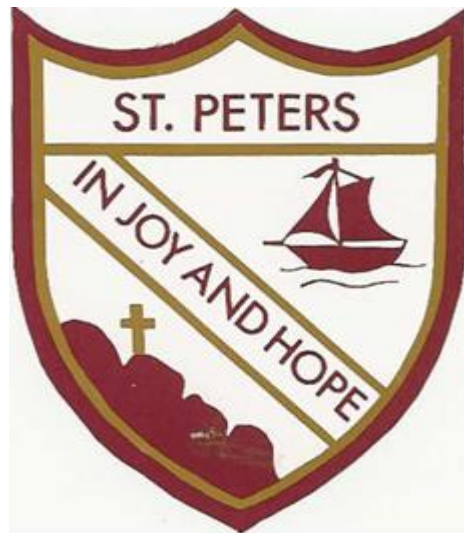# St Peter's Catholic Primary School

Mathematics Calculation Policy

Agreed by Governors: November 2017

Chair of Governor_____

St Peter' Catholic Primary School
Maths Calculation Policy

This policy has been written in response to the New National Curriculum September 2014, and aims to ensure consistency in the mathematical written methods and approaches to calculation across years 1-6.

"Children learn about calculation through solving problems, rather than solving problems after learning to calculate."
"Children are introduced to the processes of calculation through practical, oral and mental activities."

Over time children will learn how to use models and images, such as empty number lines, to support their mental and informal written methods of calculation
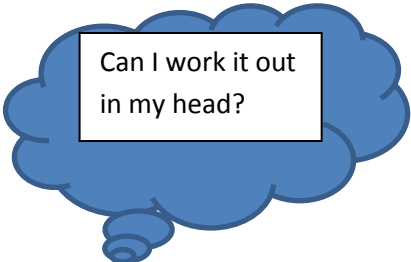
Our aim is that children leave us equipped with mental, written and calculator methods they understand and can use correctly and that when faced with a calculation, they are able to decide which method is most appropriate and have strategies to give an approximate answer and to check their solutions.

This policy indicates the progression and variety of practical and written methods within each of the four operations. C*hildren will work at the stage appropriate to their understanding*. All methods will be used across a range of contexts e.g. money, measures, time etc and will be applied to decimals as appropriate. It is important that children use the many different models.
This policy also outlines the key **vocabulary** to be used and introduced at each stage to ensure opportunities for children to develop quality mathematical dialogue.
The needs of Foundation Stage will be met through Development Matters and Early Learning Goals. The document is organised according to age related expectation, however it may be necessary for teachers to consult with lower year groups for children in order to meet their needs at the stage these children are working at.
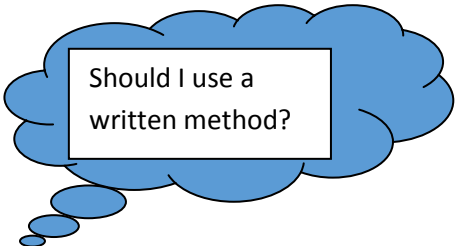
Whilst the New Curriculum for September 2014 does not feature Using and Applying, it is important, wherever possible, for teachers to create real life contexts for learning in mathematics. As part of a child's learning in calculation, they need to be taught how to select the best method according to the numbers. The hierarchy of thinking should be:

Can I work it out in my head?

Can I use some jottings to help me?

Should I use a written method?

THE STATUTORY REQUIREMENTS:

"Early learning goal – numbers:
 Children count reliably with numbers from one to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer. They solve problems, including doubling, halving and sharing."

The National Curriculum framework shows progression in the 4 rules of number and is, generally, quite explicit at stating during which year certain concepts and skills should be taught. There are, however, gaps and this policy has tried to address this and provide staff with more guidance.

MODELS AND IMAGES:

Key to the successful implementation of a School Calculation Policy is the **consistent use of representation** (models and images that support conceptual understanding of the mathematical issues) and this policy promotes a range of relevant representations, across the Primary years. Mathematical understanding is developed through use of representations that are first of all concrete (e.g. Numicon, Dienes apparatus, place value counters), and then pictorial (e.g. Array, number lines) to then facilitate abstract working (e.g. Columnar addition, long multiplication).
It is considered **good practice to demonstrate and allow children to practice each and every step physically** using the apparatus and models listed below, regardless of ability and year group. It is equally important to put calculations into **context** and for children to explore calculation in order to gain **mastery**.

Number lines –

Because the concept is so simple, number lines can pretty much take any shape you like to help a child visualise the problem in a slightly different way. For example, they can extend vertically and are called number ladders. Number lines are an invaluable tool all the way through a child's time at primary school. It is important to get children in the habit of thinking about whether drawing their own number line will help them to solve a problem.
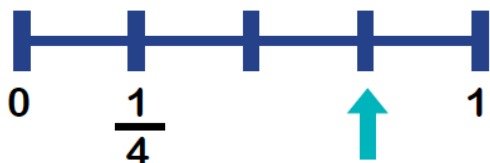
Initially, number lines should feature numbered intervals, but then children should be given blank number lines to allow greater freedom and to demonstrate depth of understanding.

There are many ways to travel along a number line – some more complicated than another – all methods will be taught and children will use method they are happiest with. They should first be used in Year 1, but are also useful in other years as shown below:

In Year 4, children start to use a **number line** to understand the concept of **negative numbers**:

From Years 4 to 6, children would need to place decimal numbers and fractions onto a number line. For example, they may be asked to write what fraction this arrow is pointing at:

They may also be asked to write what decimal this arrow is pointing at:

Number scales/balances – allows children to see totals and number facts. (also coat hanger and pegs)
100 squares – allows children to count on/back and also recognise patterns in repeated addition/multiplication.
Multiplication square – supports rote learning.
Numicon – number recognition, addition, subtraction, doubling, multiplication
Arrow cards – useful for bridging and for x/÷ by 10, 100 etc. also for understanding of place value concepts
Arrays – used to show groupings of items -ideal for early multiplication.
10 boards – allows bridging ten - 9 + 7 = 9 + 1 + 6 = 10 + 6 = 16
Bead Strings – all 4 rules
Bundles of straws – ideal to make 10
Triangles – 2 corners add up to the third (also 1 less 1 gives the third)
2 corners multiplied together give third corner (also inverse – division)
Missing number boards – ideal to show : 3 + 2 = ?….. 3 + ? = 5
Bar models:

5		
2	3	
3		2

ADDITION

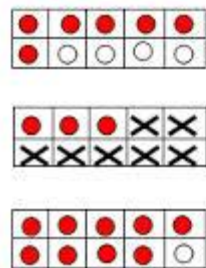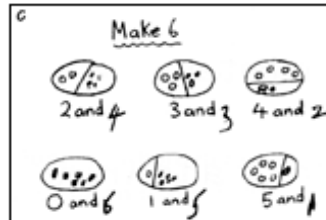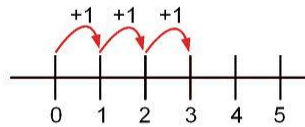| Early Mathematical development	
Mental skills	Written strategies
Counting on in ones from different starting points up to 10	Children are encouraged to develop a mental picture of the number system in their heads to use for calculation through access to a wide range of counting equipment, everyday objects, hoops, sorting trays and number tracks. Discuss – 1 more, 1 less. Recognise numbers 0 to 10 0 1 2 3 4 5 6 7 8 9 10 1, 2, 3, 4, 5, 6 … there are 6 teddies Count reliably up to 10 everyday objects
YEAR 1	
Mental skills	Written strategies

Counting on in ones from different starting points	Children will begin to use numbered lines to support their own calculations using a numbered line to count on in ones.
Recall all pairs of numbers with a total of 20.	They will then begin to use methods other that counting in ones.
Say the number that is 1 more that any given number to 20.	

Children will begin to use numbered lines to support their own calculations using a numbered line to count on in ones.
They will then begin to use methods other that counting in ones.

Begin to relate addition to combining two groups of objects
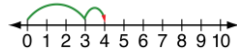
and makes 5

+1 +1 +1

0 1 2 3 4 5

Make 6

2 and 4   3 and 3   4 and 2

0 and 6   1 and 5   5 and 1

Name _____

4 + 2 = ☐

3 + 1 = ☐

8 + 2 = ☐

2 + 1 = ☐

$10 - 7 = 3$

$9 + 1 = 10$

$6 + 4 = 10$

3 + 1 = **4**

0 1 2 3 4 5 6 7 8 9 10

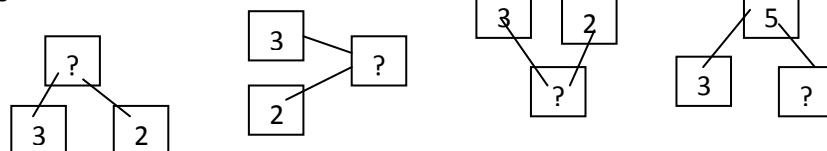Begin to compare for commutative sums e.g. 3+7 = 7 + 3

Read and write number sentences using the = and + signs
Interpret number sentences including missing number problems
eg. 3 + ☐ = 8

?

3   2

3

2

?

3   2

?

5

3

?

3	2
?	

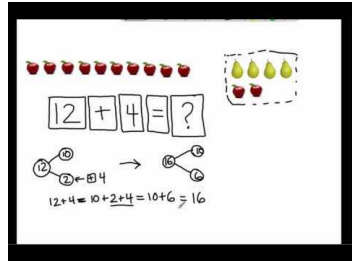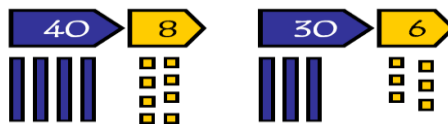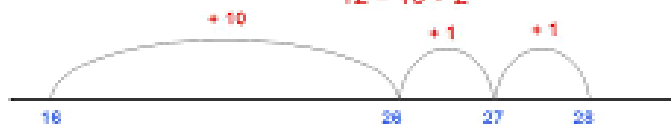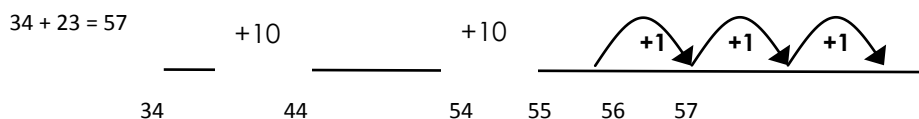| YEAR 2	
Mental skills	Written strategies
Recall addition facts for each number to 20. Add ten to a multiple of ten Begin to use number facts to 10 and knowledge of place value to add multiples of 10. e.g 7+3= 10, 70+30=100 Be able to +9 / +11 to a given number by adding 10 then compensating Add a 1 digit number to any 2 digit number mentally Use partitioning and recombining. Doubles and near doubles.	Use numicon, dienes, cubes etc to show how to make a ten when adding across $12 + 4 = 10 + 2 + 4 = 10 + 6 = 16$ (*PARTITIONING*) **Adding 2-digit and 1-digit number.** Use numberlines, numicon, 100 squares to add 3 single digit numbers and recognize that addition is **commutative** – $9 + 4 + 1 = 9 + 1 + 4 = 10 + 4 = 14$ Use 100 squares and numicon and dienes and Cuisenaire to demonstrate **adding values of 10:** $12 + 10 = 22$…….. $35 + 10 = 45$ Use numicon, rod method, numberlines to solve missing number problems. <table><tr><td>3</td><td rowspan="2">????????</td></tr><tr><td>5</td></tr></table> Partitioning – adding **two 2-digit numbers** Introduce models and images to support the partitioning of numbers (Dienes apparatus / arrow cards…)

The Four Operations

Addition – Partitioning for 2 digit + 2 digit

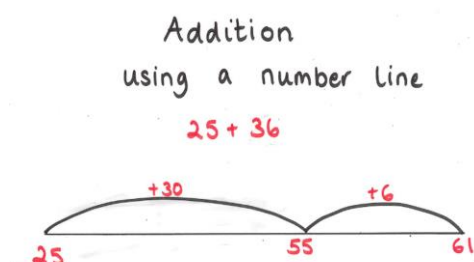-Number Line/Ruler   16 + 12 =
-2nd digit is partitioned   12 is partitioned into T + U
                             12 = 10 + 2

+ 10   + 1   + 1

16   26   27   28

Use numberline and/or Numicom.

34 + 23 = 57   +10   +10   +1 +1 +1

34   44   54   55 56 57

Followed by adding the tens in one jump and the units in one jump.

Addition
using a number line
25 + 36

+30   +6

25   55   61

Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.
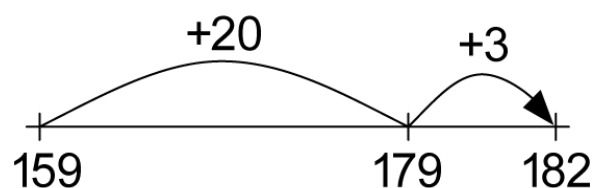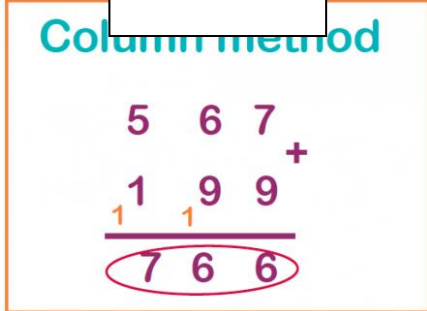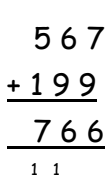
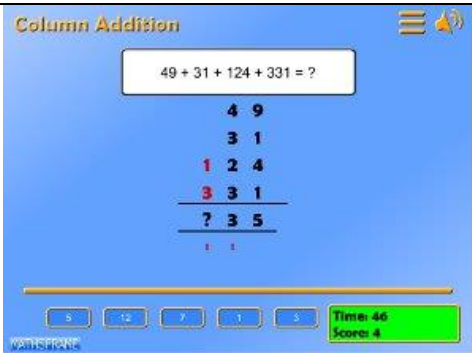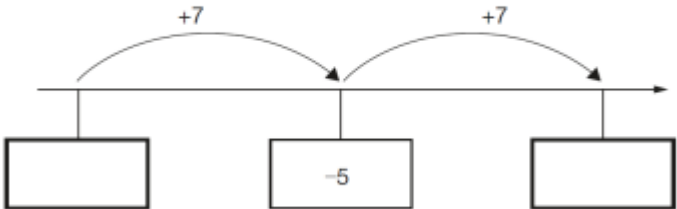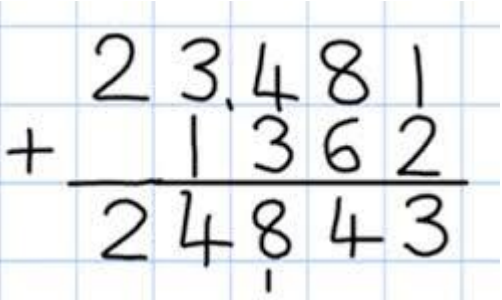| YEAR 3	
Mental skills	Written strategies – formal 1st introduced
Use mental recall of addition and subtraction facts to +/- 3d with 1, 10, 100. Use inverses to find missing whole numbers such as 'I think of a number I take 5 away from it. The answer is 35. What is my number?	Add 3-digit number and 2-digit number – eg by numberline partitioning +1 +1 +1 +20 +3 159 179 182

Use compensation to add numbers mentally eg. 49 → +50 − 1
 	
Add two 2-digit numbers mentally by partitioning eg.
40 + 20 = 60
   5 + 3 = 8
          = 68
	Year 3 - Addition
	Written methods
	
	Using place value and number facts to split 1-digit numbers.
	
	176 + 8 = 184
	since 176 + 4 = 180 and 8 = 4+4
	
	   +4 +4
	176 180 184

This next step of partitioning mirrors the column method –
Add 3-digit number to 3=-digit number:

45 + 23 =
 40 + 5
 20 + 3
 60 + 8
   68
	345 + 132 =
	300 + 40 + 5
	100 + 30 + 2
	400 + 70 + 7
	   477
		255 + 366 =
		200 + 50 + 5
		300 + 60 + 6
		500 + 110 + 11 = 621
		Bridging

DISCOUNTED

Column method

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

Column method

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

AGREED

Placement of 'carry'

YEAR 4

Mental skills	Written strategies

Estimate and use inverse operations.	Add (subtract) with up to 4 digits. **Columnar method.**
	
	This strategy would be used with decimals and across a range of contexts.
	
	Children will then move to record as follows ;
	
	  2604
	+ 137
	  2000
	   700
	    30
	    11
	  2741
	
	  2604.13
	+ 137.28
	  2000.00
	   700.00
	    30.00
	    11.00
	     0.30
	     0.11
	  2741.41

Column Addition

49 + 31 + 124 + 331 = ?

```
    4 9
    3 1
  1 2 4
  3 3 1
  _____
  ? 3 5
```

Time: 46
Score: 4

YEAR 5	

Mental skills	Written strategies
Add and subtract numbers mentally with increasingly large numbers. Use rounding to check answers.	The expanded method leads children into the more compact method *so that they understand its structure and efficiency.* Introduction of negative numbers allows number lines to be re-introduced and used by children. Here is part of a number line. Write the missing numbers in the boxes. Adding numbers with more than 4-digits. Simple and more complicated.

YEAR 6	

Mental skills	Written strategies
	All of the above.

VOCABULARY

EARLY YEARS	Count to Count on One more Add More And Make Sum Total Altogether number sentence
YEAR 1	Equal to One more Plus Add + More Many Addition Plus number line more than
	add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, „carry", expanded, compact,
YEAR 2	10/100 boundary Increase Inverse tens, units/ones
YEAR 3	Partition addition column tens boundary increase vertical carry expanded compact
YEAR 4+	thousands hundreds digits inverse decimal places decimal point tenths, hundredths thousandths

SUBTRACTION

Early Mathematical development	
Mental skills	Written strategies
Counting backwards from different starting points with numbers up to 10	Children are encouraged to develop a 'mental picture' of the number system, models will be used by the teacher to demonstrate what happens as the children count back within number rhymes an d stories…. ONE LESS
YEAR 1	
Mental skills	Written strategies

Say the number that is 1 less that any given number up to 20	Children will develop an understanding of the subtraction sign through appropriate contexts.
	They understand subtraction as **'taking away' from a set** and **counting back.**
Use number facts to 20	They will develop ways of recording calculations using pictures, number lines etc

Begin to relate subtraction to ' taking away '

Three teddies take away two teddies leaves one teddy

b
my shepherd looks after 8 sheep he has lost 5 now he has 3 left

Begin to use the − and = signs to record mental calculations in a number sentence

Maria had six sweets and she ate four. How many did she have left?

6 − 4 = 2

Children will use <u>numbered</u> number lines and practical resources to support calculation and **teachers will** *demonstrate* **the use of the number line.**

If I take away four shells there are six left

Count backwards along a number line to ' take away

0 1 2 3 4 5 6 7 8 9 10

Children will record their 'jumps' back on the top of the number line

---

YEAR 2

Mental skills	Written strategies

| Recall subtraction facts for each number to 20 eg 20 − 8, 18 - 9 18-13 5 + □ = 10 etc

 Count back in multiples of 10 from a multiple of 10

 Recognise…
 20-7 = 3
 60-7 = 53
 60 − 17 = 43 | **Children will be introduced to finding the difference by counting on using practical models and images**

 The difference between 11 and 14 is 3.
 14 − 11 = 3
 11 + □ = 14

 The difference is?

 0 ... 14
 0 ... 11
 0 ... 11 ... 14

 Begin to find the difference by counting up from the smallest number

 2-digit subtract 2-digit

 Subtraction <br> using a number line and counting back

 92 − 7

 92 91 90 89 88 87 86 85

 92 − 7 = 85 |

47 - 19 =

9 jumps back   10 jumps back

28   29 30 31 32 33 34 35 36 37   47

47 - 19 = 28

87 – 34 = 53

.   could be done … 87 – 10 – 10 – 10 – 1 – 1 – 1 – 1

– 1 – 1 – 1 – 1   – 10   – 10   – 10

53   57   67   77   **87**

answer   start

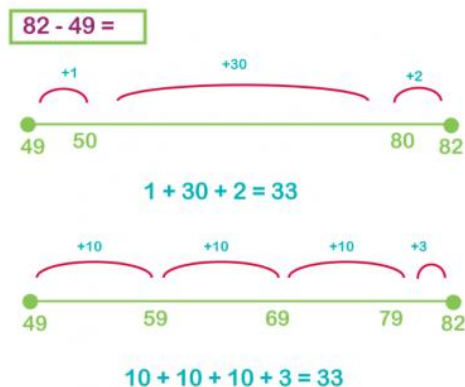17   22   42

-5   -20

DISCOUNTED
MUST TRAVEL ON TOP OF
THE LINE.

COUNT BACK 25… **above** the line:
– 20 rather than -10 then -10

Children are often taught subtraction using a number line method called 'complementary addition' (the jump strategy). This method makes it very clear that subtraction means finding the difference between a smaller number and a bigger number.

To use a number line to subtract with the jump strategy, put the small number on the left hand side and then the big number on the right hand side, then jump from one number to another and count up all the jumps at the end:

82 - 49 =

+1   +30   +2

49   50   80   82

1 + 30 + 2 = 33

+10   +10   +10   +3

49   59   69   79   82

10 + 10 + 10 + 3 = 33

Take away/count back to the nearest 10, then subtrat tens, then subtract the remainder.

YEAR 3

Mental skills	Written strategies – formal 1st introduced

Written strategies – formal 1st introduced
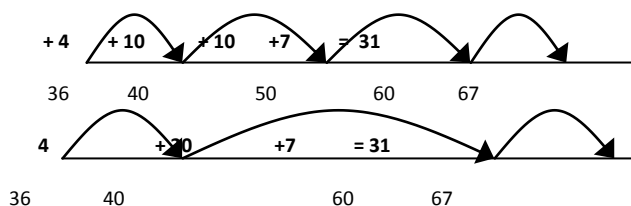
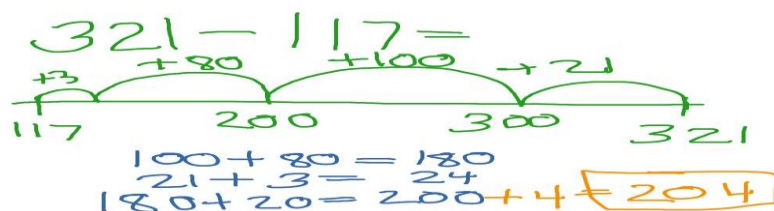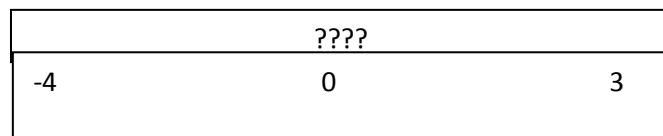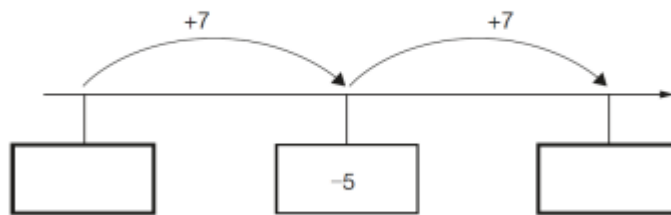|	
Subtract: 1s from 3-digit 10s from 3-digit 100s from 3-digit	*Before moving on*, children will need to be confident in recalling number bonds to 10 in order to bridge to the next 10. they will also need to be confident in adding single digit number to multiples of ten mentally 67 – 36 = + 4 + 10 + 10 +7 = 31 36 40 50 60 67 4 +20 +7 = 31 36 40 60 67 *This method will be used across a range of contents and with decimals in the context of money and beyond.* **Core Lesson** 243 – 87 = +3 +10 +100 +43 87 90 100 200 243 LEARNZILLION 321 – 117 = +3 +80 +100 +21 117 200 300 321 100 + 80 = 180 21 + 3 = 24 180 + 20 = 200 + 4 = 204 When subtracting three-digit numbers you can use a number line to help you. This method looks like adding, because it starts with the smaller number and then counts on to the bigger number to find the difference between the two numbers. 517 – 392 = +8 +100 +17 392 400 500 517 You then add up all the jumps you have made on the top: 8 + 100 + 17 = (125) The difference between between 392 and 517 is 125.

£5.60 - £3.99 =

$+1p$ $+£1$ $+60p$

£3.99 £4   £5   £5.60

1p + £1 + 60p = £1.61

Partitioned numbers are then written under one another:

Example: 74 – 27

$$\begin{array}{r} 70+4 \\ -\ 20+7 \\ \hline \end{array}$$

$$\begin{array}{r} {}^{60}\ \ {}^{14} \\ \cancel{70}+\cancel{4} \\ -\ 20+7 \\ \hline 40+7 \end{array}$$

$$\begin{array}{r} {}^{6}\ \ {}^{14} \\ \cancel{7}\cancel{4} \\ -\ 2\ 7 \\ \hline 4\ 7 \end{array}$$

Example: 741 – 367

$$\begin{array}{r} 700+40+1 \\ -\ 300+60+7 \\ \hline \end{array}$$

$$\begin{array}{r} {}^{600}\ \ {}^{130}\ \ {}^{11} \\ \cancel{700}+\cancel{40}+\cancel{1} \\ -\ 300+60+7 \\ \hline 300+70+4 \end{array}$$

$$\begin{array}{r} {}^{6}\ {}^{13}\ {}^{11} \\ \cancel{7}\cancel{4}\cancel{1} \\ -\ 3\ 6\ 7 \\ \hline 3\ 7\ 4 \end{array}$$

> Show the taking from 1 column and putting in another.

YEAR 4

Mental skills	Written strategies
Use knowledge of inverse to solve calculations mentally.	Subtract from 4-digit number using column method. $$\begin{array}{r} 3\ 6\ 7 \\ -\ 1\ 3\ 4 \\ \hline 2\ 3\ 3 \end{array}$$ $$\begin{array}{r} {}^{7}\ \ {}^{1} \\ 7\ \cancel{8}\ 4 \\ -\ \ \ 5\ 7 \\ \hline 7\ 2\ 7 \end{array}$$ $$\begin{array}{r} {}^{2}\ {}^{9}\ {}^{1} \\ \cancel{3}\ \cancel{0}\ 4 \\ -\ 1\ 3\ 8 \\ \hline 1\ 6\ 6 \end{array}$$ $$\begin{array}{r} {}^{1}\ {}^{9}\ {}^{1} \\ 2\ \cancel{0}\ 3\ 9 \\ -\ 1\ 8\ 4\ 5 \\ \hline 1\ 9\ 4 \end{array}$$

YEAR 5

Mental skills	Written strategies
Calculate subtraction complements to 1000. Recall decimal compliments to 1 using inverse $0.3 + \square = 1$	The expanded method leads children into the more compact method *so that they understand its structure and efficiency.*

15

Use of negative numbers – revisit numberline and rod method

Here is part of a number line.

Write the missing numbers in the boxes.

+7   +7
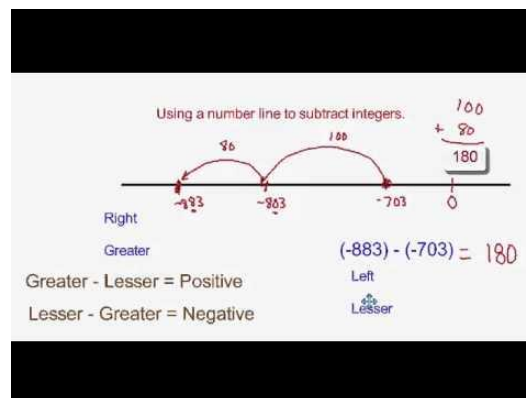
| | -5 | |

????
-4   0   3

Mental skills	Written strategies
Perform mental calculations, including with mixed operations and large numbers.	Negative numbers: Decimals: use numberline & progress to formal.

Year 6 Subtraction
Written calculations
Find a difference by counting up

0.5 - 0.31 =

        + 0.09   +1.0

0.31   0.4   0.5

Reduce the number of steps to make it more efficient
Combine

Complementary Addition as in Y5

Decomposition with exchanging where needed
• Larger number on top
• Start with units
• 0 is where problems arise
• Not borrowing- it is exchanging

Line up the decimal points

76.3
- 34.1
42.2

Line up the decimal points

4.321
- 4.1
0.221

T Th   Th   H   T   O

7   $^4\!5$, $^1\!5$ $^2\!3$ $^1\!2$

-   2   2, 6   2   3

    5   2, 9   0   9

VOCABULARY -SUBTRACTION

EARLY YEARS	Count back Less Few One less Take Take away Leave How many left? How many fewer? Difference 1 less
YEAR 1	Subtract Minus Leave How much less? equal to distance between, less than fewer
YEAR 2	partition tens units/ones
YEAR 3	10/100 boundary Decrease Inverse exchange decrease hundreds digit
YEAR 4	thousands
YEAR 5	digit, inverse, tenths, hundredths, decimal point, decimal
YEAR 6	All above

MULTIPLICATION

Early Mathematical development	
Mental skills	Written strategies
"… solve problems, including doubling, halving and sharing." *"Suppose there were three people to share the bricks between instead of two".*	Children will experience equal groups of objects and will count in 2s and 10s and begin to count in 5s. They will work on **practical problem solving activities** involving equal sets or groups. *Models and images will be used **by the teacher** to represent what is happening as outlined in EYFS PSRN - development matters*

YEAR 1	
Mental skills	Written strategies
Know doubles to 10 x10. and can recall rapidly To know doubles to 5 x 2. using fingers to support. Count in 2's, 5's, 10's by chanting and using number rhymes etc	Children will develop their understanding of multiplication and use jottings to support calculation: 3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x 3 The representation of **multiplication as an array along with the number line** will be used to link the mental strategies children are using through counting to the written calculation.

Year 1 is all pictorial.

Mental skills	Written strategies
Know facts for 2, 5, 10 times multiplication table and can count in these multiples off a multiple.	Children will develop their use of number lines or apparatus to support their understanding. **Repeated addition and arrays.** **Arrays** Children will be able to model a multiplication calculation using an array. 4 x 9 = 36 Commutative – 9 x 3 = 3 x 7 = 21

YEAR 3

Mental skills	Written strategies – formal 1st introduced

19

'count from 0 in multiples of 3, 4, 8, 50 and 100;' 'Pupils now use multiples of 2, 3, 4, 5, 8, 10, 50 and 100.'	2-digit x 1 digit of tables they know: Numberline…. This leads to grid:

2-digit x 1 digit of tables they know:

Numberline….

This leads to grid:

Use place value apparatus to support the multiplication of U x TU

4 x 13

10   3

Use place value apparatus to support the multiplication of U x TU alongside the grid method

4 x 13

	10	3
4	40	12

40 + 12 = 52

Children will t ……… gle digit.

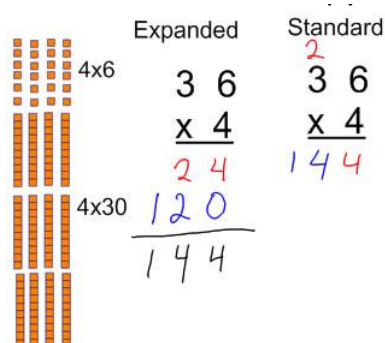| Expanded	Standard
4x6 3 6 x 4	2 3 6 x 4
2 4	1 4 4
4x30 1 2 0	
1 4 4	

AGREED

Ones times ones first

Ones times tens second

Symbols
Children will understand how symbols stand for unknown numbers to complete equations using inverse operations

□ x 5 = 20   3 x △ = 18   □ x ○ = 32

3n = 15…. What is n?

Multiplying 3 single digit numbers – 3x2x4 = 4x3x2 = etc

YEAR 4

Mental skills	Written strategies
'recall multiplication and division facts for multiplication tables up to 12 × 12' *'use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers'*	**2-digit and 3-digit numbers by 1 digit.** **The grid method will be used initially by the children.**

2-digit and 3-digit numbers by 1 digit.

The grid method will be used initially by the children.

Multiplying TU x TU

14 x 33

	30	3		
10	300	30	=	330 +
4	120	12	=	132
				462

300
120
30
+ 12
462

e.g. Know if 2 x 3 = 6 …. Then 20 x 3= 60	

$$\begin{array}{c|c|c|c}
x & 300 & 40 & 6 \\
\hline
9 & 2700 & 360 & 54 \\
\end{array}$$

```
  2700
+  360
+   54
  3114
```

$$\begin{array}{c|c|c}
x & 4 & 0.9 \\
\hline
3 & 12 & 2.7 \\
\end{array}$$

```
  12
+ 2.7
 14.7
```

Year 4 - Multiplication

Written method - Partition

Partitioning to multiply 2-digit numbers by 'friendly' single digit numbers.
23 x 4 = 92

```
23 x 4 = (20 x 4) + (3 x 4)
            80    +   12
         = 92
```

Multiplying by a 1 Digit Number

```
 +2
9 4 7
x  3
   1
```

Now we multiply 3 times the number in the tens place which is 4.

3 x 4 is 12, plus 2 is 14.
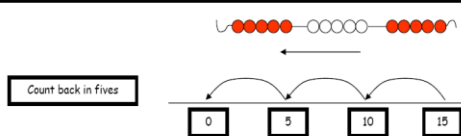
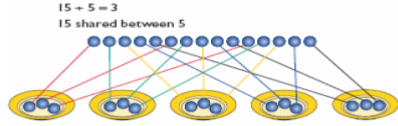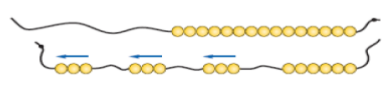| **YEAR 5**	
Mental skills	Written strategies

Multiply by 10 100 1000	Multiplying by a 2-digit number.
	815 × 34 We partition 815 into 800 and 10 and 5 and put it in a table. We partition 34 into 30 and 4 and put it in the table. | x	800	10	5
30	24000	300	150

4	3200	40	20	
				
				Multiply the numbers in the grid one by one,
				then add all the numbers to make 27,710.
				
				AGREED
				
				Multiply by the largest value first… lastly by the ones.
				
				124 × 26
				
				    1 2 4
				X 6 6
				7 4 4 0
				   7 4 4
				3 2 2 4
				
				Multiply by the largest number fir... ...n' numbers on top; then cross out when added.
				
				Also - 4-digit x 1-digit……. 4-digit x 2-digit.

YEAR 6		
Mental skills	Written strategies	
Perform mental calculations, including with mixed operations and large numbers.	As year 5 Decimals – tenths, hundredths.	

VOCABULARY

EARLY YEARS	Pair Double Group Set Count out
YEAR 1	Double, groups of lots of times array altogether multiply count
YEAR 2	Lots of Groups of Times Multiply Multiple of Repeated addition
YEAR 3	column row commutative sets of equal groups times as big as, once, twice, three times.. partition grid method product tens units/ones
YEAR 4	tenths, hundredths, decimal, carry, factor pairs
YEAR 5	Common factors multiples square number cube number
YEAR 6	All the above

DIVISION

Early Mathematical development	
Mental skills	Written strategies
Count back in 1's from any given number up to 10 Halving sharing	In division children will be introduced to both **sharing** and **grouping** through practical play activities.

YEAR 1	
Mental skills	Written strategies
Begin to count back in 10's, 2's, 5's using number rhymes	**Children will understand equal groups and share items out in play and problem solving**. They will count in 2s and 10s and later in 5s. Children will use jottings to support **practical calculation activities**. They will experience division as both **grouping** and **sharing** using different models and images to represent their thinking, including links to arrays In division children will be introduced to both **sharing** and **grouping** through practical play activities. **Children will understand equal groups and share items out in play and problem solving**. They will count in 2s and 10s and later in 5s. *Models and images will be used **by the teacher** to represent what is happening when solving practical problems as outlined in EYFS PSRN - development matters*

YEAR 2	
Mental skills	Written strategies
Divide by 2 by 5 by 10	Children will use jottings to support **practical calculation activities**. They will experience division as both **grouping** and **sharing** using different models and images to represent their thinking, including links to arrays.

Teachers will demonstrate the links between multiplication and division to support children in the later stages as they begin to 'chunk' on the number line

Understand – 5 x 4 = 20 4 x 5 = 20   20 ÷ 5 4   20 ÷ 4 = 5

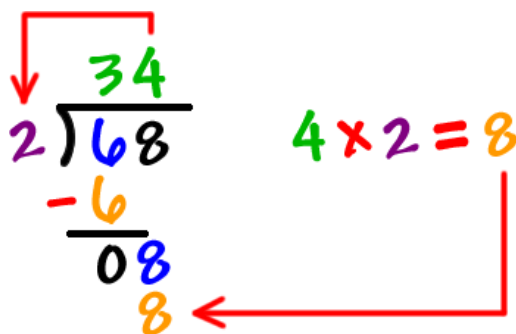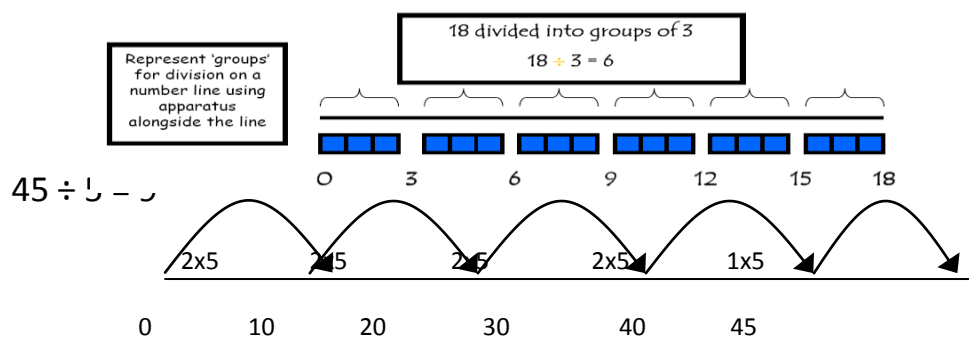| YEAR 3	
Mental skills	Written strategies – formal 1st introduced
Know tables – 3, 4, 8	Children will begin to develop their understanding of 'chunking' on a number line using repeated addition to add multiples of the divisor.

There are 6 sweets.
How many people can have 2 each? (How many 2's make 6?)

Moving to …

Represent 'groups' for division on a number line using apparatus alongside the line

18 divided into groups of 3
18 ÷ 3 = 6

$45 \div 5 = 9$

$4 \times 2 = 8$

DISCOUNTED

Expanded method

YEAR 4	

Mental skills	Written strategies
Multiples of 6, 7, 9, 25, 1000 Derive facts: $60 \div 3 = 20$ $60 \div 30 = 2$ $600 \div 3 = 200$ $600 \div 30 = 20$ $600 \div 300 = 2$	The division of a two/three-digit number will be introduced to children who are confident with multiplication and division facts. $100 \div 7 =$ Initially they add several small chunks, but with practice they should look for the biggest 'chunk' they can eg. 10 x, 20x ***Children will be able to decide what to do after division and round up or down accordingly.*** For $81 \div 3$, the dividend of 81 is split into 60, the highest multiple of 3 that is also a multiple 10 and less than 81, to give 60 + 21. Each number is then divided by 3. $81 \div 3 = (60 + 21) \div 3$ $= (60 \div 3) + (21 \div 3)$ $= 20 + 7$ $= 27$ The short division method is recorded like this: $$\begin{array}{r} 20 + \ 7 \\ \hline 3\overline{)60 + 21} \end{array}$$ Hundreths are met in Year 4… so … remainders to be shared out also??? Interpret remainders appropriately. **Once a child has mastered division by chunking, they will often be shown the quicker 'bus stop' method. (This is also known as short-hand division or short division.)** **Here is a demonstration of this method:**

$$142 \div 4 =$$

$$\begin{array}{r} 0\ 3\ 5 \\ 4\overline{)1\ ^14\ ^22} \end{array}$$

remainder 2 or fraction or decimal

YEAR 5	
Mental skills	Written strategies
Divide by 10 100 1000	Those children with a secure understanding of place value and who can rapidly recall all multiplication facts will be introduced to the standard written method as a way to calculate more efficiently.

$$\begin{array}{r} 56 \\ 3\overline{)168} \quad 18 \div 3 = 6 \\ -15 \\ \hline 18 \end{array}$$

<div style="border:1px solid">

DISCOUNTED

Expanded method

</div>

259 ÷ 6 = ?   • How many lots of 6 are there in 259?

10 x 6 = 60   10 x 6 = 60   10 x 6 = 60   10 x 6 = 60

0   60   120   180   240   259

	Running Total	
40 x 6 = 240	240	…… how many 6's will that take?

K Russell 2012

Once a child has mastered division by chunking, they will often be shown the quicker 'bus stop' method. (This is also known as short-hand division or short division.)

Here is a demonstration of this method:

$362 \div 7 =$

$$
\begin{array}{r}
5\ 1 \text{ r5} \\
7\ \overline{)\ 3\ 6\ {}^1 2}
\end{array}
$$

$362 \div 7 = 51 \text{ r5}$

YEAR 6	
Mental skills	Written strategies

$$
\begin{array}{r}
3 \\
25\ \overline{)\ 750} \\
-75 \\
\hline
0
\end{array}
\qquad
\begin{array}{r}
30 \\
25\ \overline{)\ 750} \\
-75\downarrow \\
\hline
00 \\
-\ 0 \\
\hline
\end{array}
$$

DISCOUNTED

Expanded method

Quotient ⟶ 015
Divisor ⟶ 32 ⟌ 487
0
48
32
167
160
Dividend ⟶
Remainder ⟶ 7

DISCOUNTED

Expanded method

```
how many per store? ──→    3,524 R 6
   24                  24)85,582
   48                      72 ↓
   72                      ───
   96                      12 5
  120                      12 0↓
  144                      ────
  168                        58
  192                        48↓
  216                       ────
  240                       102
                            96
                            ───
                             6
```

DISCOUNTED

Expanded method

Remainders to be interpreted appropriately.

We explain what **the bus stop** (or short-hand) method for division is and why this is a quick and efficient method for working out division with larger numbers.

```
        2  0  0 r 7
  26 /5 4 ²6  7
```

```
         1  5  1 r 29
  36 /5 4 ₁₈6  ₆7
```

Answers to be completed as appropriate – remainders, fractions, decimals.

VOCABULARY

EARLY YEARS	Group, share.
YEAR 1	share, share equally, one each, two each…, group, groups of, lots of, array
YEAR 2	divide, divided by, divided into, division, grouping, number line, left, left over
YEAR 3	grouping, inverse, short division, 'carry', remainder, multiple
YEAR 4	divisible by, factor
YEAR 5	quotient, prime number, prime factors, composite number (non-prime) common factor
YEAR 6	All the above

VIDEOS TO AID UNDERSTANDING:

Addition to 10
https://www.youtube.com/watch?v=OkW1Y11tGxw&list=PLQqF8sn28L9wjDm8uJEJcRCDDoY6raPE_

consolation and practice
https://www.youtube.com/watch?v=Uhymn4ESLPo&list=PLQqF8sn28L9wjDm8uJEJcRCDDoY6raPE_&index=4

expanded 3-digit column addition
http://www.teachertube.com/viewVideo.php?video_id=24325

discussing appropriate methods – lower KS2
https://www.youtube.com/watch?v=RCCLseBLBSo

developing column subtraction
https://www.youtube.com/watch?v=dP8NlFLZzOg

upper ks2 column subtraction
https://www.youtube.com/watch?v=3ihxp2mqnhs

multiplication ks1
https://www.youtube.com/watch?v=YPWmOVt8vgw&list=PLQqF8sn28L9yj34NpXK7Yffze7ZoXTiix

commutative multiplication
https://www.youtube.com/watch?v=VGkjjVfnGYI&list=PLQqF8sn28L9yj34NpXK7Yffze7ZoXTiix&index=2

grid method – lower ks2
https://www.youtube.com/watch?v=qyTRtoqYi7Q&list=PLQqF8sn28L9yj34NpXK7Yffze7ZoXTiix

grid to compact method – upper ks2
https://www.youtube.com/watch?v=5ppOF53x_q0&list=PLQqF8sn28L9yj34NpXK7Yffze7ZoXTiix

09/12/15

Below is the official appendix from which our Policy has been constructed.

Mathematics Appendix 1: Examples of formal written methods for addition, subtraction, multiplication and division

"This appendix sets out some examples of formal written methods for all four operations to illustrate the range of methods that could be taught. It is not intended to be an exhaustive list, nor is it intended to show progression in formal written methods. For example, the exact position of intermediate calculations (superscript and subscript digits) will vary depending on the method and format used.
For multiplication, some pupils may include an addition symbol when adding partial products. For division, some pupils may include a subtraction symbol when subtracting multiples of the divisor."

Addition and subtraction

Short multiplication

24 × 6 becomes	342 × 7 becomes	2741 × 6 becomes

```
        2   4
    ×       6
    ─────────
    1   4   4
        2
```

Answer: 144

```
        3   4   2
    ×           7
    ─────────────
    2   3   9   4
            2   1
```

Answer: 2394

```
        2   7   4   1
    ×               6
    ─────────────────
    1   6   4   4   6
                4   2
```

Answer: 16 446

Long multiplication

24 × 16 becomes	124 × 26 becomes	124 × 26 becomes

```
          2
        2   4
    ×   1   6
    ─────────
    2   4   0
    1   4   4
    ─────────
    3   8   4
```

Answer: 384

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

Answer: 3224

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

Answer: 3224

Short division

98 ÷ 7 becomes	432 ÷ 5 becomes	496 ÷ 11 becomes

```
        1   4
      ┌───────
      │     2
    7 │ 9   8
```

Answer: 14

```
          8   6   r 2
      ┌───────────
      │       3
    5 │ 4   3   2
```

Answer: 86 remainder 2

```
            4   5   r 1
        ┌───────────
        │       5
    1 1 │ 4   9   6
```

Answer: $45\frac{1}{11}$

Long division

30

432 ÷ 15 becomes

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

Answer: 28 remainder 12

---

432 ÷ 15 becomes

```
        2   8
1   5 | 4   3   2
        3   0   0    15×20
        1   3   2
        1   2   0    15×8
            1   2
```

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

Answer: $28\frac{4}{5}$

---

432 ÷ 15 becomes

```
        2   8 · 8
1   5 | 4   3   2 · 0
        3   0   ↓
        1   3   2   ↓
        1   2   0
            1   2   0
            1   2   0
                    0
```

Answer: 28·8

Providing a context for calculation: It is important that any type of calculation is given a real life context or problem solving approach to help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods when faced with problems. This must be a priority within calculation lessons.