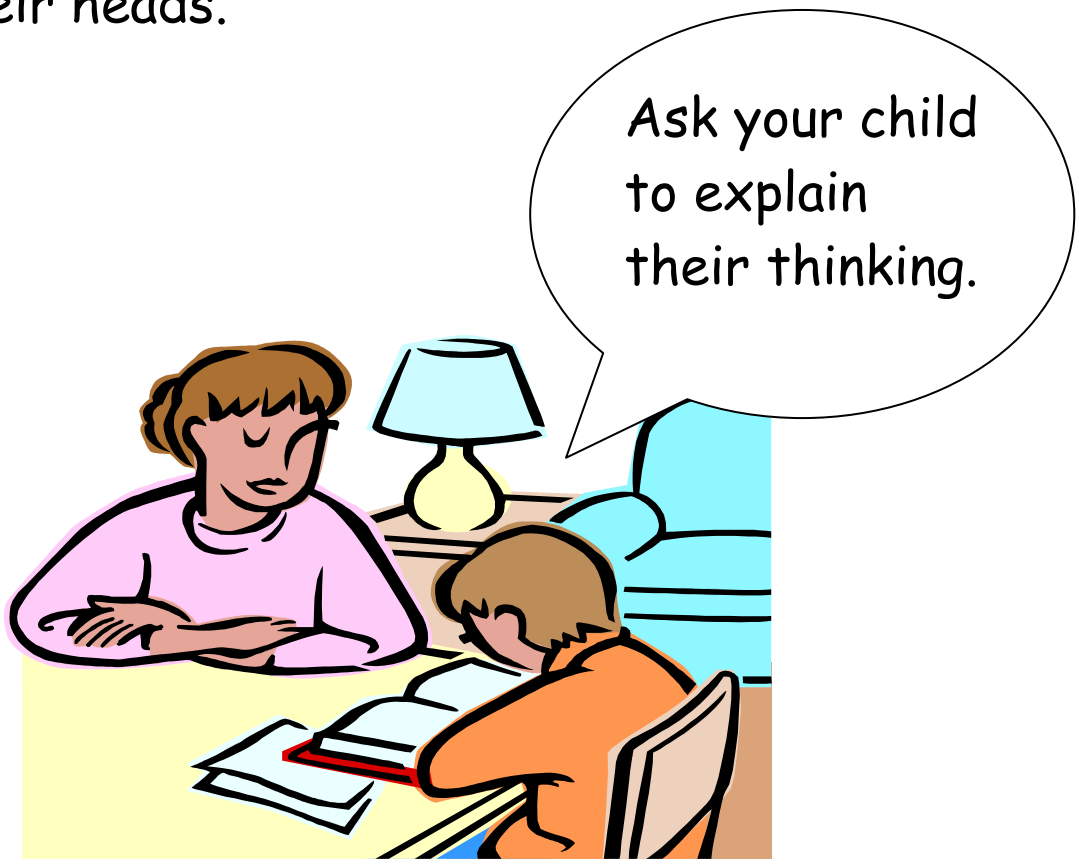
Calculation

A guide for Parents

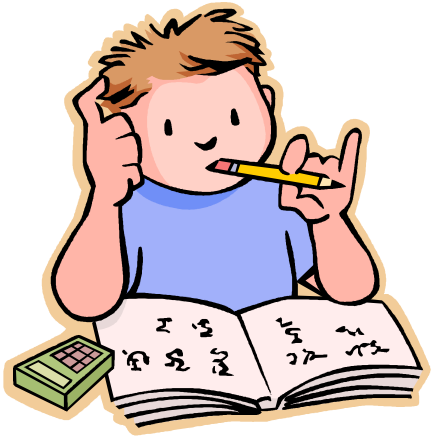
Calculation

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, (from year 3 / 4 onwards) they are only encouraged to use these methods for calculations they cannot solve in their heads.



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 two sets and counting on.

A progression from R to Y6

2 + 3 =

Add

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

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?

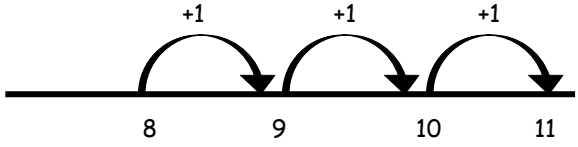
Children are encouraged to progress towards using dots or marks.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Children are introduced to the strategy of starting with the largest number and counting on, using a hundred square. This helps develop their understanding before moving on to using the strategy on a number line. It also reinforces counting on in units and later tens and units.

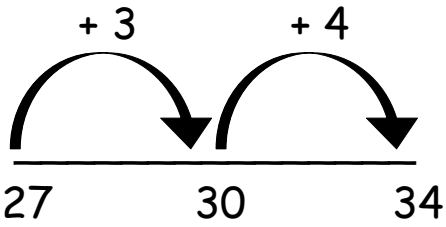
Counting forwards

8 + 3



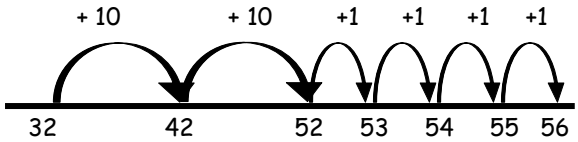
Children then progress onto counting up using an empty number line. This is a really good way for them to record the steps they have taken.

26 + 7

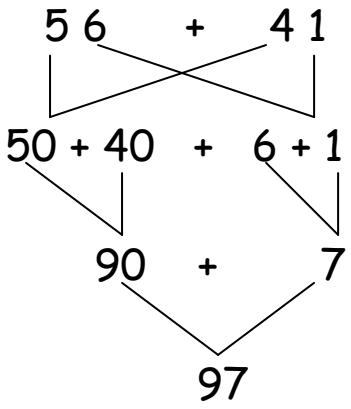


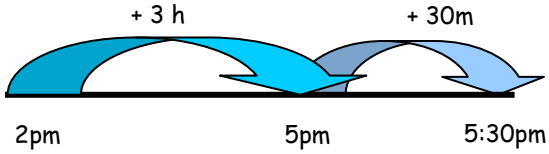
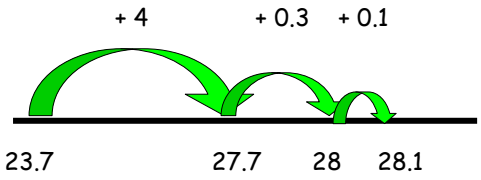
Once children can count on a single digit in 1s, they are encouraged to make use of knowledge of number bonds to ten, to help them add a single digit in fewer steps and bridge through into the next ten.

What is 32 + 24?



When children progress onto adding pairs of two digit numbers, children continue to use a number line. Children continue to be encouraged to put the largest number first on the number, partitioning

	the other number and counting on in tens and then units.
56+ 41 = 97  	**A new approach is introduced when children are secure with the mental calculation method of counting up from the largest number in tens and then units. Children are taught to partition both numbers, add the tens together, and then add the units together. Children then recombine the answer. This method prepares them for later work on column addition.**
366 + 172 366 + 132 8 90 400 498	**When children are confident in using the method above to mentally add pairs of numbers, they progress onto setting it out as expanded column addition and using the method to add larger numbers. At this stage, children are introduced to . working from the least significant digit first, i.e. units, but still need to read the numbers as 6 + 2, 60 + 30, 300 + 100, to secure full**

546 +487 13 120 900 1033 546 +487 1033 1 1 The train leaves at 2 o'clock in the afternoon. It takes 3 hours and 30 minutes to get to it's destination. What time does it arrive?  The train arrives at it's destination at 5.30 pm **23.7 + 4.4**  	**understanding of the approach used.** **When ready, children progress onto adding units that total tens and units, or tens that total hundreds and tens, to prepare them for the concept of 'carrying' when they move onto the compact method so they understand what they are doing.** **The compact method is used when children are confidently using the expanded approach.** **Children are encouraged to use a blank number line to solve problems involving money, time, decimal and other calculations.**

SUBTRACTION

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

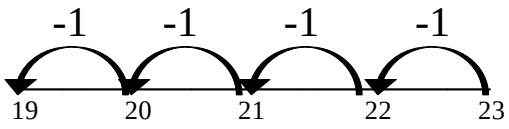
A progression from R to Y6

5 – 2 = I had five balloons. Two burst. How many did I have left?  Take away A teddy bear costs £5 and a doll costs £2. How much more does the bear cost?  Find the difference Lisa has 5 felt tip pens and Tim has 2. How many more does Lisa have? ●●●●● ●●	**Drawing a picture helps children to visualise the problem.** **Children are encouraged to progress towards using dots or marks.**

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

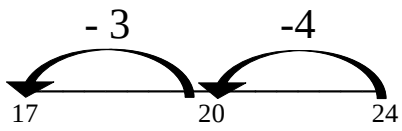
Children are introduced to the strategy of subtracting by counting back using a hundred square. To begin with, children count back in ones and later count back in tens and ones to subtract a two digit number. This helps develop their understanding of the strategy before moving on to using the strategy on a number line. It also reinforces counting back in units and later tens and units

23 – 4 = 19



When children develop confidence in counting back in units using a hundred square, they are ready to begin subtracting by counting back in units on an empty number line.

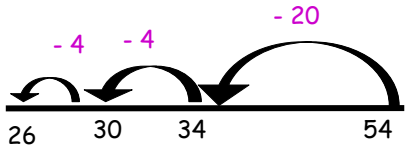
24 – 7 = 17



Once children are confident in counting back in ones on a number line, children progress onto counting back single digits in two steps, to be more efficient in calculation.

The baker makes 54 loaves and sells 28.
How many has he left?

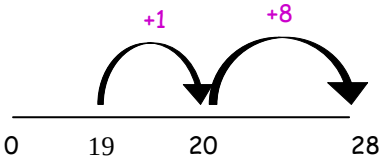
54 - 28



26 loaves are left

There are 28 children in the class, 19 have sandwiches for lunch. How many have a hot dinner?

28 - 19 = 9



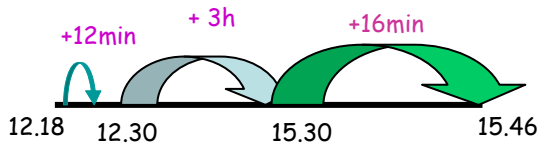
9 children have a hot dinner

Children then progress onto subtracting pairs of two digit numbers by counting back on an empty number line. They partition the number they need to subtract and count back the tens and then the units. They can count back in single tens and single units and later count back in groups of tens and groups of units like in the example.

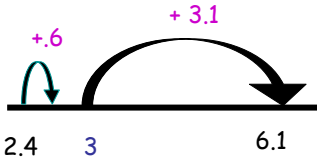
When confident with counting back along a number line to subtract, children should progress onto being taught how to subtract by counting on to find the difference. This can be an efficient method to subtract pairs of numbers, big or small, when close in size. Children continue to practise and use this method throughout their time at school, as well as learning other methods for subtraction.

The train leaves at 12.18 and arrives at 15.46.
How long is the journey?

The journey takes 3h 28min

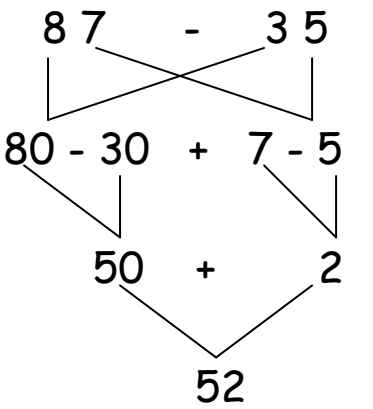


6.1 – 2.4

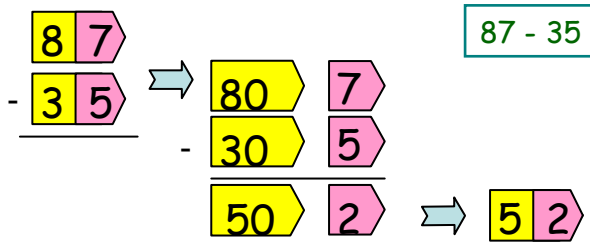


3.1 + 0.6 = 3.7

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 problems involving money, time, measures, and decimals.



87 - 35 =



A new approach is introduced when children are more secure with the mental calculation methods of counting on/back to subtract. Children are taught to partition both numbers, subtract the tens and then subtract the units. Children then recombine the answer. This method prepares them for later work on column subtraction.

563 - 248

500 and **60 and 3**
-200 and 40 and 8

Exchange 60 into 50 and 10

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

643 - 358

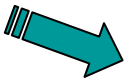
600 and **40 and 3**
-300 and 50 and 8

Exchange 40 into 30 and 10

600 and **30** and 13
-300 and 50 and 8

Exchange 600 into 500 and 100

500 and 130 and 13
-300 and 50 and 8
200 and 80 and 5



$$\begin{array}{r} {}^{5}\cancel{6}\,{}^{1}\cancel{4}\,{}^{3}1\,{}^{1}3 \\ -\,358 \\ \hline 285 \end{array}$$

The next step is to move onto a method called 'exchange'. Children partition the numbers, then subtract the units, subtracting the tens and subtracting the hundreds and recombining the answer. When they are unable to subtract a pair of numbers they may 'exchange' to make the calculation possible. This helps prepare them for the compact method of column subtraction, as it develops their understanding of 'borrowing'.

This is the compact method of subtraction. It hides the understanding and can confuse children if they are not ready for it. It is crucial for them to develop understanding by working with the expanded method above, before moving onto working with this. They may not reach this stage until they are in KS3.

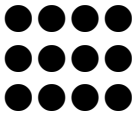
MULTIPLICATION

Children are taught to understand multiplication as repeated addition.

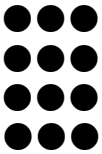
A progression from R to Y6

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20	Children are introduced to multiplication by counting on and back in equal steps of ones, twos, fives and tens. They use rhymes and songs to help practise this.
Each child has two feet. How many feet do four children have?  2 + 2 + 2 + 2	Children begin developing their understanding of multiplication by solving problems using repeated addition in 'real-life' contexts. Working practically or drawing a picture helps children to visualise and solve the problem.
6 x 3 There are 6 eggs in a box. How many eggs in 3 boxes? ●●●●●● ●●●●●● ●●●●●● 6 + 6 + 6	Children are introduced to the symbol for multiplication (X) and understand it's meaning as 'groups of' or 'lots of'. They begin to develop their understanding of multiplication expressed in number sentences.

4 x 3

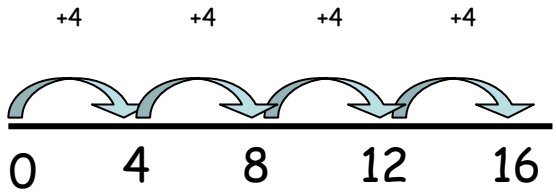


3 x 4



4 x 4

There are 4 cats. Each cat has 4 kittens. How many kittens are there altogether?



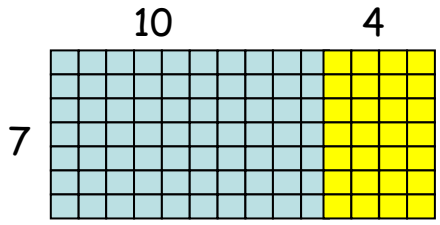
They use dots or tally marks to visually represent multiplications and support them with calculating.

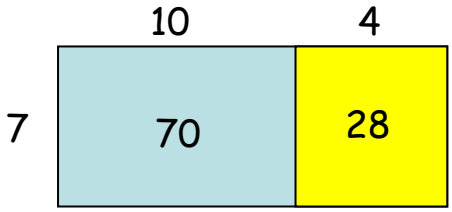
Children continue to practise counting in steps of 2,3,5 and 10 and begin counting in steps of 3 and 4.

They move onto showing their multiplications as an array. (e.g. 3 rows of 4 or 4 rows of 3) This gives children an image of the calculation, what it means, and the answer. It helps prepare them for later multiplication, when they multiply by counting on in repeated steps, it also develops their understanding that 4 x 3 has the same value as 3 x 4.

When more confident with their understanding of multiplication, Children can begin to multiply by counting on in equal steps, along an empty number line. This shows 4 jumps of 4.

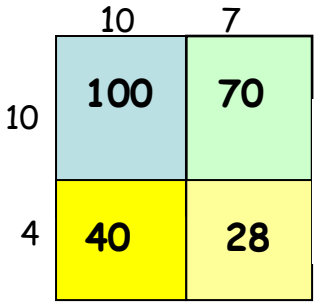
14x7=





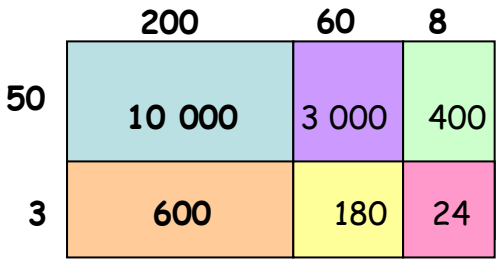
70 + 28 = 98

17 x 14



100 + 70 + 40 + 28 = 238

268 x 53



Children continue to practise counting in steps of 2,3,4,5 and 10 and begin counting in steps of 6,7,8 and 9

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 is multiplied by 7. The two answers are then added together. (An array is used to develop understanding of this process.)

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

Children will need a secure recall of 'times tables' facts to successfully use the grid method of multiplication and must continue to practise these regularly.

10 000 + 3 000 + 400 + 600 + 180 + 24
= 14 204

48
X 3
120
24
144

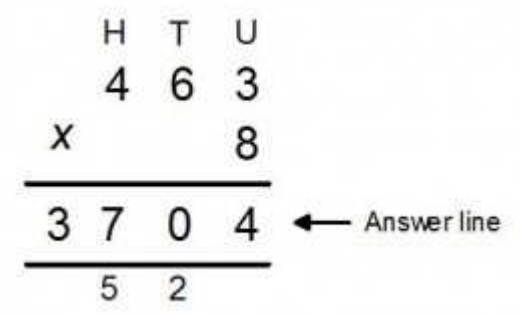
↓

48
X23
800
160
12
24
996

↓

Long

Short



If children become confident with the grid method, and are secure in fluently and accurately using it to multiply bigger numbers, they will progress onto using the formal written methods of long and then short multiplication.

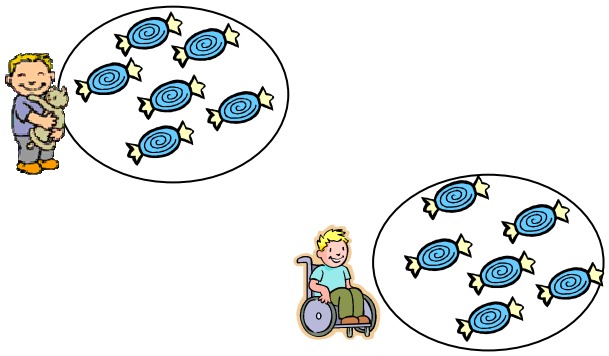
DIVISION

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

A progression from R to Y6

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

Sharing between two



Each child has 6 sweets

Grouping in threes

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

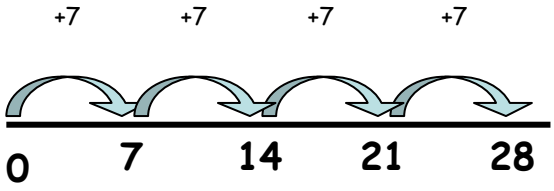
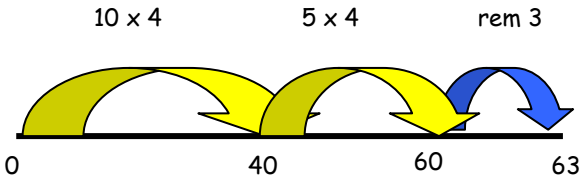
There are 4 party bags

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.

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.

12 ÷ 4= 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.
28÷7= 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.
63 children need to be seated in groups of 4. How many tables will be needed to seat all the children? 63 ÷ 4 = 15 r 3  16 tables will be needed to seat all the children, one will only have 3 seats.	When numbers get bigger, it is inefficient to do lots of small jumps on a number line. Children begin to jump in 'chunks' of the number they are dividing by, in this example 'chunks of 4' are used. A jump of 10 groups of 4 takes you to 40. Then you need another 5 groups of 4 to reach 60, leaving a remainder of 3.

63 ÷ 4 = 15 r 3

```
4 | 63
    40   10 x 4
    23
    20    5 x 4
     3
```

Children progress to this method which is known as 'chunking'. The chunks of 4 are subtracted (10 groups of 4, then 5 groups of 4) until no more chunks of 4 remain. This example shows 15 groups of 4 and a remainder of 3.

412 ÷ 7 = 58 r 6

```
7 | 412
- 350   50 x 7
    62
-  56    8 x 7
     6
```

This method is also used with larger numbers. Children need to have a secure knowledge of 'tables' facts and be able to derive associated facts.

In this calculation children might start by generating facts they know about 7. It is important that children try not to write out the whole table but just significant ones.

Things I know about 7:

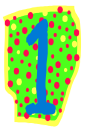
7x1=7 ∴ 7x10=70

7x2=14 ∴ 7x20=140

7x5=35 ∴ 7x50=350

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 - 4, 5, 6 . . .

- Sing number rhymes together - there are lots of commercial tapes and CDs 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 (more difficult). Try lights on the ceiling, window panes, jumps, claps or oranges in a bag.

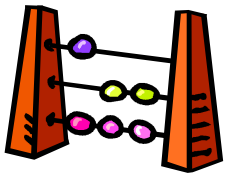
- Play games that involve counting (e.g. snakes and ladders, dice games, games that involve collecting objects).

- Look for numerals in the environment. You can spot numerals at home, in the street or when out shopping.

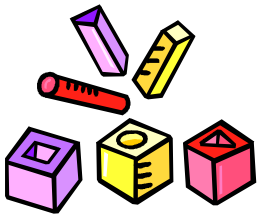
- Cut out numerals from newspapers, magazines or birthday cards. Then help your child to put the numbers in orders.

- Make mistakes when 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, 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 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 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, 15 + 3=18). Add to the list over the next few days. Try starting with a x fact as well.



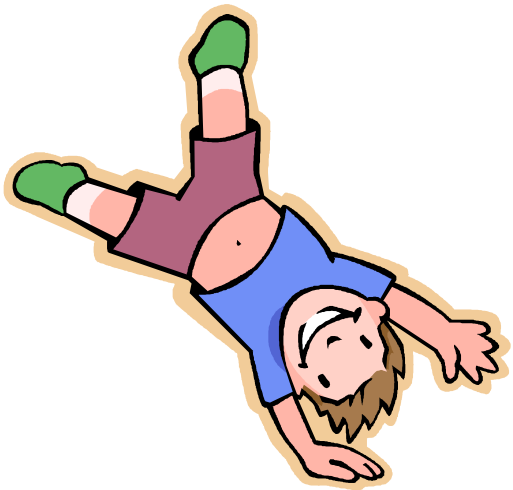
SHAPES AND MEASURES

- 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 it 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 bigger 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 cm). Help your child to use different rulers and tape measures correctly. Encourage them to estimate 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 or 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.



Make Maths Fun!