Alsager Highfields Foundation Primary School

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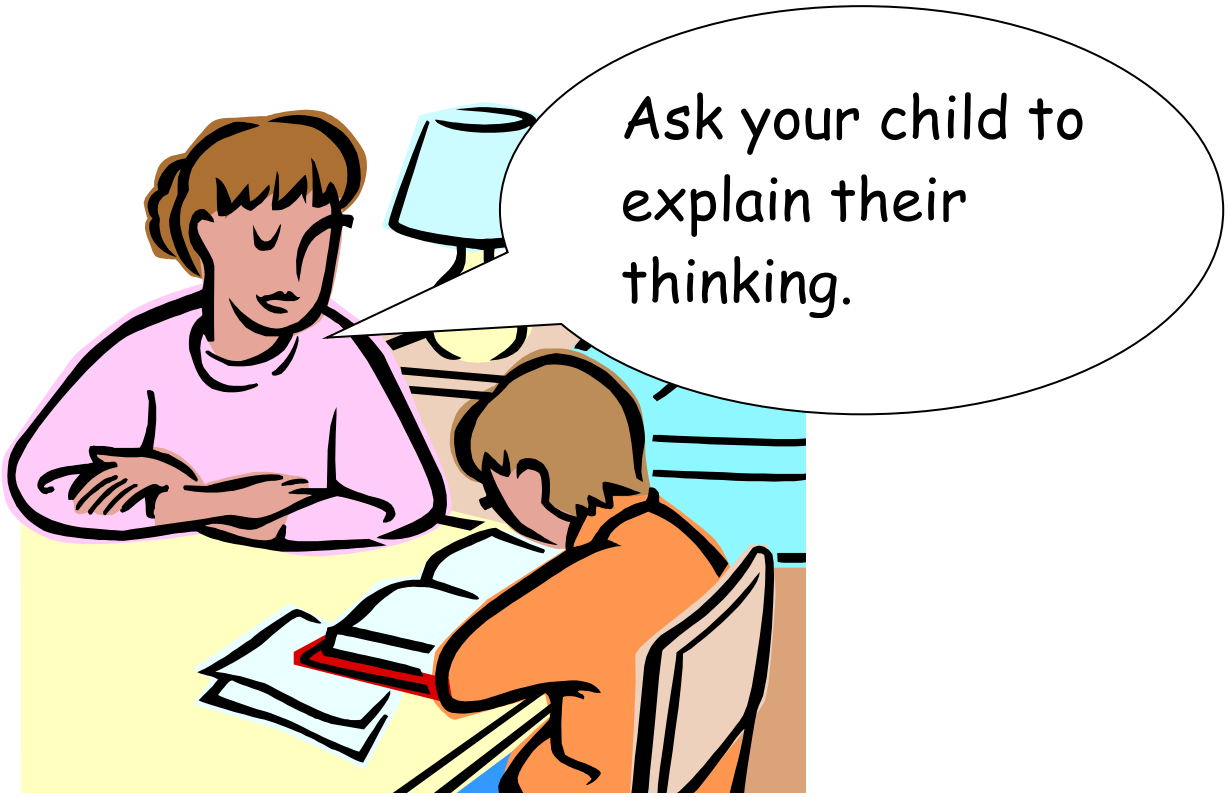
ST7 2NW

Calculation

A guide for parents

Calculation

The maths work your child is doing at school may look very different to the kind of 'maths' you remember. This is because children are encouraged to work mentally, where possible, using personal jottings to help support their thinking. Even when children are taught more formal written methods (during Key Stage 2) they are still encouraged to use mental strategies to solve the calculation.



When faced with a calculation problem, encourage your child to ask:

- Can I do this in my head?
- Could I do this in my head using drawings or jottings to help me?
- Do I need to use a written method?

Also help your child to estimate and then check the answer. Encourage them to ask:

Is the answer sensible?

ADDITION

Children are taught to understand addition as combining 2 sets and counting on.

A progression from Reception to Y6

<u>Children combine two sets and count all</u>

2 + 3 = 5

Add

At a party, I eat 5 cakes and my friend eats 3.
How many cakes did we eat **altogether?**

7 people are on the bus, 4 **more** get on at the next stop. How many people are on the bus now?

Children need to be secure with counting forwards and backwards

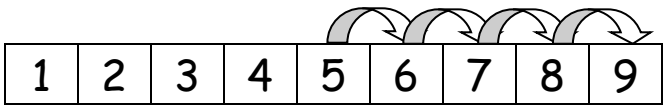
Working practically or drawing a picture helps children to visualise the problem.

Children are encouraged to progress towards using dots or marks.

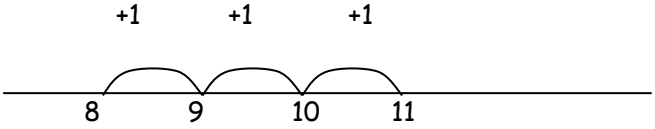
We introduce the language of "What is 1 more, 1 less..."

Counting on from the larger number

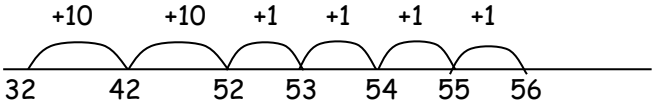
5 + 4 = 9



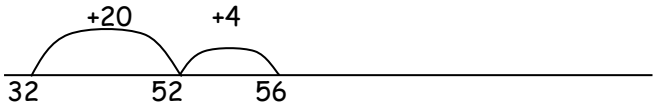
8 + 3 = 11



What is 32 + 24?



Leading to:



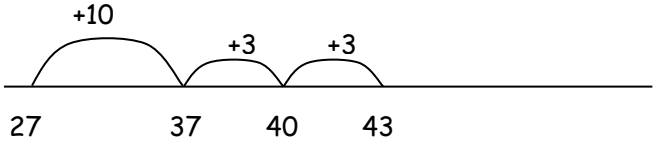
Children use number tracks to help them count on from the larger number.

Children are then introduced to a blank number line where the steps that they count on are represented with jumps. They fill in the numbers on the bottom line.

Children then count up using an empty number line, this is a good way for them to record the steps they have taken.

Bridging through a ten

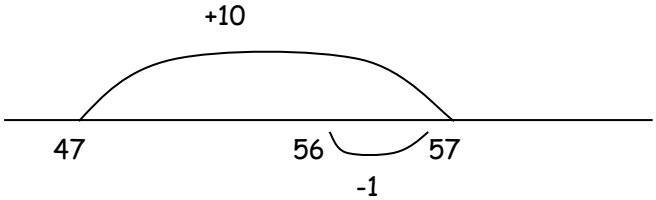
What is the total of 16 and 27?



Children can use a number line to help them <u>bridge</u> through a multiple of 10.

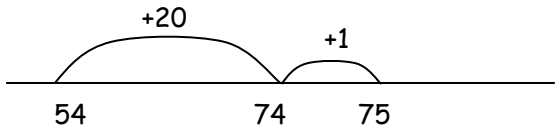
Compensating

47 + 9 = 47 + 10 – 1



Children also use number lines to add near multiples of 10. We call this <u>compensating</u>.

54 + 21 = 54 + 20 + 1



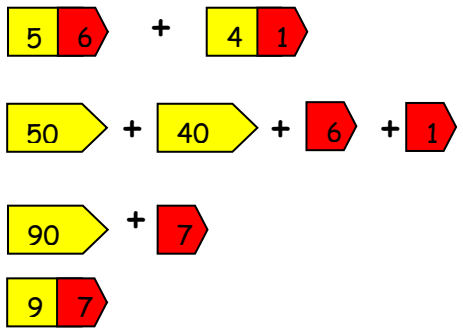
Number Bonds

0 + 10 = 10	0 + 20 = 20
1 + 9 = 10	1 + 19 = 20
2 + 8 = 10	2 + 18 = 20
3 + 7 = 10	3 + 17 = 20
and so on	and so on

It is vital that the children learn the number bonds to 10, 20 and then 100 and beyond off by heart.

Partitioning

56 + 41 =



An expanded approach is introduced when the children are secure with the mental calculation methods of counting on in ones and tens. They partition the numbers into tens and units.

142 + 36 =

100 + 0 = 100
40 + 30 = 70
2 + 6 = 8
100 + 70 + 8 = 178

Initially children will add the most significant digit first (i.e.working from left to right).

	5	4	6	
+	4	8	7	
		1	3	(6 + 7)
	1	2	0	(40 + 80)
	9	0	0	(500 + 400)
1	0	3	3	

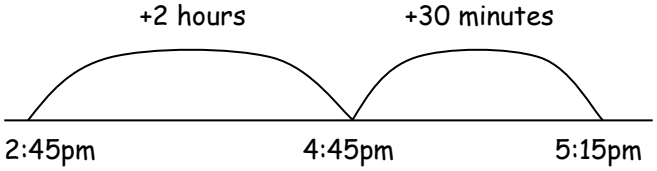
Children progress to working from the least significant digit first, i.e. units, but still need to read the numbers as 6 +7, 40 + 80, 500 + 400, to secure full understanding of the approach used.

$$\begin{array}{r} 5\ 4\ 6 \\ +\ 4\ 8\ 7 \\ \hline 1\ 0\ 3\ 3 \\ \hline \quad 1\ \ 1 \end{array}$$

We **carry** the ten units into the tens column and ten hundreds into the hundreds column.

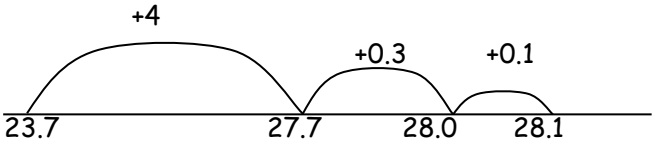
$$\begin{array}{r} £\ 1\ 6\ 7\ .\ 8\ 0 \\ £\quad 3\ 2\ .\ 7\ 7 \\ £\quad 7\ 5\ .\ 3\ 7 \\ \hline £\ 2\ 7\ 5\ .\ 9\ 4 \\ \hline \quad 1\ \ 1\ \ 1\quad\ \ 1 \end{array}$$

The train leaves at 2:45pm and arrives 2 ½ hours later. What time did the train arrive?



The train arrives at 5:15pm

23.7 + 4.4 =



The compact method is only used when the children are confident in using the expanded approach.

This method is used when numbers, including decimal numbers and money, are too large to handle in their head.

Children are encouraged to use a blank number line to solve money, time, decimal and other calculations whenever possible.

Children are encouraged to:

- **Use the most efficient method to solve a given calculation,**
- **Gain a sense of the size of the expected answer before they begin,**
- **See if their answer seems reasonable,**
- **Check their working, perhaps by doing the inverse.**

SUBTRACTION

Children are taught to understand subtraction as taking away (counting back) and finding the difference (counting up)

A progression from Reception to Y6

5 – 2 =

I had five balloons. Two burst. How many do I have left?

Take away

Physically taking away the number of objects from a set of objects is the first step.

A teddy bear costs £5 and a doll costs £2. **How much more** does the bear cost?

Find the difference

Drawing a picture helps children to visualise the problem.

We count up from 2 to 5 to find out how much more it costs.

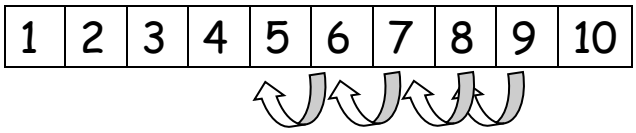
Lisa has 5 felt tip pens and Tim has 2. **How many more** does Lisa have?

● ● ● ● ●

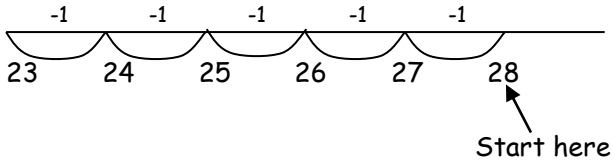
● ●

Children are encouraged to progress towards using dots or making marks.

9 – 4 = 5

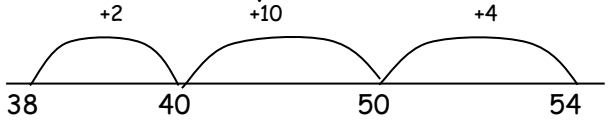


There are 28 children in a class. 5 have sandwiches for lunch. How many have a hot dinner?
28 – 5 = 23



23 children have a hot dinner.

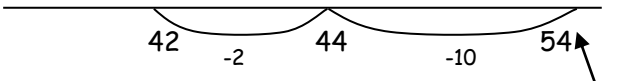
The baker makes 54 loaves of bread and sells 38. How many does he have left?



2 + 10 + 4 = 16

54 – 38 = 16

The baker makes 54 loaves of bread but burns 12 of them. How many can he sell?



54 – 12 = 42

Start here

Children use a number track to count back along.

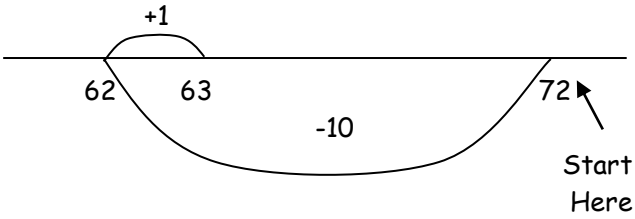
Children are then introduced to a number line where the steps they count back are represented with jumps, we jump under the number line when counting back. They fill in the numbers below the number line.

Children can move on to counting on or back putting the jumps on an empty number line themselves. It helps them <u>bridge</u> through multiples of 10.

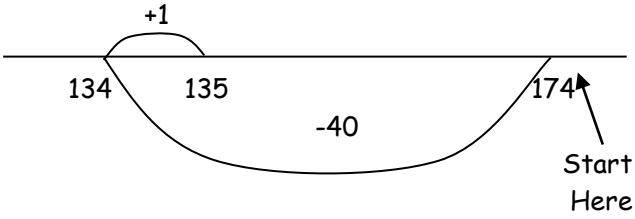
As a rule of thumb if the numbers are closer together, e.g. 54 – 38, count up to find the difference. If the numbers are further apart, e.g. with 54 – 12, take away.

Compensating

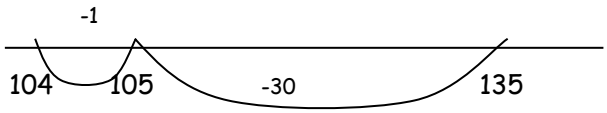
72 – 9 = 72 – 10 + 1



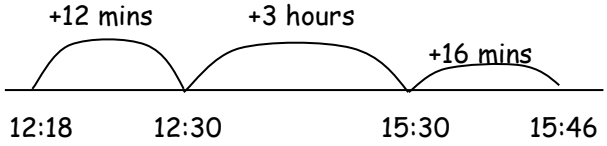
174 – 39 = 174 – 40 + 1



135 – 31 = 135 - 30 - 1

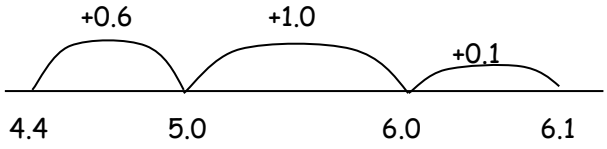


The train leaves at 12:18 and arrives at 15:46. How long is the journey?



The journey takes 3hr 28 min.

6.1 – 4.4 = 1.7



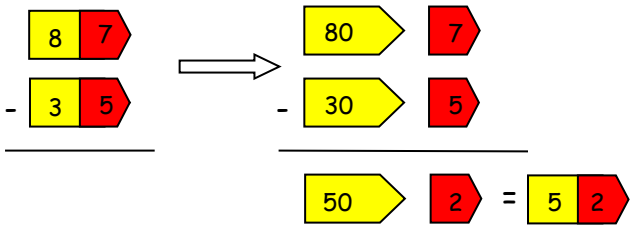
0.6 + 1 + 0.1 = 1.7

The children also use number lines to subtract near multiples of 10. We call this <u>compensating</u>.

Children are encouraged to use the most efficient method to solve a given calculation, therefore you may see children using a blank number line to solve money, decimal, time and other appropriate calculations.

Partitioning

87 – 35 =



This expanded approach is introduced when children are secure with mentally counting on and back in ones and tens over multiples of ten and hundred.

63 – 39 =

60 and 3 Exchange 60 into 50 and 10
- 30 and 9

50 and 13
- 30 and 9
20 and 4

$$\begin{array}{r} {}^{5}\cancel{6}\ {}^{1}3 \\ -\ 3\ \ 9 \\ \hline 2\ \ 4 \end{array}$$

563 – 248 =

500 and **60 and 3** Exchange 60 into 50 and 10
- 200 and 40 and 8

500 and 50 and 13
- 200 and 40 and 8
300 and 10 and 5

$$\begin{array}{r} 5\ {}^{5}\cancel{6}\ {}^{1}3 \\ -\ 2\ \ 4\ \ 8 \\ \hline 3\ \ 1\ \ 5 \end{array}$$

This is used to develop a more compact method. The word 'and' is used to show what the numbers are partitioned into and is preferred to '+' so as not to confuse addition with subtraction. Numbers are 'exchanged' (not borrowed) to enable the children to complete the process.

When the children understand that they are exchanging a ten for ten ones they can move on to the compact method.

The compact method hides the understanding and can confuse children – 'I know I need to cross out but which numbers?' They may not reach this stage until they are in Key Stage 3.

MULTIPLICATION

Children are taught to understand multiplication as repeated addition. Knowing their 'times tables' is essential, starting with counting in, e.g. 4s but then knowing that, e.g. 8 x 4 is 32 without having to count up.

A progression from Reception to Y6

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

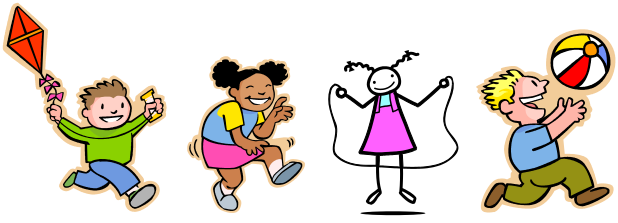
Doubling

Double 3 = 

Or 3 x 2 

4 x 2

Each child has two feet. How many feet do four children have?



2 + 2 + 2 + 2

4 groups of 2 or 4 x 2

Children are introduced to multiplication by counting on and back in equal steps of ones, twos, fives and tens.

Children learn doubles to 10, 20 and beyond, they use doubles to solve near doubles calculations.

Working practically or drawing a picture helps children to visualise the problem.

Tables are taught visually to start with. Later move towards written method:

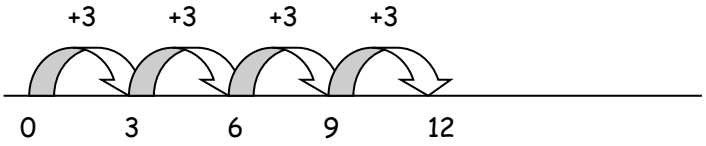
1 group of 2 = 2
2 group of 2 = 4
3 group of 2 = 6
4 group of 2 = 8
5 group of 2 = 10

3 x 6

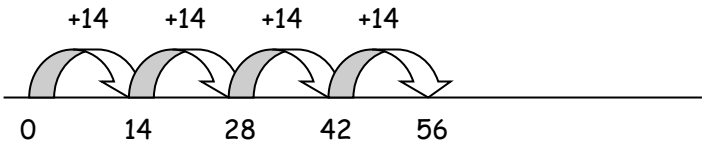
There are 6 eggs in a box. How many eggs in 3 boxes?

6 + 6 + 6

4 x 3



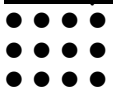
4 x 14



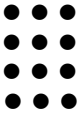
Dots or tally marks are often drawn in groups. This shows 3 groups of 6.

Children can count on in equal steps using an empty number line. This shows 4 jumps of 3.

Arrays



3 lots of 4
3 x 4



4 lots of 3
4 x 3

Doubling to x2, x4, x6, x8

372 x 2 (double hundreds, tens and units)

600 + 140 + 4

13 x 4 =

13 x 2 = 26

26 x 2 = 52 (double and double again)

9 x 8 =

9 x 2 = 18

18 x 2 = 36

36 x 2 = 72 (double, double and double again)

12 x 6 =

12 x 3 = 36

36 x 2 = 72 (x3 then double)

Drawing an array (3 rows of 4 or 4 rows of 3) gives children an image of the answer. It also helps to develop the understanding than 4 x 3 has the same value as 3 x 4.

Learning and applying knowledge of doubles supports children in multiplication.

Children are taught to use their knowledge of doubles to multiply in their heads.

Grid Method

14 x 7 = 98

x	10	4
7	70	28

70 + 28 = 98

342 x 3 = 1026

x	300	40	2
3	900	120	6

900 + 120 + 6 = 1026

17 x 14 =

x	10	7
10	100	70
4	40	28

100 + 70 + 40 + 28 = 238

Expanded Vertical Multiplication

38 x 7 =

$$\begin{array}{rrr} & 3 & 8 \\ \times & & 7 \\ \hline & 5 & 6 \\ 2 & 1 & 0 \\ \hline 2 & 6 & 6 \\ \hline \end{array}$$

(8 x 7)

(30 x 7)

When numbers get bigger, it is inefficient to do lots of jumps on a number line or to draw an array.

Children progress to the grid method. When calculating 14 x 7, 14 is partitioned into 10 and 4, and each of these two is multiplied by 7. The two answers are then added together.

This method is also used with larger numbers. Again partition the numbers and multiply each part. Add the numbers together.

Children need a secure recall of 'times tables' facts to successfully use the grid method of multiplication.

The next step is the expanded vertical method, allowing children to complete each step on a new line.

Short Multiplication

$$\begin{array}{rr} & 38 \\ \times & 7 \\ \hline 266 \\ \hline & {\scriptstyle 5} \end{array}$$

$$\begin{array}{rrrr} & 4 & 5 & 9 \\ \times & & 3 & 8 \\ \hline 3 & 6 & 7 & 2 \\ 13 & {\scriptstyle 4}7 & {\scriptstyle 7}7 & 0 \\ \hline 17 & 2 & 4 & 2 \\ \hline & {\scriptstyle 1} & {\scriptstyle 1} & \end{array}$$

(459 x 8)

(459 x 30)

They can then move onto the compact vertical method.

For this method to be fairly error free, children need:

- **a secure recall of 'times tables',**
- **an understanding of why to place a 0 when multiplying by the tens,**
- **to be confident at adding vertically.**

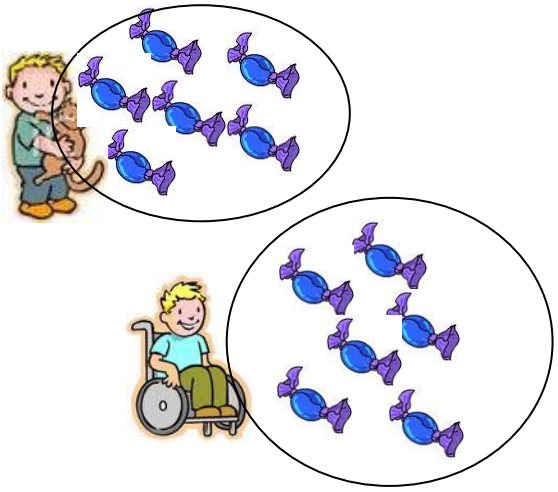
DIVISION

Children are taught to understand division as sharing, halving, grouping and chunking.

A progression from Reception to Y6

Sharing between two

There are 12 sweets and 2 children. They share the sweets equally, how many sweets does each child have?



Each child has 6 sweets.

Sharing is a skill children come to school with. 'One for me, one for you' is repeated subtraction of one.

Working practically or drawing a picture helps children to visualise the problem.

In this example children 'share' the 12 sweets between the two children until there are none left.
They count how many in each group.

Grouping in threes

There are 12 sweets and each party bag needs three sweets. How many party bags can be made?

There are 4 party bags

Children progress to removing 'groups' of a number. In this example children put 'groups of three sweets' into the party bags until they have no sweets left.
They count how many groups.

12 ÷ 4 = 3

4 apples are packed in a basket.
How many baskets can you fill with 12 apples?

●●●● ●●●● ●●●●

Dots or tally marks are often drawn in groups. This shows 3 groups of 4.

Halving

Children learn that halving is the opposite of doubling. They learn halves of even numbers to 10 and 20 then they learn to apply their knowledge to 2, 3 and 4 digit numbers.

Half of 12 = 6 (by partitioning)

Half of 10 = 5 Half of 2 = 1

Half of 748 by partitioning

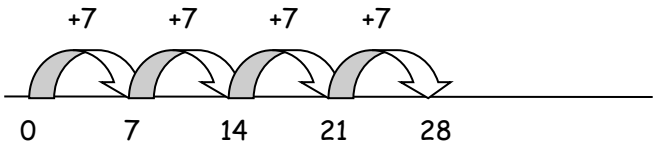
350 + 20 + 4 = 374

Repeated addition

28 ÷ 7 = 4

A chew bar costs 7p. How many can I buy with 28p?

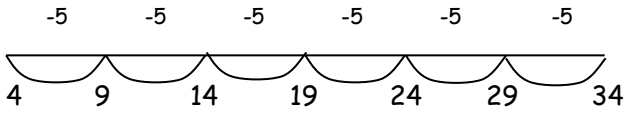
Children can count on in equal steps using an empty number line to work out how many groups of 7 there are in 28. This shows you need 4 jumps of 7 to reach 28.



Repeated subtraction

34 ÷ 5 = 6r4

They count back in steps of 5 until they can't take away another whole 5.



Chunking

28 ÷ 7 = 4

	2	8	
-		7	(1 x 7)
	2	1	
-		7	(1 x 7)
	1	4	
-		7	(1 x 7)
		7	
-		7	(1 x 7)
		0	

4 'lots' or 'groups' of 7 were subtracted.

The chunking method requires the children to use repeated subtraction. As they become confident with this method they then think about 'chunking' the number to be subtracted.

56 ÷ 8 =7

	5	6	
-	4	0	(5 x 8)
	1	6	
-	1	6	(2 x 8)
		0	

5 + 2 = 7 'lots' of 8 were subtracted.

The chunks of 8 are subtracted (5 groups of 8 and then 2 groups of 8) until no more chunks of 8 remain.

Long Division

How many 62 seater coaches will be needed to transport 750 children to Blackpool?

750 ÷ 62 = 12 r 6

62	7	5	0			
-	6	2	0	10	x	62
	1	3	0			
-	1	2	4	2	x	62
			6			

13 coaches will be needed as you cannot leave 6 children behind.

The chunking method develops into long division. When dividing by 2 digit numbers we use the chunking method and encourage the children to take away 'chunks' of the number (10 chunks of 62 and 2 chunks of 62, which leave 6 remaining).

Things I can work out about 62:

62 x 2 = 124 ∴ 62 x 4 = 248

62 x 10 = 620 ∴ 62 x 5 = 310

Short Division

416 ÷ 7 =

$$\begin{array}{r} 5\ \ 9\ \ \text{r}3 \\ 7\,\overline{)\,4\ \ 1\ \ {}^{6}6} \end{array}$$

I have 3.64m of lace to divide between 4 pairs of trainers. What length of lace does each trainer get?

3.64 ÷ 8 =

$$\begin{array}{r} 0\ \ .\ \ 4\ \ 5\ \ 5 \\ 8\,\overline{)\,3\ .\ {}^{3}6\ \ {}^{4}4\ \ {}^{4}0} \end{array}$$

Each trainer will get 0.46m of lace.

In this calculation children might start be generating facts they can derive about 62 to help them when 'chunking'.

Short division is difficult to explain to children mathematically but if children know their 'times tables' it is an efficient way of solving short division problems.

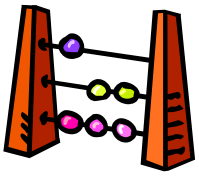
They learn how to use it with decimals and give their answer to 2 decimal places.

A few ideas for you to try at home...

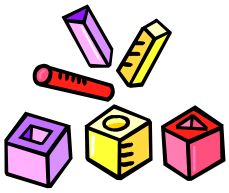
COUNTING

- Practise saying the number names. Encourage your child to join in with you.
- When they are confident, try starting from different numbers, e.g. 4, 5, 6.
- Sing number rhymes together – there are many commercial CDs and tapes 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.
- Count things you cannot touch or see. Try lights on the ceiling, window panes, claps, drop coins into a tin or oranges in a bag.
- 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, on car number plates or when out shopping.
- Cut out numerals from newspapers, magazines or birthday cards. Then help your child to put the numbers in order.
- Make mistakes when counting or ordering numbers. Can your child spot what you have done wrong?

PRACTISING NUMBER FACTS



- Find out which number facts your child is learning at school (addition facts to 10, 20, times tables, doubles, halves 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 number bonds 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 (-) 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 two minutes?
- Play Bingo. Each player chooses five answers (e.g. numbers to 10 to practise simple addition, multiples of five 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 the 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, 15 + 3 = 18). Add to the list over the next few days. Try starting with x facts as well.



SHAPES AND MEASURES

- Choose a shape of the week, e.g. cylinder. Look for this shape in the environment (tins, candles, etc). Ask your child to describe the shape to you (2 circular faces, 2 curved edges).
- Play 'guess my shape'. You think of a shape, your child asks questions to try to identify the shape but you can only answer 'yes' or 'no' (e.g. Does it have more than 4 corners? Does it have any curved sides?)
- Hunt for right angles around your home. Can your child also spot angles larger or smaller than a right angle?
- Look for symmetrical objects. Help your child to draw or paint symmetrical pictures/patterns.
- Make a model using boxes/containers of different shapes and sizes. Ask your child to describe their model.
- Practise measuring the lengths or heights of objects (in metres or centimetres). Help your child to use different rulers and tape measures correctly. Encourage them to estimate first before measuring.
- Let your child help with cooking at home. Help them to measure ingredients accurately using weighing scales or measuring jugs. Talk about what each division on the scale stands for.
- Choose some food items out of the cupboard. Try to put the objects in order of weight, by feel alone. Check by looking at the amounts on the packets.
- **Practise telling the time with your child**. Use both digital and analogue clocks. Ask your child to be a 'timekeeper' (e.g. tell me when it is half past four because then we are going swimming).
- Use a stop clock to time how long it takes to do everyday tasks (e.g. how long does it take to get dressed?) Encourage your child to estimate first.

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 meal on a budget.

These are just a few ideas to give you a starting point. Try to involve your child in as many problem-solving activities as possible. The more 'real' a problem is, the more motivated they will be when trying to solve it.

USEFUL MATHS WEBSITES

There are links to maths games on the school Learning Platform

GOOD FOR:	WEB ADDRESS:
General Maths Games	http://www.woodlands-junior.kent.sch.uk/maths/index.html http://www.ictgames.com/resources.html http://www.arcademicskillbuilders.com/ http://www.counton.org/ http://www.crickweb.co.uk/ks2numeracy.html http://www.bbc.co.uk/schools/bitesizeprimary/ http://www.primarygames.co.uk/ (these will have evaluation written across the screen as it is only a demonstration version) http://primaryhomeworkhelp.co.uk/maths/ http://coolmaths4kids.com http:channel4learning.com/sites/mathsmansion
Multiplication Games	http://www.multiplication.com/interactive_games.htm http://primaryhomeworkhelp.co.uk/maths/timestable/interactive.htm