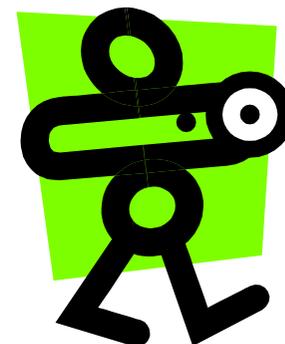
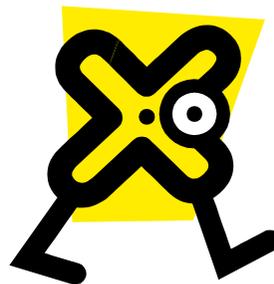


# Petworth C of E Primary School

## Progression in Calculation 2021



## What you need to know about calculations

Mathematics will be at the core of your child's schooling from the moment they start to the moment they leave. They will be involved in drawing, measuring, geometry and lots of other practical activities that will help your child to understand and enjoy the subject. This booklet offers guidance to the methods used to help our pupils with calculations. The methods we are advocating are in line with the National Curriculum. We hope this will be helpful to you and that you will be able to support your child in learning by heart the basic rules which will assist in mental recall eg. number bonds and multiplication tables.

The methods that we use in school may or may not be familiar to you. Children are often confused when they ask parents for help at home and they try to teach the methods that they themselves were taught. Knowing how the methods in this booklet work will help you to help your children.

All staff in school work from this document so that we can ensure the consistency of our approach and can make sure that the children move onto the next step when they are ready.

The four operations that are covered by this booklet are addition, subtraction, multiplication and division. Whichever operation is being taught the child needs to experience all of these steps to completely embed their understanding.

- 1) Using objects and creating concrete visualizations of the number or calculation
- 2) Using pictures which may include representations such as part, part, whole or a bar model,
- 3) Using a numberline
- 4) Using an expanded method
- 5) Using a compact written method
- 6) Using a combination of methods to prove they are correct.

### Mental methods first

Children should always be encouraged to consider if a mental calculation would be appropriate before using written methods. - These are covered in the first part of each section.

## Why do children need to do written calculations?

- To represent work that has been done practically.
- To support, record and explain mental calculation
- To keep track of steps in a longer task
- To work out calculations that are too difficult to do mentally

Children should be taught when it is appropriate to do an approximate or estimate first and should check with the inverse operation at the end.

By upper Key Stage 2, children should be confident in choosing and using a strategy that they know will get them to the correct answer as efficiently as possible.

As a school we are committed to a mastery approach within mathematics; this means we put emphasis on the pupils understanding and explaining the mathematics they have used. It may also mean the children using one or more methods to prove they are correct and giving a full explanation. The children may also discuss the use of; fluency, problem solving and reasoning, which are the three areas we teach in each lesson. Fluency is the children's use of basic calculations, problem-solving requires the children to decipher the information that is needed and reasoning focuses on looking for underlying patterns and formulae in their mathematics.

## What can parents do to help?

- Count with their child
- Play number games
- Involve children when taking measurements or weighing items
- Take note of numbers in real life e.g. telephone numbers, bus numbers, lottery numbers etc.
- Give children opportunities to use money to shop, check change etc.
- Talking about the mathematics in football e.g. 'How many points does your favourite team need to catch the next team in the league?'
- When helping their children calculate use the method that they have been taught

Please don't...

Teach your children that to multiply by 10 you 'just add a zero'. - you 'move the digits to the left and add a zero as a place holder'

Tell them that you can move the decimal point. - You can't. You can only move the digits to the left or to the right

Tell them that they are doing 'sums' - 'sum' is a mathematical word that means 'addition', everything else is a 'calculation'

## Glossary

**2-digit** – a number with 2 digits like 23, 45, 12 or 60

**3-digit** – a number with 3 digits like 123, 542, 903 or 561

**Addition facts** – knowing that  $1+1 = 2$  and  $1+3 = 4$  and  $2+5 = 7$ . Normally we only talk about number facts with totals of 20 and under.

**Array** – An array is an arrangement of a set of numbers or objects in rows and columns – it is mostly used to show how you can group objects for repeated addition or subtraction.

**Bar model** – A pictorial strategy. Understanding which number represents the whole and how the number is made up.

**Bridge to ten** – a strategy when using numberlines. Adding a number that takes you to the next 'tens' number.

**Bus Stop Method** – traditional method for division with a single digit divisor

**Concrete apparatus** – objects to help children count – these are most often cubes (multilink) but can be anything they can hold and move.

Dienes (purple hundreds, tens and ones blocks), Numicon, Cuisenaire rods are also referred to as **concrete apparatus**.

**Column chunking** – method of division involving taking chunks or groups or the divisor away from the larger number

**Decimal number** – a number with a decimal point

**Divisor** – the smaller number in a division calculation. The number in each group for chunking.

**Double** – multiply a number by 2

**Exchanging** – Moving a 'ten' or a 'hundred' from its column into the next column and splitting it up into ten 'ones' (or 'ones') or ten 'tens' and putting it into a different column

**Find the difference** – A method for subtraction involving counting up from the smaller to the larger number

**Grid method** – a method for multiplying two numbers together involving partitioning

**Half** – a number, shape or quantity divided into 2 equal parts

**Halve** – divide a number by 2

**Integer** – a number with no decimal point

**Inverse** – the opposite operation. Addition is the inverse of subtraction, multiplication is the inverse of division.

**Ones** – another term for single digit numbers. The right hand column in column methods is the 'ones' column. We used to call these 'units'

**Long Multiplication** – column multiplication where only the significant figures are noted

**Number bonds to ten** – 2 numbers that add together to make ten, like 2 and 8, or 6 and 4.

**Number bonds to 100** – 2 numbers that add together to make 100 like 20 and 80, or 45 and 55 or 12 and 88

**Numberline** – a line either with numbers or without (a blank numberline). Children use this tool to help them count on for addition of subtraction and also in multiplication and division.

**Numberline Chunking** – method of division involving taking chunks or groups or the divisor away from the larger number

**Number sentence** – writing out a calculation with just the numbers in a line e.g.  $2+4=6$  or  $35 \div 7 = 5$  or  $12 \times 3 = 36$  or  $32 - 5 = 27$

**Part, part, whole** – Asking the pupils to recognise the whole and the parts that make it up. Can introduce the children to recognising that numbers can be made up in a variety of ways.

**Partition** – split up a larger number into the hundreds, tens and ones. E.G.  $342 - 300$  and  $40$  and  $2$

**Place Value** – knowing that in the number 342 – the '3' means '3 hundreds', the '4' means '4 tens' and the '2' means '2'.

**Quarter** – a number, shape or quantity divided into 4 equal parts

**Recombine** – for addition, once you have partitioned numbers into hundreds, tens and ones then you have to add then hundreds together, then add the tens to that total, then add the ones to that total **Remainder** – a whole number left over after a division calculation **Repeated addition** – repeatedly adding groups of the same size for multiplication

**Significant digit** – the digit in a number with the largest value. E.G. in 34 – the most significant digit is the 3, as it has a value of '30' and the '4' only has a value of '4'

**Single digit** – a number with only one digit. These are always less than 10. **Taking away** – a method for subtraction involving counting backwards from the larger to the smaller number

**Tens number** – a number in the ten times tables – 10,20,30,40 50,etc.

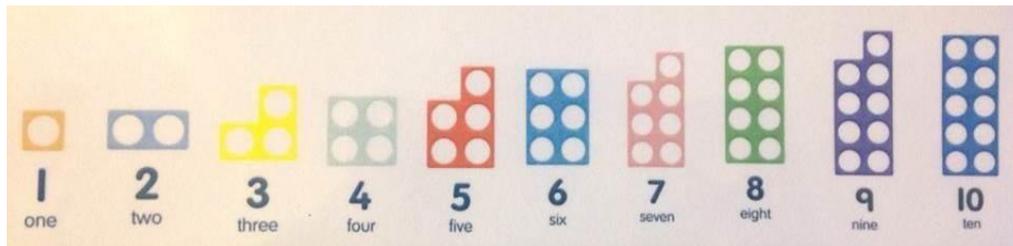
## Resources that your children will use to help with calculation

### Dienes



Dienes, although it has been used in schools for years is a crucial step in knowing what a 'one', a ten, a hundred and a thousand look like and how they can be added together and split up to form smaller and larger numbers.

### Numicon



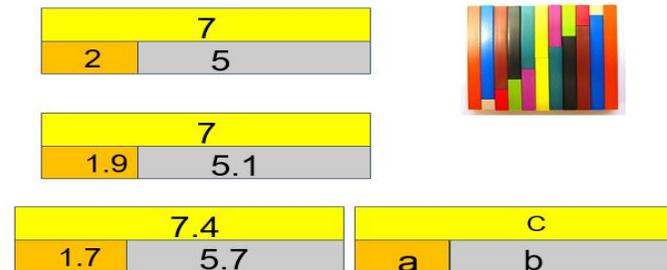
Numicon is an especially useful resource as it can be used for teaching all four operations as well as fractions, decimals, percentages and a range of other aspects of maths. Each piece represents an integer from 1 to 10. The children love using it as it is colourful and tactile

### Cuisenaire Rods and a number track



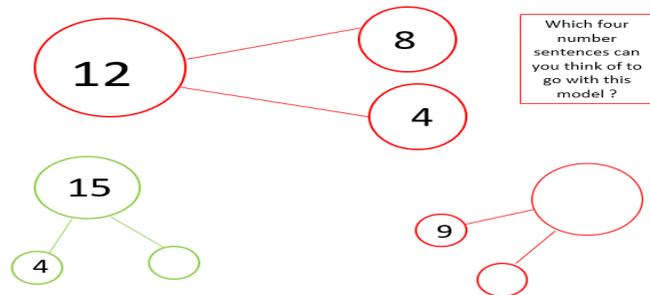
Although these little rods that represent integers from 1 to 10, can be used for a range of aspects of maths, we normally use them for multiplication and division. They are also really useful for addition.

### Bar models



This is the next logical step from the cuisenaire rods and moves the concrete resource into the pictorial. We draw one bar to represent the whole. Early problems will likely include two parts, so we draw another two bars that together are the same size as the whole. Later, there will be more parts and we will need to change our drawing accordingly. These aid the children in visualizing the problem they are faced with and how it could potentially be solved.

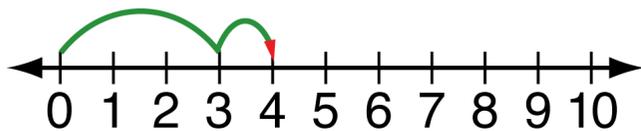
## Part, Part, Whole models



The part, part, whole model allows the pupils to investigate how numbers are made up and use this to add and subtract to create their whole.

## Numberlines

$$3 + 1 = 4$$



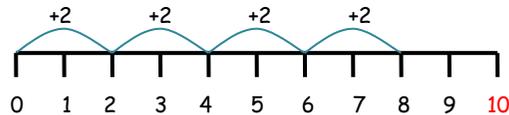
Numberlines are a mainstay of teaching calculations. We have pre numbered and blank numberlines in school that children can write on, or they can draw their own as appropriate for the calculation.

# Addition

## Ideas and strategies that children should master before tackling written calculations.

These steps lettered a-n, are not necessarily taught in order, they will be taught as the child becomes ready.

- Addition can be done in any order. e.g.  $34 + 56 = 90$  or  $56 + 34 = 90$
- Usually start with the largest number (so that you have to do less counting and so there is less potential for mistakes.) e.g.  $27 + 5 = 32$
- Must know **number bonds to 10** e.g.  $1+9=10$ ,  $2+8=10$ ,  $3+7=10$ ,  $4+6=10$ ,  $5+5=10$  etc.
- Addition facts** for all **single-digit** numbers. e.g.  $1+1=2$ ,  $1+2=3$ ,  $1+4=5$ ,  $2+1=3$ ,  $2+2=4$ ,  $2+3=5$  etc.
- Count forward in steps of 1, 2, 5, 10 and 100 along a **numberline**.



- Understand the **numberline** as a continuum. A **numberline** is just a tool that helps us count forwards and backwards - it has no 'official' starting or ending point.
- Concrete apparatus** available. e.g. using objects like multilink, Dienes, toys, blocks, Cuisenaire rods, Numicon
- Understand **place value**. e.g. Knows that in the number 327, the '3' means '3 hundreds', the '2' means '20' and the '7' means 7
- Can **partition** numbers. e.g. Can split a number like 327 into  $300 + 20 + 7$
- Counting forwards and backwards in steps of different sizes. e.g. counting forwards in 1s - 1, 2, 3, 4, 5 etc.; or in steps of 2 - 2, 4, 6, 8, 10 etc.; or in steps of 5 - 5, 10, 15, 20, 25 etc.; or in steps of 10 - 10, 20, 30, 40, 50 etc.
- Know doubles of numbers from 1-10 e.g. double 3 is 6, (or 2 lots of 3 is 6, or 2 times 3 is 3, or 2 groups of 3 is 6)
- Know doubles of numbers from 10-20. e.g. double 12 is 24, (or 2 lots of 12 is 24, or 2 times 12 is 24, or 2 groups of 12 is 24)
- Know that adding numbers always produces a larger answer.
- Know that addition can be calculated in any order. e.g.  $2+3=5$  or  $3+2=5$
- Count up to 10 objects reliably.
- Find 'one more' than a number. e.g. when given a number, say 13, they can count on to find 'one more' e.g. 14.
- Add two or more groups of objects together to find a total of less than 10. These may be **concrete apparatus** or pictures.



- Use the + and = signs to record mental calculations in a **number sentence**. e.g.  $2+6=8$

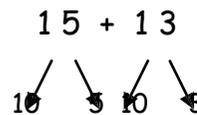
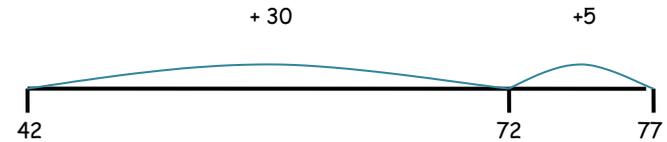
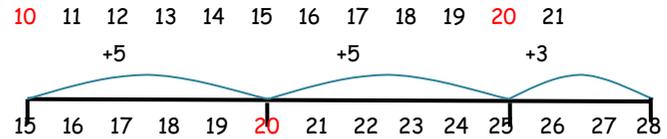
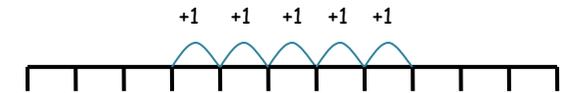
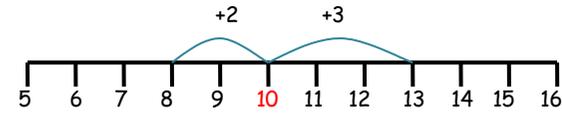
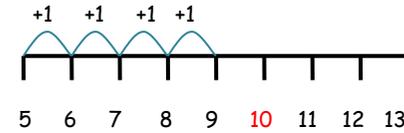
### Vocabulary

+ Add  
Addition  
Plus  
And  
Count on  
More  
Sum  
Total  
Altogether  
Increase

# Addition

## Non-standard methods

- Count along a **numberline** to add **single digit** numbers together to find a total of less than 10 e.g.  $5 + 4 = 9$
- Add **single digit** numbers that **bridge to 10** using a **numberline**. This involves partitioning the smaller number in to 2 parts, one of which will add to the larger number to make 10 e.g.  $8 + 5 = 13$
- Add a **2-digit** number and a **single digit** number using a **numberline** e.g.  $13 + 5 = 18$
- Add two **2-digit** numbers **bridging to 10** using a **numberline**. This involves partitioning the smaller number into 2 or more parts, one of which will add to the larger number to make a link to the 'next **tens number**' e.g.  $13 + 15 = 28$  So split 13 into 5 and 5 and 3.
- Add two **2-digit** numbers adding the most **significant digit** first using a **blank numberline**. e.g.  $42 + 35 = 77$
- Partition and recombine** e.g.  $15 + 13 = 28$  (MAY BE DONE OUT OF ORDER)
- Add a **3-digit** number and a **2-digit** number using a **numberline** e.g.  $243 + 64$



Then  $10 + 10 + 5 + 3 = 28$

## Standard Written methods - Column Addition

12. 2-digit add 1-digit

$$\begin{array}{r} 24 \\ + 5 \\ \hline 29 \end{array}$$

13. 3-digit add 1-digit

$$\begin{array}{r} 247 \\ + 6 \\ \hline 253 \\ \hline 1 \end{array}$$

14. 2-digit add 2digit

$$\begin{array}{r} 26 \\ + 38 \\ \hline 64 \\ \hline 1 \end{array}$$

15. 3-digit add 2-digit

$$\begin{array}{r} 129 \\ + 42 \\ \hline 171 \\ \hline 1 \end{array}$$

16. 3-digit add 3-digit

$$\begin{array}{r} 126 \\ + 356 \\ \hline 482 \\ \hline 1 \end{array}$$

17. Adding decimals

$$\begin{array}{r} 126.41 \\ + 36.82 \\ \hline 163.23 \\ \hline 11 \end{array}$$

# Subtraction

## Ideas and strategies that children should master before tackling written calculations.

These steps lettered a- f, are not necessarily taught in order, they will be taught as the child becomes ready.

### Vocabulary

- Subtract  
Take Away  
Minus  
Less  
Fewer  
Difference

Subtraction can be seen in two ways: as 'taking away' or as 'finding the difference'.

- 'Taking away' is usually used when subtracting a small number from a much larger one - usually **2-digit** subtract a **single digit** like  $32 - 6$ . This is sometimes called 'counting back.' At Petworth Primary School we will use this method in mental calculations only, as the 'finding the difference' method has more explicit links to more complex subtraction used further on in school.
  - Must know **number bonds** to 10 and the reverse. e.g.  $1+9=10$ ,  $2+8=10$ ,  $3+7=10$  etc and  $10-1=9$ ,  $10-2=8$ ,  $10-3=7$  etc
  - Must know **number bonds** to 100 (sometimes called **complements** to 100) e.g.  $20+80 = 100$ ,  $45+55=100$ ,  $100-43=57$ , etc
  - Understand the **numberline** as a continuum. A **numberline** is just a tool that helps us count forwards and backwards - it has no 'official' starting or ending point.
  - Subtraction cannot be calculated in any order. e.g.  $9-4=5$  is not the same as  $4-9 = -5$
  - Understand **place value**. e.g. . Knows that in the number 327, the '3' means '3 hundreds', the '2' means '20' and the '7' means 7.
- Use **concrete apparatus** to physically 'take away' from numbers less than 10.
  - 'Finding the difference' by counting on. By using a **numberline**, fingers or other **apparatus** or mentally count from a smaller number to a larger one. e.g.  $9-4=5$ . Start at 4 and count on to 9. The 'difference' is the answer.

- Use **concrete apparatus** or pictures to either 'take away' or 'find the difference' between 2 groups e.g.  $8-3=5$

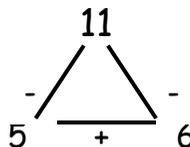


- Count on/count back in 1s or 10s on a **numberline**
- Counting forwards / backwards in steps of different sizes. e.g. counting in 1s, 2s, 5s, 10s etc. from any given starting point
- Find 'one less' than a number. e.g. when given a number, say 13, they can **count back** to find 'one less' e.g. 12
- Use - and = signs to record mental calculations in **number sentences**. e.g.  $23 - 6 = 17$
- Addition/Subtraction inverses (**trios**)

$$11-6 = 5$$

$$11-5 = 6$$

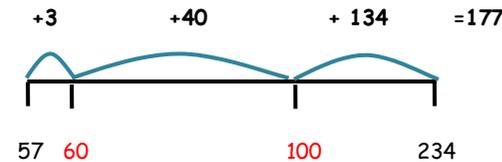
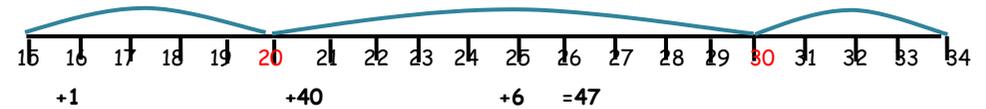
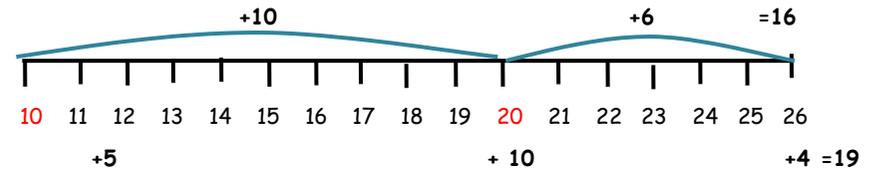
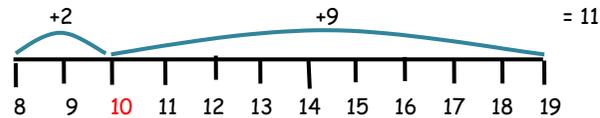
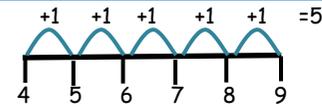
$$5+6=11$$



# Subtraction

## Non-standard methods

- Use 'counting on' with a numberline from a single digit less than 10 to another single digit less than 10 e.g.  $9-4=5$
- Use 'counting on' with a numberline from a single digit to a 2-digit number less than 20. e.g.  $19-8=11$
- Subtract 10 from a 2-digit number using 'counting on', on a numberline. e.g.  $26-10=16$
- Use a numberline for 2-digit numbers subtract 2-digit numbers using 'bridging to ten'. e.g.  $34-15=19$
- Use a numberline for 2-digit numbers subtract 2-digit taking bigger jumps to be more efficient e.g.  $76-29=47$
- Use numberline for 3-digit numbers subtract 2-digit numbers using efficient bigger jumps. e.g.  $234-57=177$



## Standard written methods - Column Subtraction

- Use Numicon or Dienes set out in column subtraction for 2-digit subtract 2-digit without 'exchanging'

16. Use column subtraction for 2-digit subtract 2-digit numbers without exchanging.

- Use Numicon or Dienes set out in column subtraction for 2-digit subtract 2-digit with 'exchanging'

2) There are 3 'tens' in 34. Change one of the tens into ten 'ones' and add them to the '4 ones'. Now you have 14 - 8. You still have 34 in total but instead of being '30+4' it is now '20+14'

- Use column subtraction for 2-digit subtract 2-digit numbers with 'exchanging'

$$\begin{array}{r} 34 \\ - 28 \\ \hline 06 \end{array}$$

1) 8 is larger than 4 so you can't take it away from 4

$$\begin{array}{r} 41 \\ - 28 \\ \hline 13 \end{array}$$

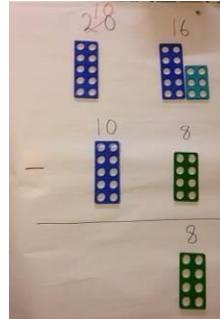
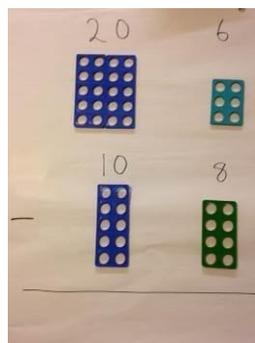
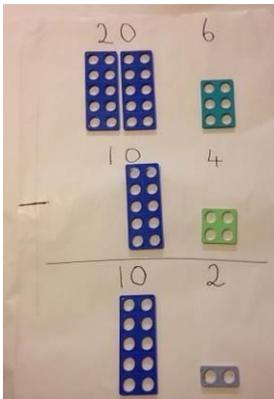
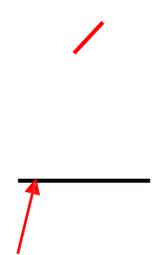
$$\begin{array}{r} 54 \\ - 28 \\ \hline 26 \end{array}$$

- Use column subtraction for 3-digit numbers subtract 2-digit numbers

$$\begin{array}{r} 54.6 \\ - 22.8 \\ \hline 31.8 \end{array}$$

Remember to put the decimal point in your answer space first!

- Use column subtraction for decimal numbers.

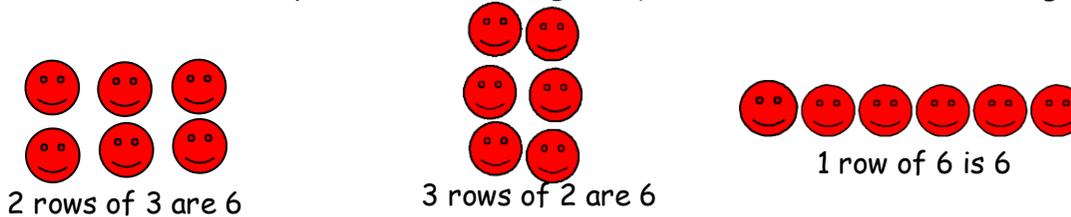


# Multiplication

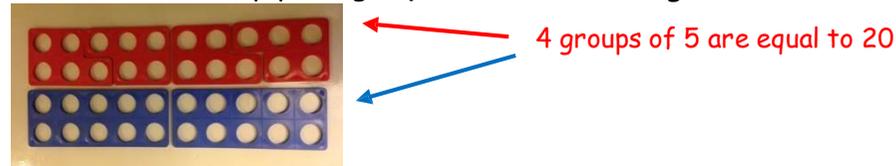
## Ideas and strategies that children should master before tackling written calculations.

These steps lettered a-h, are not necessarily taught in order, they will be taught as the child becomes ready.

- Understand **place value**. e.g. Knows that in the number 327, the '3' means '3 hundreds', the '2' means '20' and the '7' means 7
- Recognise simple sequences of numbers. e.g. 5,10,15,20 (add five each time or count in 5s) 2,4,6,8 (add 2 each time or count in 2s)
- Be able to use a method for adding and subtraction (see previous sections)
- Know that multiplication can be calculated in any order e.g.  $3 \times 4 = 12$  and  $4 \times 3 = 12$
- Be able to show multiplication facts using **arrays**. You can show a number, e.g. 6, in several ways using pictures or objects

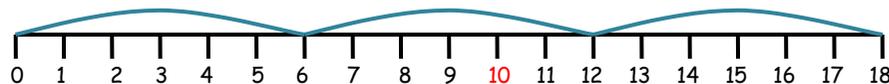


- That multiplication and division are **inverse** of each other. e.g.  $2 \times 6 = 12$  and  $12 \div 6 = 2$
- Can **double** and **halve** numbers from 1 to 100 e.g. Double 4 is 8,  $4 \times 2 = 8$ ; half of 8 is 4,  $8 \div 2 = 4$
- Multiplication is **repeated addition**. e.g. To find  $4 \times 3$ , you add 4 groups of 3, or you add 3 four times:  $3+3+3+3 = 12$ 
  - Put objects into groups of the same number.
  - Use a e.g. and Cuisenaire rods, or Numicon to multiply using **repeated addition**. e.g.  $4 \times 5 = 20$



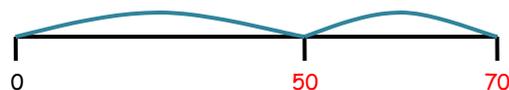
- Use a numbertrack and Cuisenaire rods or Numicon alongside a **numberline** for **repeated addition**
- Use a numbered **numberline** and record the **jumps** (how many groups of..) for **single digit times single digit numbers** e.g.  $3 \times 6$ 

1 group of 6      1 group of 6      1 group of 6      = 3 groups of 6



- Use a **numberline** for **single digit numbers times single digit numbers**
- Use a **numberline** for **2-digit numbers times single digit numbers** e.g.  $14 \times 3$
- Use **times tables facts** to make more efficient jumps on a **numberline** e.g. for  $14 \times 5$ , you could add  $10 \times 5$  and  $4 \times 5$ 

10 groups of 5      4 groups of 5



### Vocabulary

X Lots of  
Groups of  
Times  
Multiply  
Multiplication  
Jumps

Multiple  
Number line  
Product  
Twice  
Three times  
Array Row  
Column  
Double  
Repeated  
addition

# Multiplication

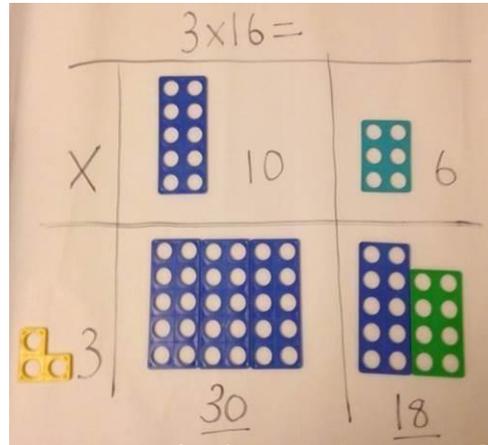
## Non-standard methods

8. Use Dienes or Numicon set out in **Grid method** for **2-digit** numbers times **single digit** numbers e.g.  $3 \times 16 = 48$

1) Partition 16 into 10 and 6

2) Put the 3 in the left column

3) Work out  $3 \times 10$  and put the answer and the Numicon in the box



$$\begin{array}{r} 30 \\ + 18 \\ \hline 48 \end{array}$$

4) Work out  $3 \times 6$  and put the answer and the Numicon in the box

5) Add up the 'mini answers'  $30 + 18$

9. Use **Grid Method** for **2-digit** numbers times **single digit** numbers e.g.  $24 \times 3 = 72$

1<sup>st</sup> - Partition 24 into 20 and 4

2<sup>nd</sup> - Work out  $20 \times 3$  and put the answer in the box

3<sup>rd</sup> - Work out  $4 \times 3$  and put the answer in the box

4<sup>th</sup> - Add your answers together either mentally or using column addition

X	20	4
3	60	12

$$\begin{array}{r} 60 \\ + 12 \\ \hline 72 \end{array}$$

10. Use **Grid Method** for **2-digit** numbers times **2-digit** numbers

(Dienes or Numicon could be used to support if needed)

E.g.  $24 \times 32 = 768$

1<sup>st</sup> - Partition 24 into 20 and 4

2<sup>nd</sup> - Partition 32 into 30 and 2

3<sup>rd</sup> - Work out  $20 \times 30$  and put the answer in the box

4<sup>th</sup> - Work out  $4 \times 30$  and put your answer in the box

5<sup>th</sup> - Work out  $20 \times 2$  and put your answer in the box

6<sup>th</sup> - Work out  $4 \times 2$  and put your answer in the box

7<sup>th</sup> - Add your answers together using column addition

x	20	4
30	600	120
2	40	8

$$\begin{array}{r} 600 \\ + 120 \\ 40 \\ \hline 8 \\ \hline 768 \end{array}$$

11. Use **Grid Method** for **3-digit** numbers times **2-digit** numbers

12. Use **Grid Method** for **3-digit** numbers times **3-digit** numbers

# Multiplication

## Standard Written Methods

### 13. Short Multiplication for 2-digit numbers times single digit numbers e.g. $23 \times 8$

$$\begin{array}{r} 23 \\ \times 8 \\ \hline 184 \end{array}$$

2) 2 (really 2 tens)  $\times$  8 is 16 (really 160) then add the '2 tens' from below the line to make 18 (really 180)

1)  $3 \times 8$  is 24. Put the one (4) in the ones column and the '2 tens' under the tens column

### 14. Long Multiplication for 2-digit number times 2-digit numbers e.g. $23 \times 18$

4)  $1 \times 3$  (really  $10 \times 3$ ) is 3 (really 30) - Write the 3 in the tens column.

5)  $1 \times 2$  (really  $10 \times 2$ ) is 2 (really 20) Write the 2 in the hundreds column

6) Add up both of your 'mini answers'

$$\begin{array}{r} 23 \\ \times 18 \\ \hline 184 \\ 230 \\ \hline 414 \end{array}$$

1)  $8 \times 3$  is 24. Write the 4 in the ones column and the 2 (really 2 tens) under the tens column.

2)  $8 \times 2$  (really  $8 \times 20$ ) is 16 (really 160) add the 2 tens from below the line to make 18 (really 180)

3) Place a '0' in the ones column as everything will now be multiplied by a 'tens number'.

### 15. Long multiplication for 3-digit numbers times 2-digit numbers. e.g. $234 \times 64$

### 16. Long multiplication for 4-digit numbers times 2-digit numbers e.g. $2345 \times 64$

### 17. Long multiplication for decimal numbers. e.g. $23.4 \times 64.7$

# Division

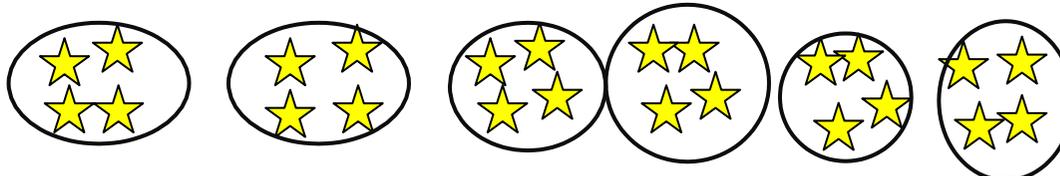
## Ideas and strategies that children should master before tackling written calculations.

These steps lettered a-j, are not necessarily taught in order, they will be taught as the child becomes ready.

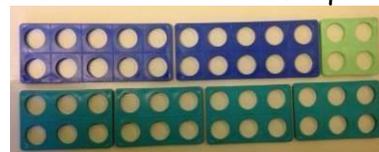
- a) Understand **place value**. e.g. Knows that in the number 327, the '3' means '3 hundreds', the '2' means '20' and the '7' means 7
- b) Put objects into groups of the same number.
- c) Recognise simple sequences of numbers. e.g. 5,10,15,20 (add five each time or count in 5s) 2,4,6,8 (add 2 each time or count in 2s)
- d) Be able to use a method for adding and subtraction (see previous sections)
- e) Recall multiplication facts up to  $12 \times 12$  and derive division facts. e.g.  $5 \times 4 = 20$ , so  $20 \div 5 = 4$  and  $20 \div 4 = 5$
- f) Be able to show multiplication facts using **arrays**. You can show a number, e.g. 6, in several ways using pictures or objects



- g) That multiplication and division are **inverse** of each other. e.g.  $2 \times 6 = 12$  and  $12 \div 6 = 2$
  - h) Can find a **half** ( $\frac{1}{2}$ ) and a **quarter** ( $\frac{1}{4}$ ) of a group of objects or a whole number
  - i) Can **double** and **halve** numbers from 1 to 100 e.g. Double 4 is 8,  $4 \times 2 = 8$ ; half of 8 is 4,  $8 \div 2 = 4$
  - j) Know that division cannot be calculated in any order e.g.  $12 \div 4 = 3$  is not the same as  $12 \div 3 = 4$
1. Share objects into groups of equal size.
  2. Use dots/pictures and circles on paper e.g.  $24 \div 6 = 4$

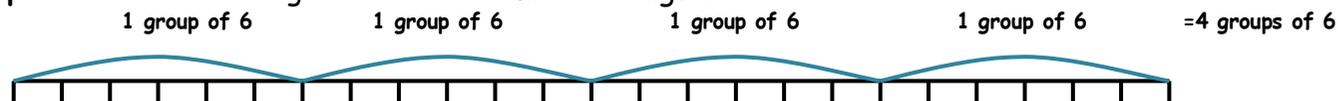


3. Use Numicon to divide numbers into chunks of equal size e.g.  $24 \div 6 = 4$



24 divided into groups (chunks) of 6  
There are 4 groups of 6 in 24

4. **Repeated addition** using a numbered **numberline** e.g.  $24 \div 6 = 4$



### Vocabulary

$\div$  Lots of  
 Groups of  
 Share  
 Group  
 Jumps  
 Numberline  
 Equal  
 Halve  
 Divide  
 Division  
 Divided by  
 Remainder  
 Factor  
 Decimal  
 Decimal place  
 Divisible

# Division

## Non-standard methods

Chunking is a type of division with several methods.

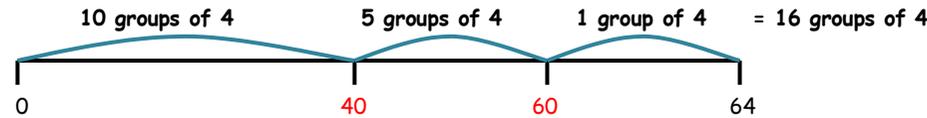
### Numberline Chunking

5. Use **Numberline Chunking** for 2-digit numbers divided by **single digit** numbers e.g.  $64 \div 4 = 16$

1) Use a table to write down the times tables facts for the **divisor** (4)

2) Draw a **numberline** starting at 0 and ending with the 'target number' (64)

3) Choose the 'mini answer' from the table that is closest to the 'target number' without going over



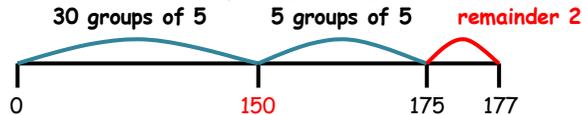
4) Record that 'mini answer' on the **numberline** and write how many 'groups' it was above the jump.

5) Which 'mini answer' can you add now to get closest to the 'target number' without going over?

6) Repeat until you end at the 'target number'. Count up how many 'groups' you have added. This is the answer.

<u>2 x 4</u>	<u>5x4</u>	<u>10 x4</u>
8	20	40
<u>20 x 4</u>	<u>50 x 4</u>	<u>100 x4</u>
80	200	400

6. Use **Numberline Chunking** for 3-digit numbers divided by **single digit** numbers with **remainders** (using more efficient jumps) e.g.  $177 \div 5$



7. Use **Numberline Chunking** for 3-digit numbers divided by **2-digit** numbers with **remainders**.

<u>2 x5</u>	<u>5x5</u>	<u>10 x5</u>
10	25	50
<u>20 x 5</u>	<u>50 x 5</u>	<u>100 x5</u>
100	250	500

### Column Chunking (current Year 4, 5 and 6)

8) Use **Column Chunking** for 2-digit numbers divided by **single digit** numbers e.g.  $64 \div 4 = 16$

1) Use a table to write down the times tables facts for the divisor (4)

2) Write the largest number and then choose which is the biggest group of 4 you can subtract (10 groups of 4 = 40). Subtract this from the 64.

3) Write the answer and then choose 'mini answer' you can subtract next (5 groups of 4 = 20)

6) Repeat until you are left with 0, then count up how many 'groups' you subtracted (16 groups of 4)

$$\begin{array}{r}
 64 \\
 - 40 \text{ (10 groups of 4)} \\
 \hline
 24 \\
 - 20 \text{ (5 groups of 4)} \\
 \hline
 4 \\
 - 4 \text{ (1 group of 4)} \\
 \hline
 0
 \end{array}$$

<u>2 x4</u>	<u>5x4</u>	<u>10 x4</u>
8	20	40
<u>20 x 4</u>	<u>50 x 4</u>	<u>100 x4</u>
80	200	400

9. Use **Column Chunking** for 3-digit numbers divided by **single digit** numbers with **remainders** (using more efficient chunks)

10. Use **Column Chunking** for 3-digit numbers divided by **2-digit** numbers with **remainders**.

# Division

## Standard Written Methods

11. Use the **Bus Stop Method** to divide a **2-digit** number by a **single digit** number e.g.  $80 \div 5 =$  without remainders

- 1) How many groups of 5 are in 8? 1. Write the '1' above the '8', on the line.
- 2) How many are left over? 1 group of 5 is 5, and there are 3 more to reach 8. Write this '3' next to the '0'
- 3) How many groups of 5 are in 30? 6. Write the '6' above the '0' on the line.
- 4) The answer is  $80 \div 5 = 40$

$$\begin{array}{r} 16 \\ 5 \overline{)80} \end{array}$$

12. Use the **Bus Stop Method** to divide a **2-digit** number by a **single digit** number with **remainders** e.g.  $83 \div 5 = 16r3$

$$\begin{array}{r} 16r3 \\ 5 \overline{)83} \end{array}$$

13. Use the **Bus Stop Method** to divide a **3-digit** number by a **single digit** number with **remainders** e.g.  $483 \div 5 = 96r3$

14. Use the **Bus Stop Method** to divide a **3-digit** number by a **single digit** number with a **decimal answer** e.g.  $483 \div 5 = 96.6$

- 1) Complete the steps until you reach the point where there would be a remainder THEN
- 2) Put a decimal point and two '0' after the big number
- 3) Put a decimal point after the last number on the line.
- 4) How many groups of 5 are in 30? '6'. Write the '6' above the line.

$$\begin{array}{r} 96.6 \\ 5 \overline{)483.00} \end{array}$$

15. Use the **Bus Stop Method** to divide a **4-digit** number by a **single digit** with a **decimal answer** eg.  $5483 \div 5$

16. Use the **Bus Stop Method** to divide a **decimal number** by a **single digit** number with a **decimal answer** e.g.  $83.7 \div 5 = 16.74$



11) What is  $5 \times 13$ ? 65. Write the 65 below the 70 and subtract it. Write the answer 5 underneath the '5'.

$$\begin{array}{r}
 035.5 \\
 \hline
 13 \overline{)462.00} \\
 \begin{array}{r}
 (3 \times 13 = 39) \quad - 39 \downarrow \\
 \hline
 72 \downarrow \\
 (5 \times 13 = 65) \quad - 65 \downarrow \\
 \hline
 70 \downarrow \\
 (5 \times 13 = 65) \quad - 65 \\
 \hline
 5
 \end{array}
 \end{array}$$

12) Bring down the next '0' and write it next to the '5'

$$\begin{array}{r}
 035.5 \\
 \hline
 13 \overline{)462.00} \\
 \begin{array}{r}
 (3 \times 13 = 39) \quad - 39 \downarrow \\
 \hline
 72 \downarrow \\
 (5 \times 13 = 65) \quad - 65 \downarrow \\
 \hline
 70 \downarrow \\
 (5 \times 13 = 65) \quad - 65 \downarrow \\
 \hline
 50
 \end{array}
 \end{array}$$

13) How many groups of 13 are in 50? 3. Write the '3' above the '0' on the answer line.

$$\begin{array}{r}
 035.53 \\
 \hline
 13 \overline{)462.00} \\
 \begin{array}{r}
 (3 \times 13 = 39) \quad - 39 \downarrow \\
 \hline
 72 \downarrow \\
 (5 \times 13 = 65) \quad - 65 \downarrow \\
 \hline
 70 \downarrow \\
 (5 \times 13 = 65) \quad - 65 \downarrow \\
 \hline
 50
 \end{array}
 \end{array}$$

14) What is  $3 \times 13$ ? 39. Write '39' below the '50' and subtract it. Write the answer '11' underneath the '5'.

$$\begin{array}{r}
 035.53 \\
 \hline
 13 \overline{)462.00} \\
 \begin{array}{r}
 (3 \times 13 = 39) \quad - 39 \downarrow \\
 \hline
 72 \downarrow \\
 (5 \times 13 = 65) \quad - 65 \downarrow \\
 \hline
 70 \downarrow \\
 (5 \times 13 = 65) \quad - 65 \downarrow \\
 \hline
 50 \\
 (3 \times 13 = 39) \quad - 39 \\
 \hline
 11
 \end{array}
 \end{array}$$

15) Now there are two decimal places in the answer, you can stop working...

16) ...unless you are going to find 3 decimal places and then round to 2 decimal places

18. Use Long 'Bus Stop' Division to divide a **3-digit** decimal number by a **2-digit** number with a **decimal answer** e.g.  $462.7 \div 13 = 35.59$

19. Use Long 'Bus Stop' Division to divide a **4-digit** decimal number by a **2-digit** number with a **decimal answer** e.g.  $2462.7 \div 13 = 189.44$