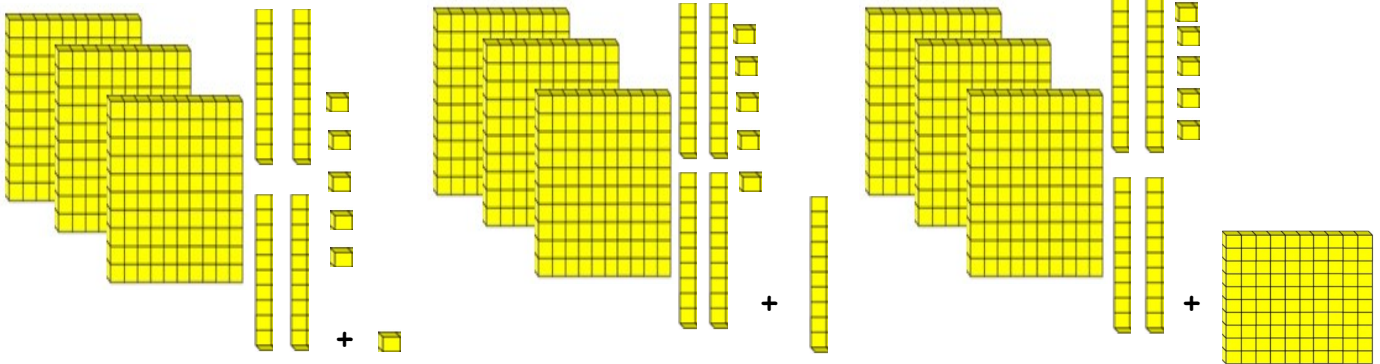
Addition Year 3

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

H T O + 1
3 4 5 + 1 = 346

H T O + 10
3 4 5 + 10 =

H T O + 100
3 4 5 + 100 = 455



Introduce the **expanded column addition** method:

	2	3	6
+		7	3
<hr/>			
			9
	1	0	0
	2	0	0
<hr/>			
	3	0	9

Add ones first, in preparation for the compact method

Move to the **compact column addition** method, with 'carrying':

236	Add ones first
<hr/>	
+ 73	
<hr/>	
309	
1	

'Carry' numbers
Underneath the
bottom line

Remind children the actual value is 'three tens and seven ones', not 'three add seven', which equals ten ones.

Addition Year 4

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

Column addition with up to 4 digit numbers:

Without carrying

$$247+127$$

Estimation: $250 + 100 = 350$

$$\begin{array}{r} 247 \\ + 122 \\ \hline 369 \end{array}$$

With 'carrying'

$$247+127$$

Estimation: $250 + 100 = 350$

$$\begin{array}{r} 247 \\ + 127 \\ \hline 374 \end{array}$$

Moving to 4 digits

	3	5	1	7	
+		3	9	6	
	3	9	1	3	

Add ones first

'Carry' numbers underneath the bottom line.

Reinforce correct place value by reminding the children the actual value is 1 ten and 9 tens, not 1 add 9 etc.

Use and apply this method in the context of money and measures as well

Addition Year 5

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

$$\begin{array}{r}
 \text{£ } 23.59 \\
 + \text{£ } 7.55 \\
 \hline
 \text{£ } 31.14
 \end{array}$$

Make sure the children align the decimal point - remember the decimal point does not move.

$$\begin{array}{r}
 19.01 \\
 3.65 \\
 + 0.70 \\
 \hline
 23.36
 \end{array}$$

Empty decimal places can be filled with zero to show the place value in each column.

Say '6 tenths add 7 tenths' to reinforce place value

Numbers should exceed 4 digits

$$\begin{array}{r}
 23,481 \\
 + 1,362 \\
 \hline
 24,843
 \end{array}$$

Use and apply this method in the context of money and measures as well

Addition Year 6

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

Adding numbers of increasing complexity:

$$23.261 + 9.08 + 1.3 =$$

Encourage estimation: $25 + 10 + 60 + 1 = 96$

	2	3	.	3	6	1
		9	.	0	8	0
	5	9	.	7	7	0
+		1	.	3	0	0
	<hr/>					
	9	3	.	5	1	1

Empty decimal places can be filled with zero to show the place value in each column.

Also adding several numbers with more than 4 digits

$$81,059 + 3688 + 15,301 + 20,551$$

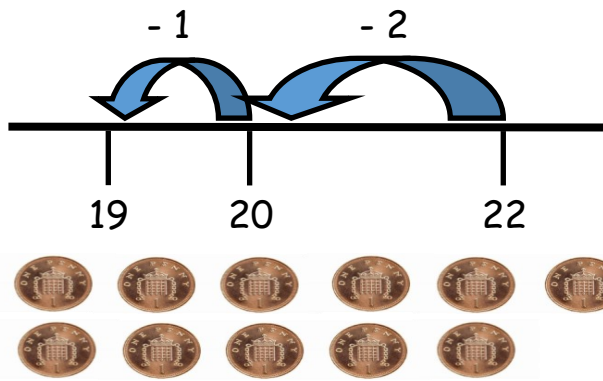
Estimation: $80,000 + 5000 + 15,000 + 20,000 = 120,000$

	8	1	,	0	5	9
		3	,	6	6	8
	1	5	,	3	0	1
+	2	0	,	5	5	1
	<hr/>					
1	2	0	,	5	7	9
	1	1		1	1	

Use and apply this method in the context of money and measures as well

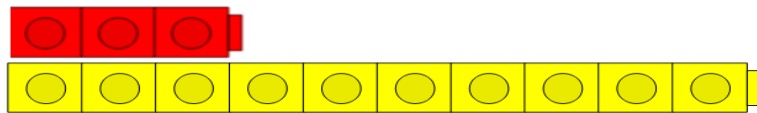
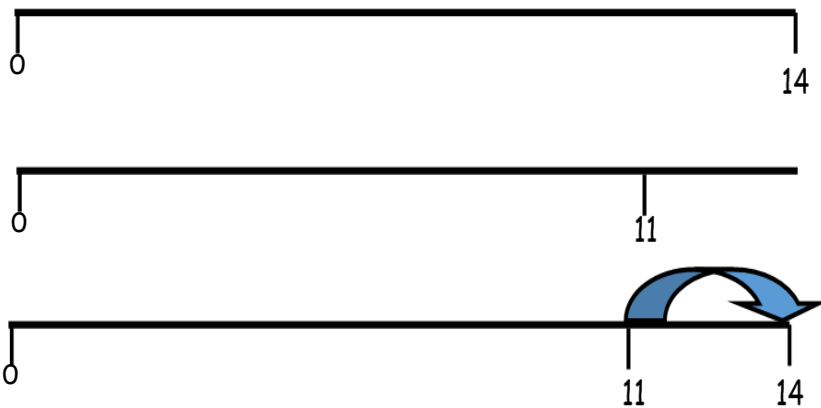
Subtraction - Prior Learning to Year 3

$$22 - 3$$



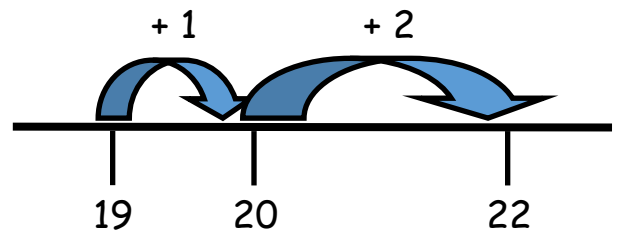
Which line has most money?

How much more?



The difference is ?

$$22 - 19 = 3$$



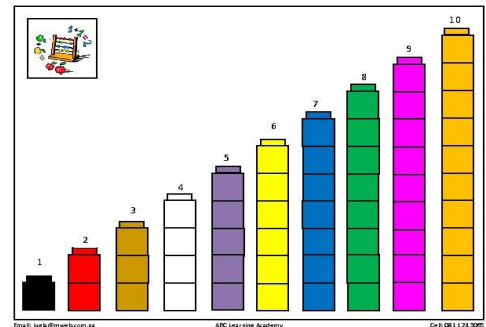
The difference

Between 11 and 13 is 3

$$14 - 11 = 3$$

$$11 + \square = 14$$

You could also use cubes to model this.



54p in the purse. Take 10p out , another 10p and so on...

54p
44p, 34p ...

Use and apply this method in the context of money and measures as well

Subtraction - Prior Learning to Year 3

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

**76...66,
56, 46**

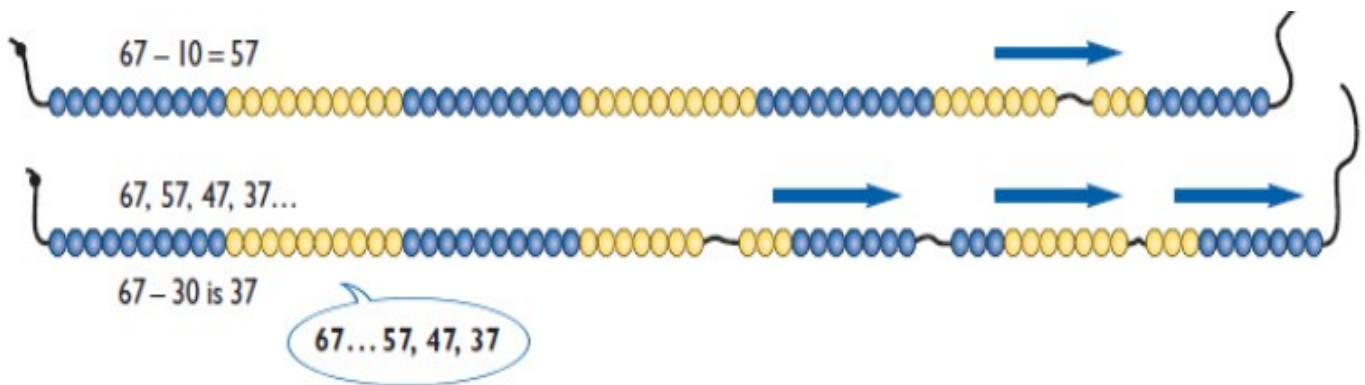
$$96 - 10 = 86$$

$$86 - 10 = 76$$

$$76 + 10 = 66$$

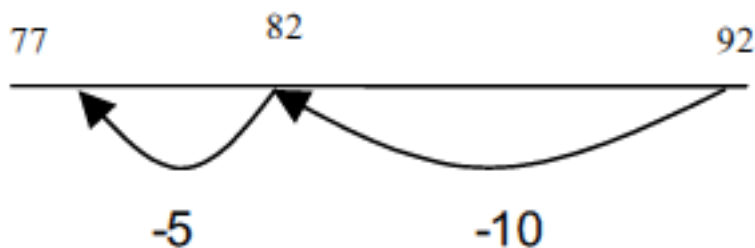
Etc.

$$76 - 30 = 46$$



Counting back (empty number line):

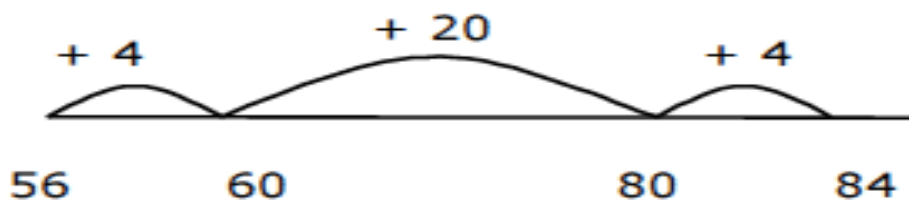
$$92 - 15 =$$



Finding the difference (counting on - empty number line)

$$84 - 56 = \square$$

$$56 + \square = 84$$



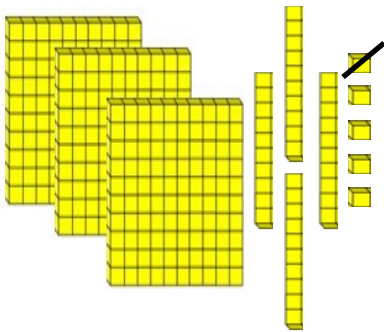
Subtraction Year 3

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (as prior learning)

Recap calculating using number lines (as prior learning) - counting on and back

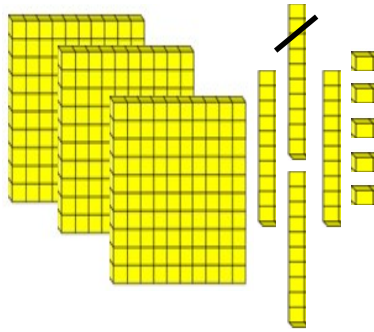
H T O + 1

3 4 5 - 1 = 344



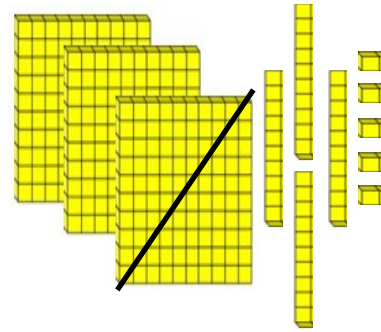
H T O + 1

3 4 5 - 10 = 335



H T O + 1

3 4 5 - 100 = 245



Subtracting with 2 and 3 - digit numbers

Introduce the partitioned column subtraction method.

89 - 35 = 54

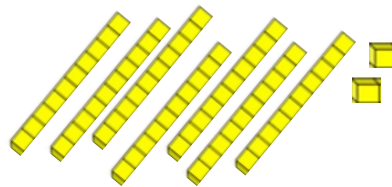
$$\begin{array}{r} 80 + 9 \\ - 30 + 5 \\ \hline 50 + 4 \end{array}$$

Introduce this method where no exchanges are required.

Then introduce exchanging - use Dienes rods to model.

$$\begin{array}{r} 60 \\ 70 + 2 \\ - 40 + 7 \\ \hline 20 + 5 = 25 \end{array}$$

72 - 47



When learning to exchange explore partitioning in different ways so that children understand that when you exchange the value is the same. e.g.

$72 = 70 + 2 = 60 + 12 = 50 + 22$ etc.

Emphasise that the value hasn't change , we have just partitioned it in a different way.

Once secure in exchanging move on to the partitioned column method to subtract any 2 and 3 digit numbers

2	3	8	-	1	4	6	=	9	2
$\begin{array}{r} 100 \\ 200 + 30 + 8 \\ - 100 + 40 + 6 \\ \hline 0 + 90 + 2 \end{array}$									

An exchange has been made because you can not subtract 40 from 30

Subtraction Year 4

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (as prior learning)

Subtract with up to 4 - digit numbers

Continue expanded subtraction method with up to 4 digit numbers.

Children begin to estimate their answers:

$$2754 - 1562$$

$$\text{Estimation } 2800 - 1500 = 1300$$

$$\begin{array}{r} 2754 - 1562 = 1192 \\ 2000 + \cancel{700} + 50 + 4 \\ - 1000 + 500 + 60 + 2 \\ \hline 1000 + 100 + 90 + 2 \end{array}$$

Move on to compact method if children are ready

$$\begin{array}{r} 2\overset{6}{\cancel{7}}54 \\ - 1562 \\ \hline 1192 \end{array}$$

Give plenty of opportunities to apply compact method to money and measures as well.

Subtraction Year 5

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

Subtract with at least 4-digit numbers

Continue with compact column subtraction with exchanging and using larger integers.

Children who are not secure with number facts and place value will need to remain on the partitioned column method until ready for the compact method.

Encourage children to estimate their answers first.

$$2754 - 1562 =$$

$$\text{Estimate } 2800 - 1500 = 1300$$

	2	7 ⁶	5	4
-	1	5	6	2
	1	1	9	2

$$31056 - 2128 =$$

$$\text{Estimate } 31000 - 2000 = 29000$$

	3 ²	1 ⁰	0	5 ⁴	6
-		2	1	2	8
	2	8	9	2	8

Move on to decimals using decomposition method - encourage children to estimate first. $7169 - 372.5$

$$\text{Estimation } 7000 - 400 = 6600$$

	7 ⁶	1 ⁰	6	9 ⁸	.	0
-		3	7	2	.	5
	6	7	9	6	.	5

Give plenty of opportunities to apply compact method to money and measures as well.

Subtraction Year 6

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

Subtracting with increasingly large and more complex numbers and decimal Values.

$$\begin{array}{r} \cancel{9} \cancel{8} \cancel{0}, 699 \\ - 89,949 \\ \hline 60,750 \end{array}$$

Using the compact column method to subtract more complex integers.

$$\begin{array}{r} \cancel{9} \cancel{0} 5 \cdot \cancel{4} 19 \text{ kg} \\ - 36 \cdot 080 \text{ kg} \\ \hline 69 \cdot 339 \text{ kg} \end{array}$$

Using the compact column method to subtract money and measure, including decimals with different numbers of decimal places.

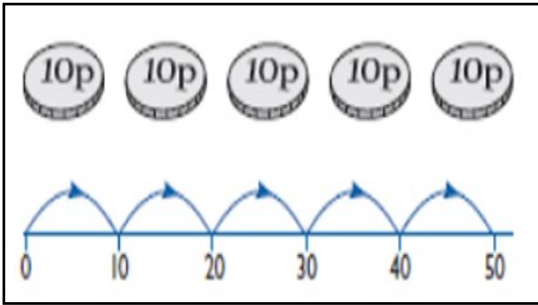
Empty decimal places can be filled with zero to show the place value in each column.

Children should be able to apply their knowledge of a range of mental strategies, mental recall skills, and informal and formal written methods when selecting the most appropriate method to work out subtraction problems

Give plenty of opportunities to apply compact method to money and measures as well.

Multiplication - Prior Learning to Year 3

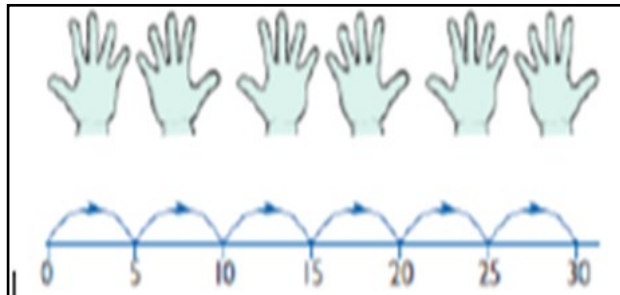
To build on models and images to promote conceptual understanding.



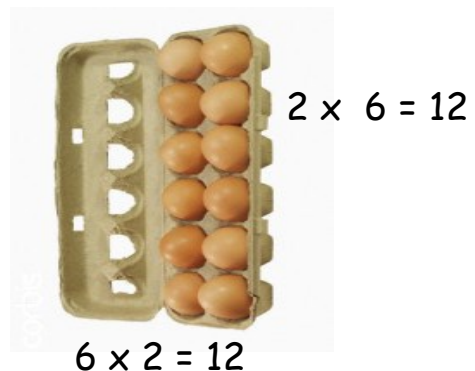
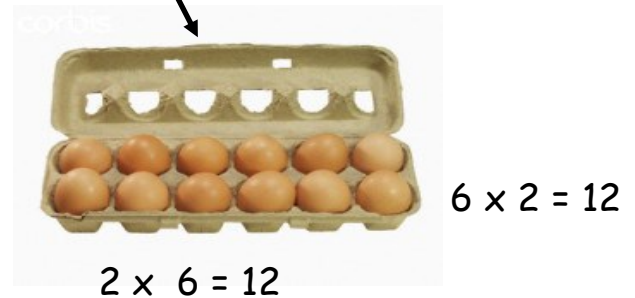
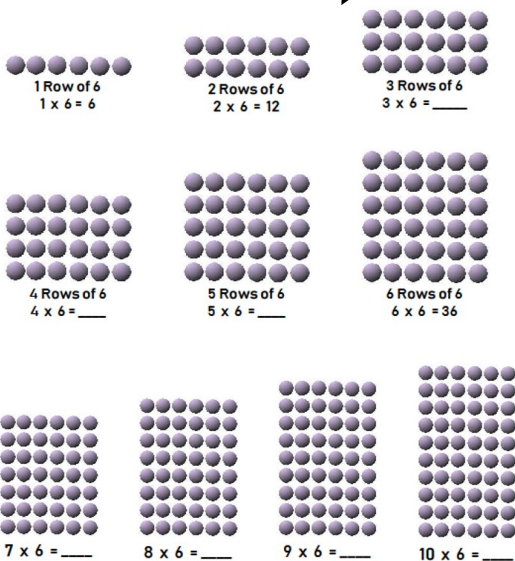
$$10p + 10p + 10p + 10p + 10p = 50p$$

$$10p \times 5 = 50p$$

5 hops of 10

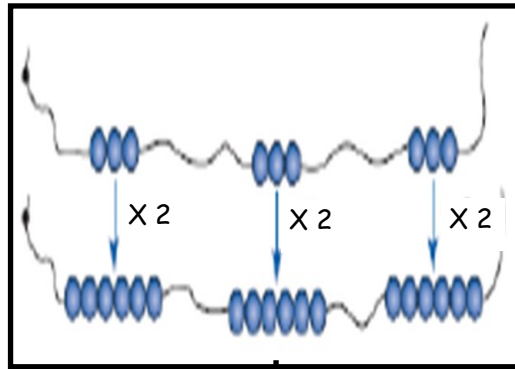


Use arrays to show commutative Property of multiplication



Multiplication - Prior Learning to Year 3

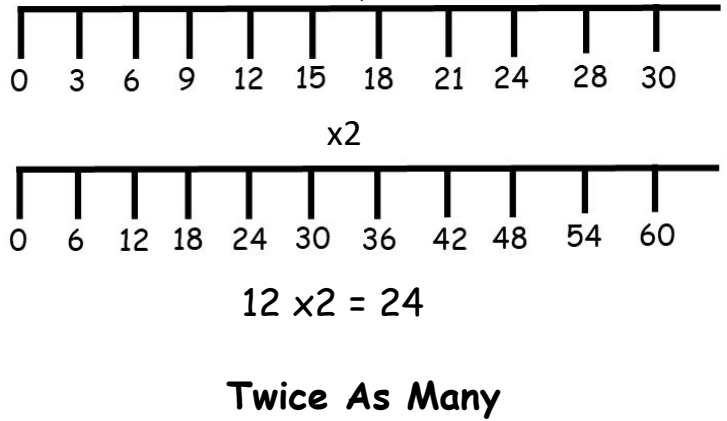
To build on models and images to promote conceptual understanding.



Relate multiplication to scaling

A diagram showing a stack of four colored blocks (blue, green, red, yellow) on the left. A blue arrow points to a taller stack of eight colored blocks on the right. Below the stacks, the text reads: "Double 4 is 8" and "4 x 4 = 8".

Double 4 is 8
 $4 \times 4 = 8$



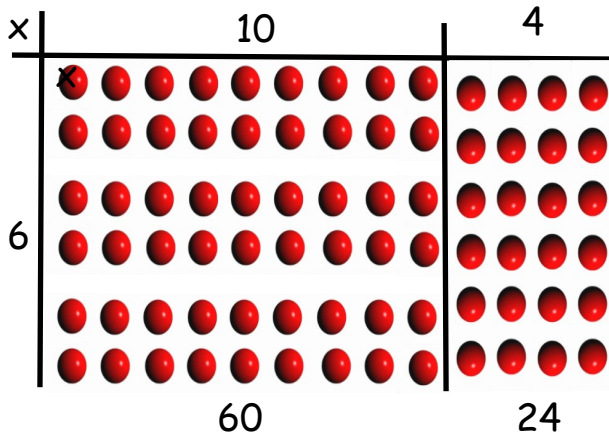
Multiplication Year 3

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

Build on children's learning of arrays to introduce the 'Grid Method'

$$14 \times 6$$

$$\text{Estimation: } 10 \times 6 = 60$$

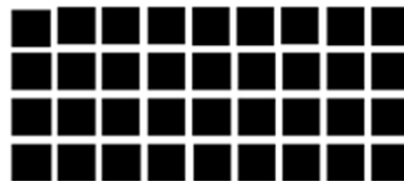
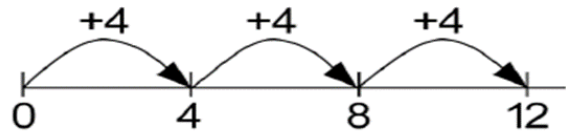


x	10	4
6	60	24

Skills children need to do:

- Partition numbers into tens and units
- Children use existing knowledge to find related facts in the 2,3,4,5,8 and 10 tables
- Working out near doubles and adjusting, using doubling etc. (taught mental strategies)

Strategies to support this are repeated addition using a number line, arrays and bead bars



$$9 \times 4 = 36$$



$$7 \times 3 = 21 \text{ or } 7 + 7 + 7 = 21$$

Multiplication Year 4

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

Multiply 2 and 3 - digits by a single digit (using all multiplication tables up to 12×12)

Develop the grid method:

$$3 \times 156 = 468$$

$$\text{Estimation: } 3 \times 160 = 480$$

x	100	50	6
3	300	150	18

$$\begin{array}{r} 300 \\ 150 \\ + 18 \\ \hline 468 \end{array}$$

Encourage column addition to add accurately

Move onto short multiplication if and when children are confident and accurate multiplying 2 and - 3 digit numbers by a single digit.

Children should estimate before they calculate and use their estimation to check the reasonableness of their answer.

Children should be able to :

- Estimate
- Multiply multiples of 10 and 100 by a single digit
- Recall all times tables up to 12×12

Multiplication Year 5

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

Multiply up to 4 - digits by 1 or 2 digits

Introduce column multiplication:

Use the grid method to lead on to short multiplication - children need to see how the steps are related and why it is efficient e.g. there are less steps involved in column multiplication.

Short multiplication for multiplying by a single digit

x	300	20	7
4	1200	80	28



$327 \times 4 =$
Estimation: $300 \times 4 = 1200$

	3	2	7
x			4
<hr/>			
	1	3	0
		1	2

Introduce long multiplication for multiplying by 2 digits

$18 \times 13 =$
Estimation: $20 \times 10 = 200$

x	10	8
10	100	80
3	30	24

From
Grid
→
To
Formal

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

18 x 3 on the first row
(8 x 3 = 24. carrying the 2 for 20, then 1 x 3)

18 x 10 on the 2nd row.
Put a 0 in the ones first.
Then say 1 x 8, and 1 x 1.
Add to find the total.

Multiplication Year 5

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

Multiply up to 4 - digits by 1 or 2 digits

Moving towards more complex numbers :

$$\begin{array}{r} 3652 \\ \times \quad 8 \\ \hline 29216 \\ 54' \end{array}$$

$$\begin{array}{r} 1234 \\ \times \quad 16 \\ \hline 7404 \quad (1234 \times 6) \\ 12340 \quad (1234 \times 10) \\ \hline 19744 \end{array}$$

Multiplication Year 6

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

As year 5 but then moving on to decimals with up to 2d.p. by a single digit.

$$3.19 \times 8 =$$

$$\text{Estimation: } 3 \times 8 = 24$$

Remind the children
That the single digit
Belongs in the ones
Column.

	3	.	1	9
x	8			
<hr/>				
2	5	.	5	2
<hr/>				
	1		7	

Line up the decimal
Points in the question
and the answer

Use and apply this method for
multiplying money and other measures.

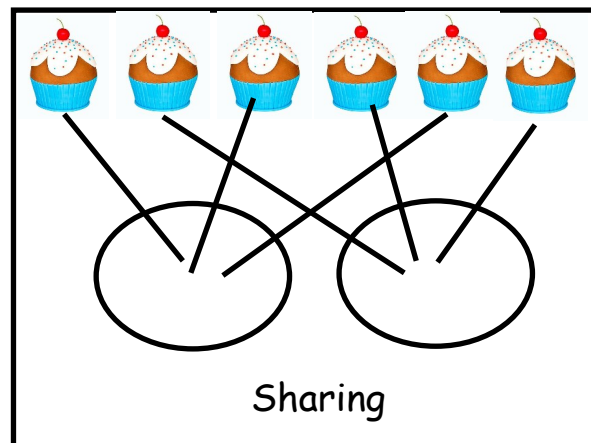
Division - Prior Learning to Year 3

To build on models and images to promote conceptual understanding.

Know the difference between grouping and sharing

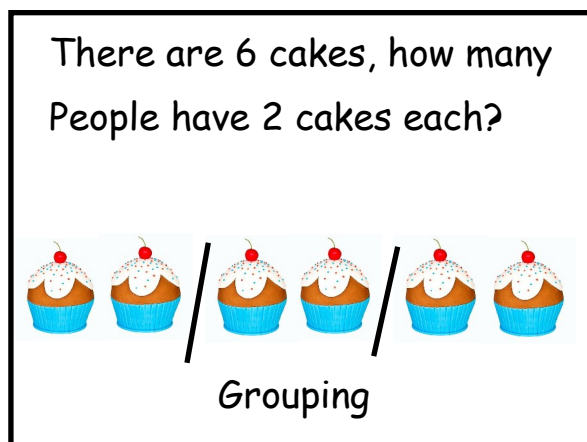
Sharing

Sharing - share these cakes between 2 people



6 cakes shared between 2 people,
how much do they get each?

Grouping

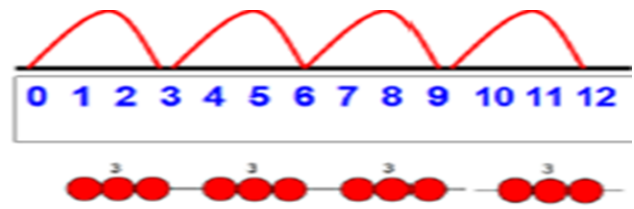


There are 6 cakes, how many peo-
ple can have 2 cakes each?

Division - Prior Learning to Year 3

Grouping using a number line

Children to see the link between multiplication and division and begin to re-call division facts



$$12 \div 3 = 4$$

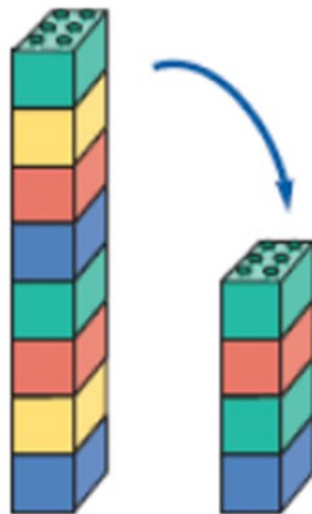
Ask the question:

"How many groups of 3 are in 12?"

or

"A CD costs £3. How many CDs can I buy with £12?" (Problem Solving)

Children understand that halving means "divided by 2"



half of 8 is 4

$$8 \div 2 = 4$$

Children should be taught to recognise whether problems require 'sharing' and 'grouping'

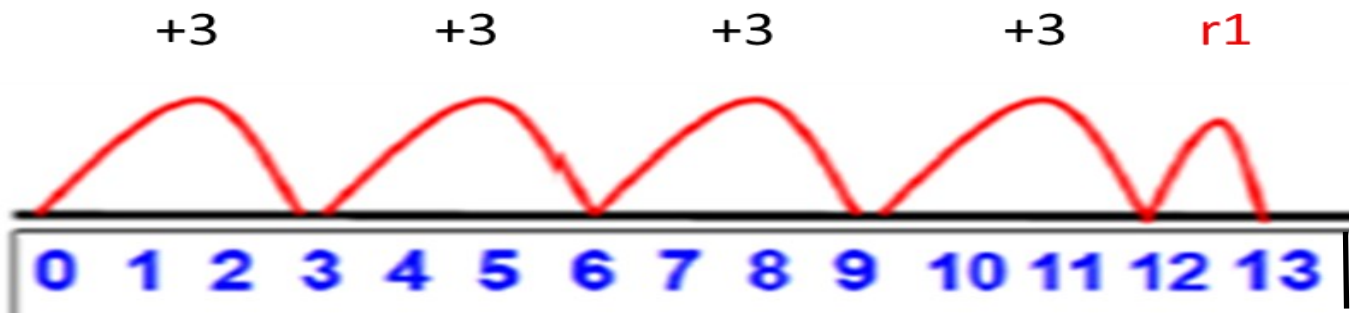
Division Year 3

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

Divide 2- digit numbers by a sing digit starting with no remainders and then moving onto remainders.

Step 1

Children continue to work out unknown division facts by grouping on a number line from zero. They are also now taught the concept of **remainders** - this should be introduced practically using arrays and number lines.



Step 2

Once children are secure with division as grouping and demonstrate this using number lines, arrays etc.

short division for larger 2-digit numbers should be introduced but without remainders.

$$\begin{array}{r} 32 \\ 3 \overline{)96} \end{array}$$

Remind children of correct place value, that 96

is equal to 90 and 6, but in short division, pose:

How many 3's in 9? = 3, and record it above the **9 tens**.

How many 3's in 6? = 2, and record it above the **6 ones**

(each digit must be a multiple of the divisor).

Division Year 3

Children continue to learn from concrete resources and other models and images to develop conceptual understanding
(see prior learning)

Divide 2- digit numbers by a single digit starting with no remainders and then moving onto remainders.

Step 3

Once children demonstrate a full understanding of remainders, and also the short division method taught, they can be taught how to use the method when remainders occur within the calculation (e.g. $96 \div 4$), and be taught to 'carry' the remainder onto the next digit.

$$\begin{array}{r} 24 \\ 4 \overline{) 96} \\ \underline{8} \\ 16 \\ \underline{16} \\ 0 \end{array}$$

This should only be taught when children can calculate remainders.

Division Year 4

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

**Divide up to 3-digit numbers by a single digit
(without remainders initially)**

Children continue with the short division method—without remainders initially. Once children have secured the skill of remainders move onto dividing numbers with up to 3-digits by a single digit

$$\begin{array}{r} 218 \\ 4 \overline{) 872} \end{array}$$

Note - the final answer does not need to have a remainder at this stage, the remainder can be within the calculation

$$\begin{array}{r} 037 \\ 5 \overline{) 185} \end{array}$$

Note - when the answer for the first column is zero ($1 \div 5$) children could initially write a zero above as a place holder and must always 'carry' (1) over to the next digit as a remainder.

**Include money, measure and real life contexts
when children are confident**

Division Year 5

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

Divide up to 4-digit numbers by a single digit including those with remainders

$$\begin{array}{r} 663 \text{ r } 5 \\ 8 \overline{) 5309} \end{array}$$

The answer to $5309 \div 8$ could be expressed as:

- 663 and five eighths
- 663 r 5
- 660 rounded etc.

Division needs to have a real life problem solving context, where pupils consider the meaning of the remainder and how to express it, ie, as a fraction, a decimal, or as a rounded number or value, depending on the context of the problem.

Include money, measure and real life contexts when children are confident

Division Year 6

Children continue to learn from concrete resources and other models and images to develop conceptual understanding (see prior learning)

Divide up to 4-digit numbers by both a single digit and a 2 - digit number (including decimal numbers and quantities)

$$\begin{array}{r} 0812.125 \\ 8 \overline{)6497.000} \end{array}$$

When calculating a decimal remainder a decimal point is added after the units because there is still a remainder and that remainder is carried onto zeros after the decimal point - keep dividing to an appropriate degree of accuracy for the problem being solved.

Introduce long division to those children who are ready.

$$\begin{array}{r} 27 \\ 36 \overline{)972} \\ \underline{-720} \\ 252 \\ \underline{-252} \\ 000 \end{array}$$

Zero is added as a place holder