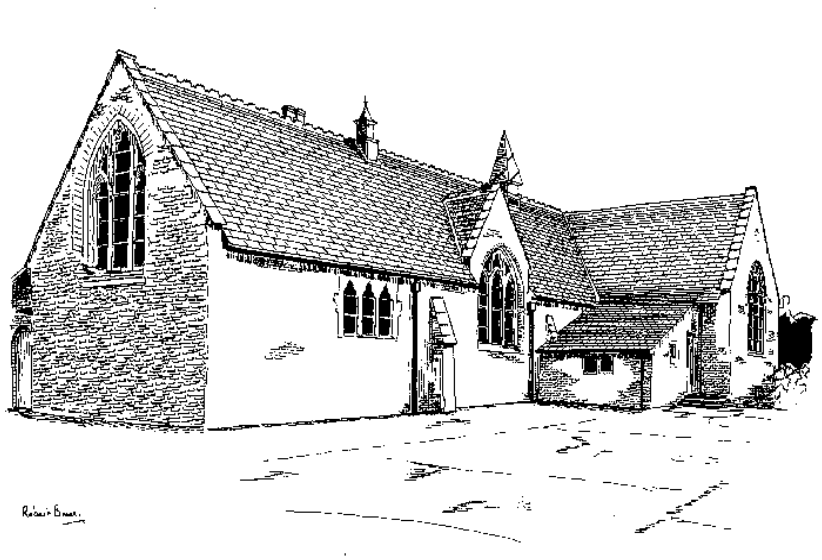
Mathematics

Booklet for Parents



Buckland CE Primary School

Introduction

The purpose of this booklet is to summarize the various calculation methods that children are taught as they progress through the school, many of which are different to the methods that you may have been taught in your primary school days. Included in the booklet are also various ideas and suggestions for maths activities that you can enjoy doing with your child at home.

Within the new mathematics curriculum, there are 4 key strands:

- Number:
    - Place value
    - Calculation: all four operations of addition, subtraction multiplication and division
    - Fractions
- Measurement
- Geometry
    - Properties of shapes
    - Position and direction
- Statistics

In year 6, pupils also learn algebra and ratio and proportion.

The aims of the study are to encourage pupils to become fluent with mental mathematics, be able to reason mathematically and solve problems. Calculation is an important strand within the mathematics programme of study. Pupils begin to learn calculation through mental methods first before progressing onto written methods. In addition, they are taught informal methods before learning the formal written methods of calculation. Whilst children are taught more formal written methods as they progress through the school, they are still encouraged to think about mental strategies they could use first and only use written methods for those calculations they cannot solve in their heads.

The children are taught a range of methods as this enables them to understand the mathematics behind the calculations and choose the method which they feel most able to use. The calculation methods are also more efficient with some calculations than others, which is why the children are taught to consider the appropriate method to use before calculating. Additionally, the children are encouraged to estimate and give an approximate answer to their calculations before completing them so that they are thinking mathematically about the calculations.

Teaching these methods, staff develop the children's mathematical thinking skills by developing the pupil's understanding for example with place value and how the digits move places, particularly when multiplying and dividing numbers by 10, 100 and 1000. They develop the pupil's understanding of how numbers are combined and are partitioned. The methods for all of the four operations are made explicit on the next pages and demonstrate the progression from stage 1 to 6.

Calculation methods

In order for pupils to develop their written calculations, they need to be fluent with mental mathematics and therefore, the mental methods are taught primarily as a foundation to the written methods. The calculation methods are developed through the years with each year building on the previous. Outlined below are the calculation methods for each operation. It is important particularly with the compact methods in the upper years, that the children develop a conceptual understanding of these calculation methods. Therefore, pupils are taught to understand each step of the process of each method by thinking mathematically.

Addition

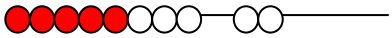
Foundation Stage
The teaching of addition begins in Foundation Stage with counting. They learn to count forwards and backwards from numbers using number tracks and combine amounts using practical resources. At this stage it is important that pupils develop their use of language related to the mathematics they are learning and that they begin to recognise for example, that 'more than', 'add' and 'altogether' are all related to addition.

Stage 1
Moving into stage 1, pupils continue to use practical resources to add numbers such as Numicon and bead strings.

A number track is used to complete jumps.

3 + 2 = 5

Two sets of objects are combined.



Bead strings are used for making number bonds.

5.

Numicon is used to add number bonds within 10: 2 + 3= 5, 1 + 4 =

'eight add two more makes ten'
'one more than four is five'

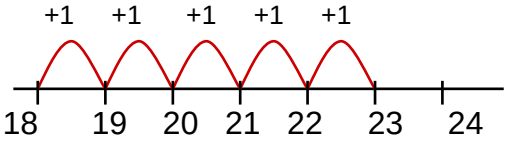
At this stage, it is important that the pupils learn by memory the number bonds within 10 as these are used in the later years with calculations involving larger numbers.

5 = 3 + 2 and 4 + 1
6 = 3 + 3 and 4 + 2 and 5 + 1

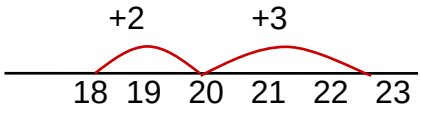
Stage 2

Progressing into stage 2, the pupils learn to add numbers using structured apparatus to support understanding of place value. They make connections between partitioning both numbers using resources and the number line.
They learn to add numbers using a number line, counting on from any number in ones to begin with and counting on from the largest number.

18 + 5



…to…

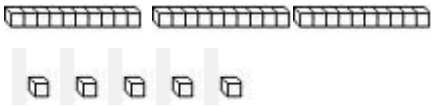


Using resources, the pupils solve addition problems such as:
'How might I rearrange these to find the total?'

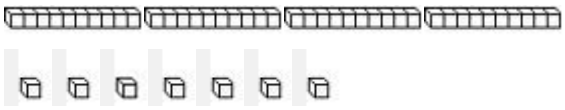
Stage 3

Progressing into stage 3, pupils begin to partition numbers into tens and ones and some may begin to partition into hundreds, tens and ones. Using resources, pupils learn to use the expanded horizontal addition method. They begin to make connections between partitioning and the use of the number line.

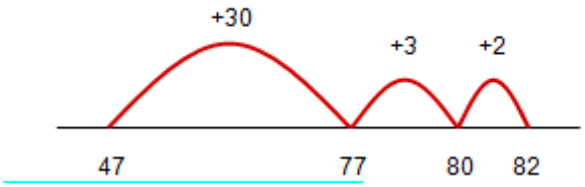
Add…



…and…



35 + 47



At this stage, it is important that the pupils learn the number bonds to 100 as these support them when calculating with larger numbers:

10 + 90 = 100	40 + 60 = 100
20 + 80 = 100	50 + 50 = 100
30 + 70 = 100	60 + 40 = 100

By partitioning and recombining

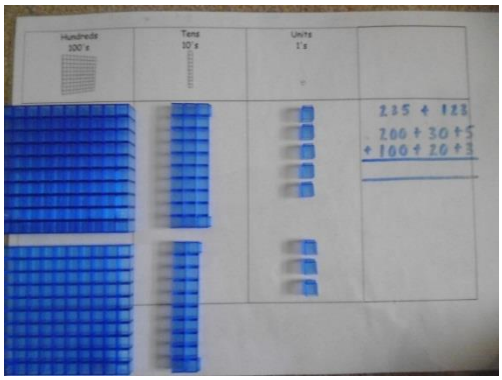
30+ 40 = 70

5 + 7 = 12

70 + 12 = 82

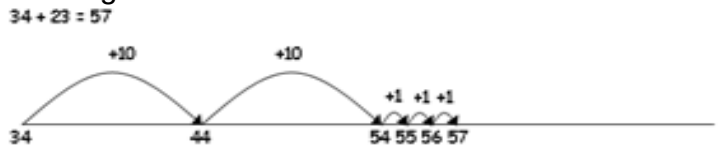
Stage 4

After learning the expanded horizontal method, pupils begin to use columnar addition for adding using resources to develop an in-depth understanding of the place value of the digits.

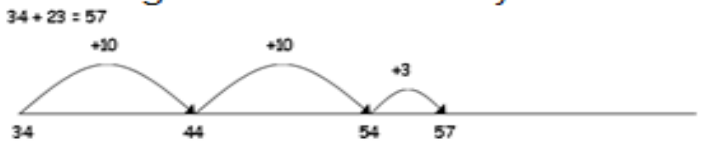


They continue to use the number line with larger numbers, partitioning the numbers to add in jumps of tens numbers as well as ones.

Counting on in tens and ones to solve addition calculations:



Counting on more efficiently:



Stage 5

At this stage the children begin to use informal written methods of addition. They learn to add in columns, beginning with 2-digit numbers. As the pupils become more confident with the place value of numbers, they learn to use the column method for adding two 3-digit numbers.

Expanded vertical method, leading to columnar addition:

Informal columnar:
Adding the tens first:

$$\begin{array}{r} 47 \\ +\ 76 \\ \hline 110 \\ 13 \\ \hline 123 \end{array}$$

Adding the ones first:

$$\begin{array}{r} 47 \\ +\ 76 \\ \hline 13 \\ 110 \\ 123 \end{array}$$

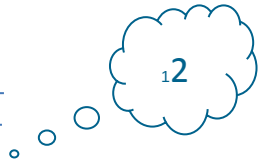
Stage 6

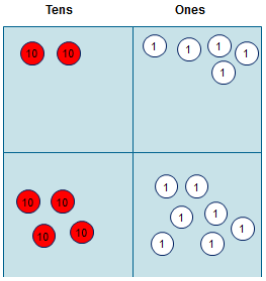
As pupils become more confident with the informal column method for addition, they learn to use formal column methods. Whilst learning this method, the pupils develop their understanding of 'exchange', whereby for example, ones are exchanged for a ten. Pupils are encouraged to consider mental strategies first as they support their understanding of the formal calculation methods.

Formal columnar:

25
+47

25
+47
72
1





587
+ 475
1062
1 1

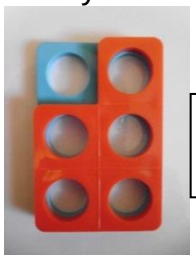
Subtraction

Foundation Stage

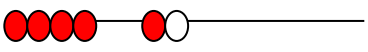
The teaching of subtraction begins in Foundation Stage with counting back. They learn to count backwards using number tracks and to subtract amounts using practical resources. They also sing songs such as '10 green bottles'. At this stage it is important that pupils develop their use of language related to the mathematics they are learning and that they begin to recognise for example, that 'less than', 'subtract' and 'how many left' are all related to subtraction.

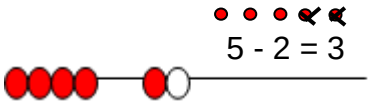
Stage 1

In the early stages, the children begin to learn **subtraction as taking away from a group.** The children use a range of practical equipment to help them understand the concept. The children use number tracks to count back or remove counters/objects from the number track or set. They subtract using beads on strings, by removing counters from a set and using Numicon. As with addition, it is important at this stage that the children develop a good knowledge of mathematics vocabulary.



'one less than six is five'





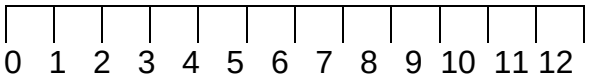
'six take away two leaves four'

Stage 2

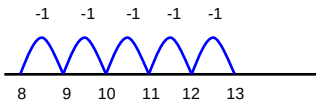
Counting back and on

At Stage 2, the children begin to use numbered lines to support their own calculations, initially counting back in ones before beginning to count in larger numbers.

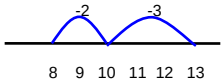
Structured number line with all numbers labelled



13 – 5 = 8



13 – 5 = 8

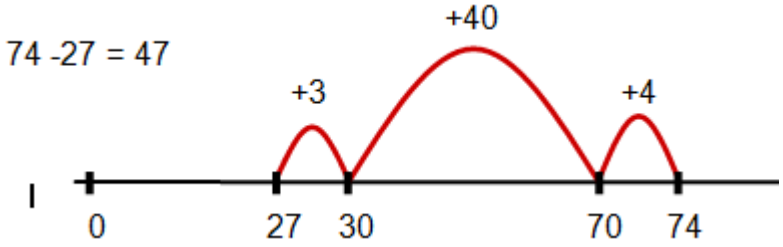


Stage 3

Finding the difference:

Teachers model how to find the difference when two numbers are relatively 'close together.' Initially children compare two sets before moving on to a number line comparison. **Pupils are taught to choose whether to count on or back** depending on which is more efficient.

Use empty number lines to find the difference by bridging through multiples of ten.



Subtract by starting with the first number and partitioning the second, i.e.

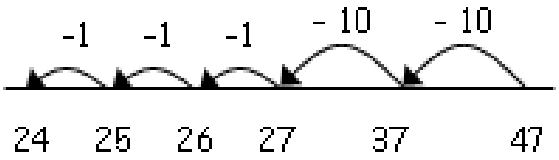
74 - 27
74 – 20 = 54
54 – 4 = 50
50 – 3 = 47

Stage 4

At stage 4, children continue to use empty number lines and use more formal written methods when numbers become too big or complex.

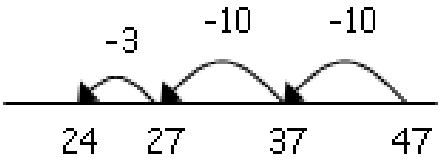
Counting back in tens and ones to solve an addition calculation:

47 – 23 = 24



Counting back more efficiently:

47 – 23 = 24



Stage 5

As they become more confident with this, they begin to develop their understanding of the expanded method of subtraction by partitioning numbers into their place value.

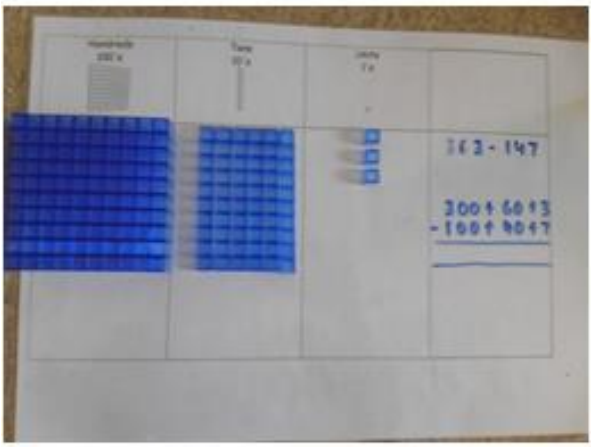
363 – 147 = 216

50 13

~~300~~ + ~~60~~ + 3

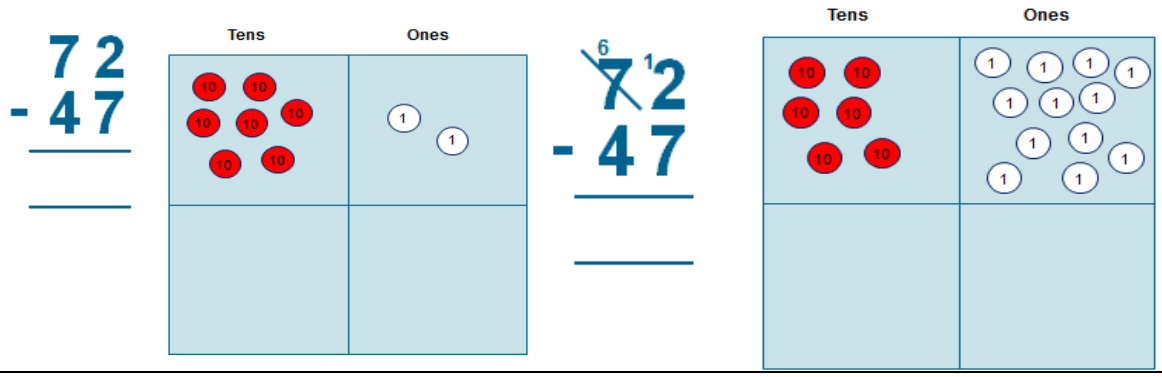
100 + 40 + 7

200 + 10 + 6 = 216



Stage 6

Finally, at stage 6 the children progress from the expanded method of subtraction to the compact method. The concept of exchange is modelled



Multiplication

Stage 1

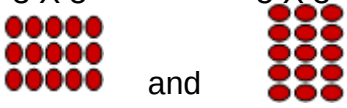
The pupils begin to develop an early conceptual understanding of multiplication using objects, pictorial representations and arrays.

Stage 2

In the next stage, pupils develop their understanding of multiplication as repeated addition. They continue to use arrays to multiply two numbers together, understanding that with multiplication the numbers can be multiplied both ways.

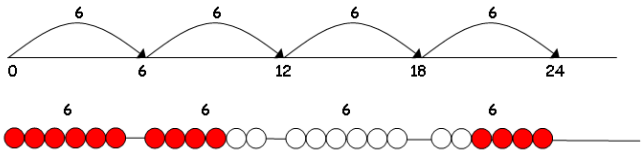
Arrays:

3 X 5 and 5 X 3



Number lines:

6 X 4 = 24

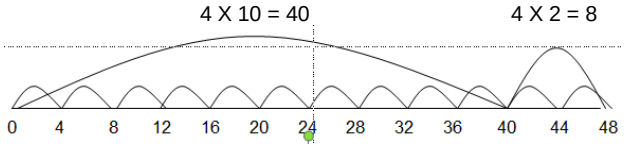


So: ‘Six taken four times”

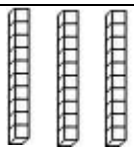
Stage 3

At stage 3, the children continue to relate multiplying a 2-digit by 1-digit number using repeated addition and arrays.
Children use an empty number line to multiply 'chunk's efficiently:

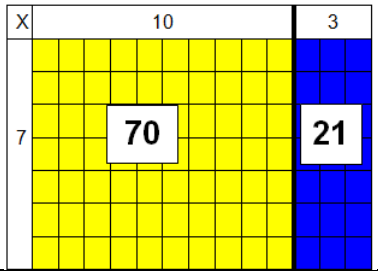
4 X 12 = 48



They begin to multiply 2-digit by 1-digit numbers on a grid, partitioning the numbers into their place value:
3 X 13 = 39

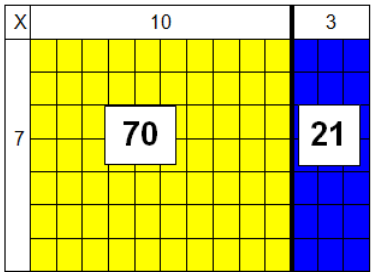
X	10	3
3		

This is then connected with the visual image of an array:
7 X 13 = 91



Stage 4

As they progress into stage 4, children connect the array grids with long and short multiplication. At this stage that the two methods are shown alongside each other so that the pupils can see how they connect.

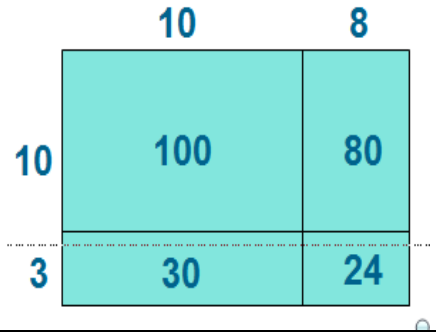


7 X 13 = 91

7 X 10 = 70
7 X 3 = 21
= 91

Stage 5

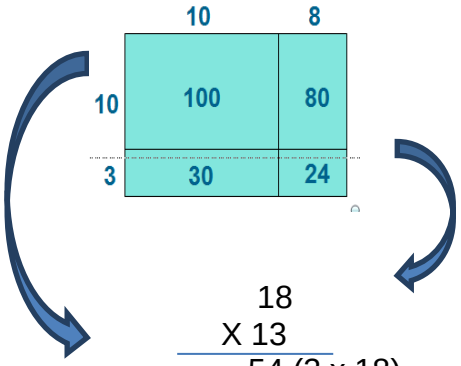
Progressing onto stage 5, the children continue to learn the grid method alongside the method of long multiplication with 2, 3 and 4-digit numbers. They learn to multiply the numbers without the support of the visual image of an array.



	TO
	18
	X 13
	24
	3 0
	8 0
+	1 0 0
	2 3 4

Stage 6

Progressing onto stage 6, children continue to relate multiplying a 4/3/2-digit by 1/2-digit number with grid to using short multiplication. As you can see, the expanded method above has been compact. Hence this is called compact multiplication.

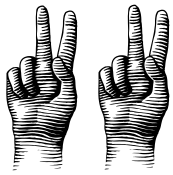


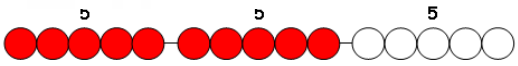
18
X 13
54 (3 x 18)
2
+ 180 (10 x 18)
234 (13 x 18)

Division

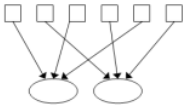
Stage 1

Stage 1 begins with developing pupils' early conceptual understanding of division as grouping and sharing**.** Pupils use objects, pictorial representations and arrays to show the concept of division as grouping and sharing.



"Two children share six pencils between them." How many pencils do they each get?

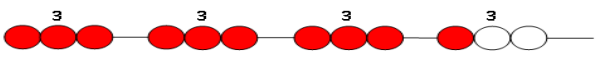


"Six children are asked to get into groups of two." How many groups of 2 are there?

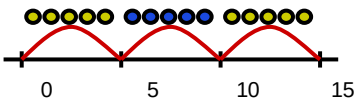
Stage 2

At this stage, the pupils begin to develop their understanding of division as repeated subtraction by investigating division as repeated subtraction using number lines and arrays.

12 ÷ 3 = 4



15 ÷ 5 = 3



Stage 3

Progressing into stage 3, the pupils begin to learn to divide a 2-digit by 1-digit number, using a number line to divide by 'chunks'.

96 ÷ 6 = 16

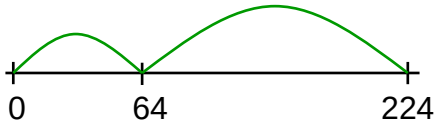
6 x 6 = 36 10 x 6 = 60

Stage 4

As pupils progress into stage 4, pupils continue to use a number line to divide a 3/2-digit by 1-digit. They begin to connect the number line chunking with the more formal chunking method.

224 ÷ 8 = 28

8 x 8 = 64 20 x 8 = 160




```
    28                                    28
 8 | 224                               8 | 224
   - 160   (8 X 20)          20 X 8 =  160
     64          …or…                    64
   -  64   (8 X 8)             8 X 8 =   64
 0
```

Stage 5

At stage 5, the pupils divide 4, 3 and 2-digit numbers by 1-digit numbers using long division. By this stage pupils are ready to use a formal written calculation method, such as long division. Pupils begin to understand remainders as whole numbers, fractions and through rounding in an appropriate way to the context.

Long division:

415 ÷ 9 = 46 and 1/9

```
      46 and 1/9
9 | 415
  - 0
   ³4¹1
  - 36
     55
   - 54
      1 of 9 left over
```

Stage 6

In the final stage, pupils learn to divide a 4/3/2-digit by 2/1-digit number using long and then short division. By this stage, the children can use formal written calculation methods, including long and short division.

Long division:

432 ÷ 15 = 28 4/5

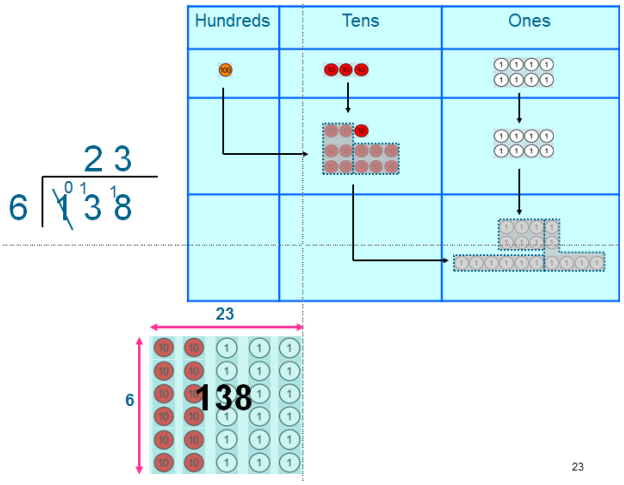
```
      28 and 4/5
15 | 432
   - 0
     43
   - 30
     132
   - 120
      12
```

12 of 15 left over = 12/15 which simplifies to 4/5 (by dividing the numerator & denominator by 3)

Short division:

138 ÷ 6 = 23

```
    2 3
6 | 1 3 8
```



Practising number facts

Outlined below are ideas for how to help your child at home with practising their rapid recall and mental mathematics facts.

- Find out which number facts your child is learning at school (addition facts to 10, times tables, doubles etc). Try to practise for a few minutes each day using a range of vocabulary.
- Have a 'fact of the day'. Pin this fact up around the house. Practise reading it in a quiet, loud, squeaky voice. Ask your child over the day if they can recall the fact.
- Play 'ping pong' to practise complements with your child. You say a number. They reply with how much more is needed to make 10. You can also play this game with numbers totalling 20, 100 or 1000. Encourage your child to answer quickly, without counting or using fingers.
- Throw 2 dice. Ask your child to find the total of the numbers (+), the difference between them (-) or the product (x). Can they do this without counting?
- Use a set of playing cards (no pictures). Turn over two cards and ask your child to add or multiply the numbers. If they answer correctly, they keep the cards. How many cards can they collect in 2 minutes?
- Play Bingo. Each player chooses five answers (e.g. numbers to 10 to practise simple addition, multiples of 5 to practise the five times tables). Ask a question and if a player has the answer, they can cross it off. The winner is the first player to cross off all their answers.
- Give your child an answer. Ask them to write as many addition sentences as they can with this answer (e.g. 10 = □ +□). Try with multiplication or subtraction.
- Give your child a number fact (e.g. 5+3=8). Ask them what else they can find out from this fact (e.g. 3+5=8, 8-5=3, 8-3=5, 50+30=80, 500+300=800, 5+4=9, 15+3=18). Add to the list over the next few days. Try starting with a x fact as well.

Counting ideas

- Practise chanting the number names. Encourage your child to join in with you. When they are confident, try starting from different numbers - 4, 5, 6 . . .
- Sing number rhymes together - there are lots of commercial tapes and CD's available.
- Give your child the opportunity to count a range of interesting objects (coins, pasta shapes, buttons etc.). Encourage them to touch and move each object as they count.
- Play games that involve counting (e.g. snakes and ladders, dice games, games that involve collecting objects).
- Look for numerals in the environment. You can spot numerals at home, in the street or when out shopping.
- Cut out numerals from newspapers, magazines or birthday cards. Then help your child to put the numbers in orders.
- Make mistakes when chanting, counting or ordering numbers. Can your child spot what you have done wrong?
- Choose a number of the week e.g. 5. Practise counting to 5 and on from 5. Count out groups of 5 objects (5 dolls, 5 bricks, 5 pens). See how many places you can spot the numeral 5.

How to help your child with real life problems

- Go shopping with your child to buy two or three items. Ask them to work out the total amount spent and how much change you will get.
- Buy some items with a percentage extra free. Help your child to calculate how much of the product is free.
- Plan an outing during the holidays. Ask your child to think about what time you will need to set off and how much money you will need to take.
- Use a TV guide. Ask your child to work out the length of their favourite programmes. Can they calculate how long they spend watching TV each day / each week?
- Use a bus or train timetable. Ask your child to work out how long a journey between two places should take? Go on the journey. Do you arrive earlier or later than expected? How much earlier/later?
- Help your child to scale a recipe up or down to feed the right amount of people.
- Work together to plan a party or meal on a budget.