

Calculation Progression Guide



St Patrick's Catholic Primary School

Introduction

Written methods of calculations are based on mental strategies. Each of the four operations builds on mental skills which provide the foundation for jottings and informal written methods of recording. Skills need to be taught, practised and reviewed constantly. These skills lead on to more formal written methods of calculation.

Strategies for calculation need to be represented by models and images to support, develop and secure understanding. This, in turn, builds fluency. When teaching a new strategy it is important to start with numbers that the child can easily manipulate so that they can understand the methodology.

The transition between stages should not be hurried as not all children will be ready to move on to the next stage at the same time, therefore the progression in this document is outlined in stages. Previous stages may need to be revisited to consolidate understanding when introducing a new strategy.

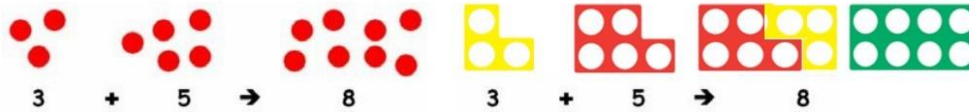
A sound understanding of the number system is essential for children to carry out calculations efficiently and accurately.

Although there are suggested ages/phases included in this calculation progression guide, it should be noted that **it is suitable for children to move to any previously learnt strategy** to help them accurately represent/solve calculations.

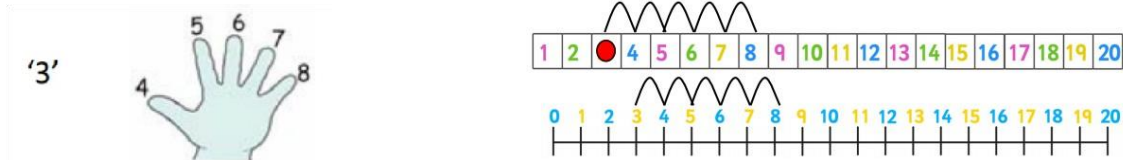
Addition - EYFS & Key Stage One

EYFS:

Counting All: e.g. Count out three counters and then five counters-find the total by counting all of the counters.



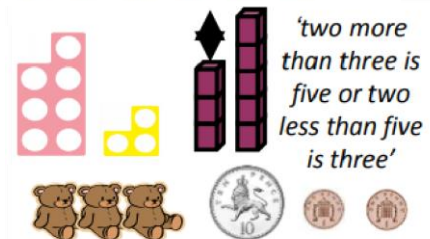
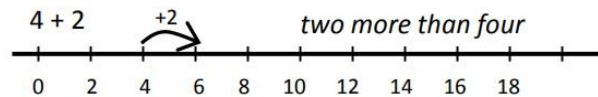
Counting on from the first number: e.g. 3+5



YEAR ONE:

Combining & Comparing:

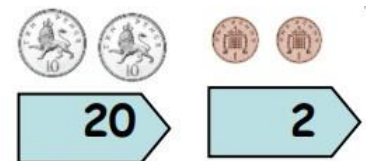
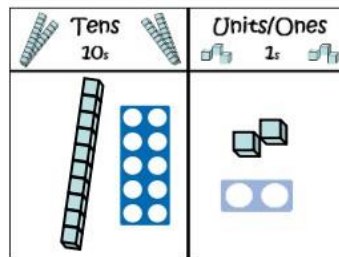
Use practical resources such as bears, counters, cubes and number lines/ hundred grids and progress to a resource such as Numicon to encourage counting in groups rather than ones



YEAR TWO:

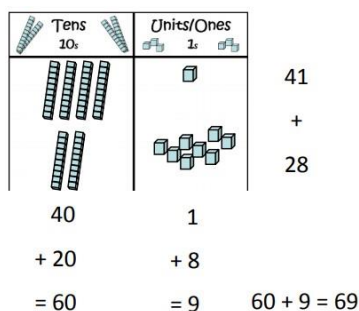
Partitioning :

Children should be able to partition numbers in different ways e.g. as 2+2+2+1 or 5+3 or 23 as 20 +3 or 10+13

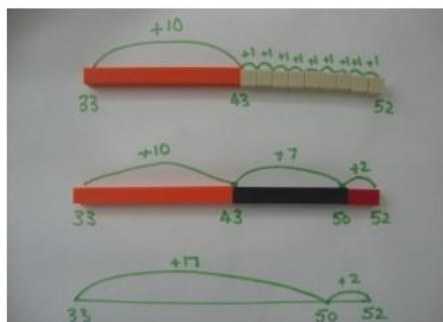


Partitioning & Recording :

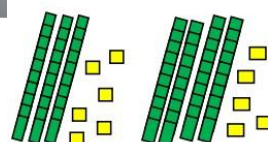
Children apply, develop and secure their understanding of place value. They record using jottings and record number sentences.



$$33 + 19 = ?$$



33 + 19
33 + 10 + 7 + 2
33 + 17 + 2
Encourage use of number bonds
33 + 20 - 1



$$\begin{array}{r} 36 \\ + 45 \\ \hline 81 \end{array}$$

Addition - Key Stage Two

YEARS THREE & FOUR:

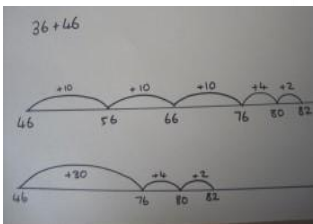
Expanded Column Addition: e.g. expanded method & using manipulatives alongside recording.

$$100 + 40 + 1$$

$$+ 100 + 20 + 8$$

$$200 + 60 + 9 = 269$$

Expanded recording



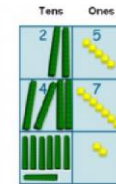
Column addition (no exchanging) with up to three-digits

$$\begin{array}{r} 40 + 1 \\ + 20 + 8 \\ \hline 60 + 9 = 69 \end{array}$$

Expanded recording
without exchange

$$\begin{array}{r} 40 + 3 \\ 20 + 8 \\ \hline 70 + 1 = 71 \\ 10 \end{array}$$

Expanded recording
with exchange



	2	5
+	4	7
	7	2
	1	

Column Addition: Add numbers with up to four digits using a formal written column method) including numbers with up to two decimal places in the context of money.

$$\begin{array}{r} \text{HTU} \\ 789 \\ + 642 \\ \hline 1431 \\ \hline 11 \end{array}$$

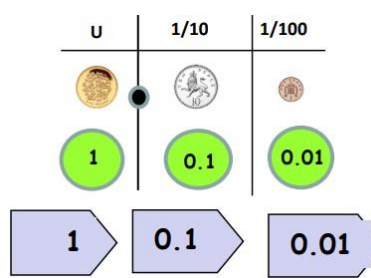
$$\begin{array}{r} £7.89 \\ + £6.42 \\ \hline £14.31 \\ \hline 11 \end{array}$$

Compact (column) recording

YEARS FIVE & SIX:

Applied written method:

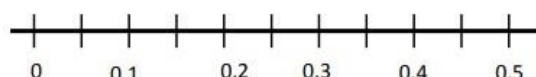
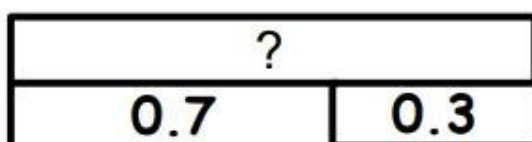
Children should add numbers with more than four-digits and decimals up to three places



$$\begin{array}{r} 21.41 \\ + 1.12 \\ 0.35 \\ \hline 22.88 \end{array}$$

Calculation Efficiency: Children solve more complex calculations mentally, deciding on the times that formal written methods are required.

Bar Model

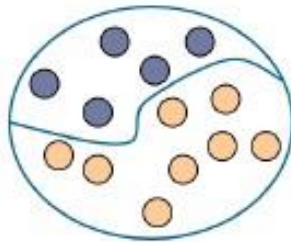
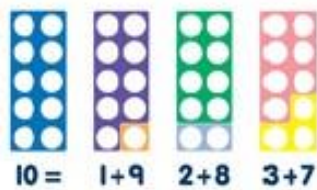


$$\begin{array}{r} 51.89 \\ + 3.128 \\ \hline 55.018 \\ \hline 11 \end{array}$$

Subtraction - EYFS & Key Stage One

EYFS:

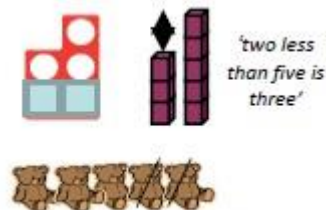
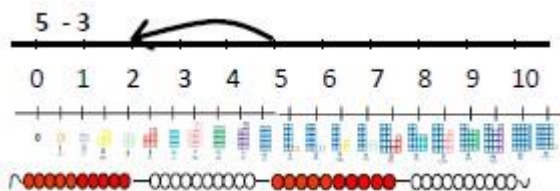
Partitioning sets: and learning number facts e.g. pairs that make 8, 9, 10 etc



Seeing 12 as made up of 5 and 7

YEAR ONE:

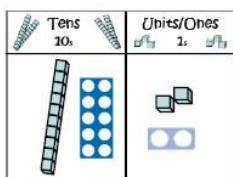
Counting Back & Taking Away: Understand subtraction as taking away What is ... less than ...?) & compare quantities to say how many less and/or how many more



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

YEAR TWO:

Finding the difference : Children understand subtraction as taking away and finding the difference



$$10 - 4$$

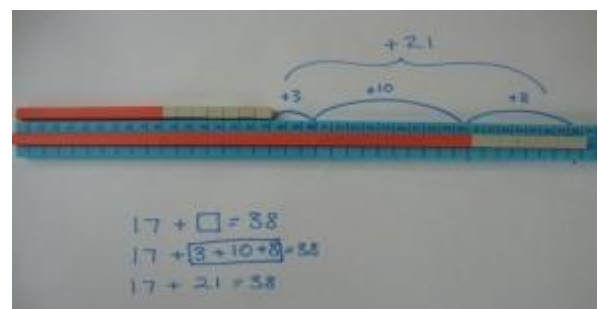
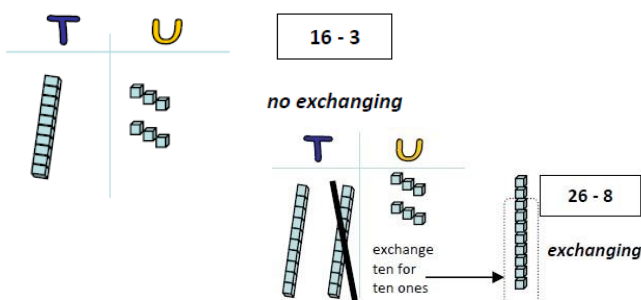
Finding the difference



Cuisenaire
Bar Model

10
7 ?

Partitioning & Recording : Children apply, develop and secure their understanding of place value . They record using jottings and record number sentences.



Subtraction - Key Stage Two

YEARS THREE & FOUR:

Expanded Column Addition: e.g. Subtract numbers with up to three digits (formal written column method)

Children SHOULD use manipulatives alongside algorithms to transition between practical and abstract

no exchange

$$\boxed{68 - 23}$$

$$\begin{array}{r} 60 \quad 8 \\ - 20 \quad 3 \\ \hline \end{array}$$

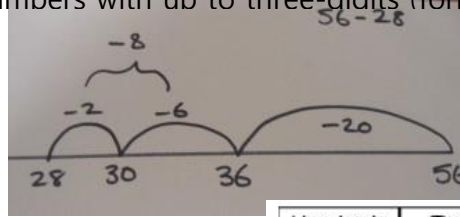
$$40 + 5 = 45$$

with exchange

$$\boxed{63 - 28}$$

$$\begin{array}{r} 50 \quad 60 \quad 10 + 3 \\ - 20 \quad 8 \\ \hline \end{array}$$

$$30 + 5 = 35$$



Hundreds	Tens	Units/Ones
100s	10s	1s

Column Subtraction: Subtract numbers with up to four digits using a formal written column method) including numbers with up to two decimal places in the context of money .

Column subtraction (with exchange)

$$\boxed{723 - 317}$$

$$\begin{array}{r} 7 \quad 2 \quad 3 \\ - 3 \quad 1 \quad 7 \\ \hline 4 \quad 0 \quad 6 \end{array}$$

$$\boxed{723 - 367}$$

$$\begin{array}{r} 6 \quad 11 \quad 1 \\ 7 \quad 2 \quad 3 \\ - 3 \quad 6 \quad 7 \\ \hline 3 \quad 5 \quad 6 \end{array}$$

$$\begin{array}{r} 6 \quad 11 \quad 1 \\ \pounds 7 \quad 2 \quad 3 \\ - \pounds 3 \quad 6 \quad 7 \\ \hline \pounds 3 \quad 5 \quad 6 \end{array}$$

Ensure children can solve calculations where zero is a place holder

YEARS FIVE & SIX:

Applied written method: Children should subtract larger numbers & subtract numbers mentally with increasingly large numbers

Children might use manipulatives alongside algorithms

Column subtraction (with exchanging)

$$\begin{array}{r} 2 \quad 13 \quad 11 \quad 1 \\ 1 \quad 3 \quad 4 \quad 2 \quad 3 \\ - 1 \quad 2 \quad 6 \quad 7 \quad 8 \\ \hline 7 \quad 4 \quad 5 \end{array}$$

Column subtraction (no exchanging)

$$\begin{array}{r} 13548 \\ - 12128 \\ \hline 1420 \end{array}$$

Calculation Efficiency : Children solve more complex calculations mentally & subtract multi-digit numbers including numbers with up to three decimal places

$$\begin{array}{r} 1.48 \\ - 1.21 \\ \hline 0.27 \end{array}$$

Column subtraction (no exchanging)

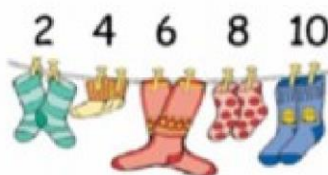
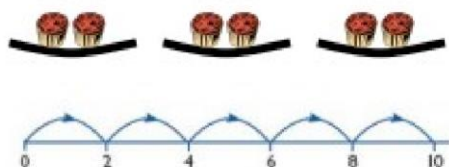
Column subtraction (with exchanging)

$$\begin{array}{r} 6 \quad 11 \quad 1 \\ 7 \quad 2 \quad 3 \\ - 3 \quad 6 \quad 7 \\ \hline 3 \quad 5 \quad 6 \end{array}$$

Multiplication - EYFS & Key Stage One

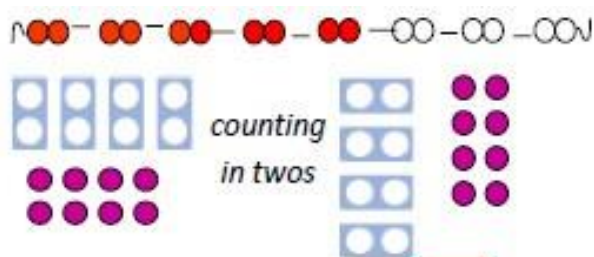
EYFS:

Counting in equal sets:



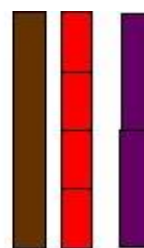
YEAR ONE:

Counting in sets: Solve single step practical problems involving multiplication



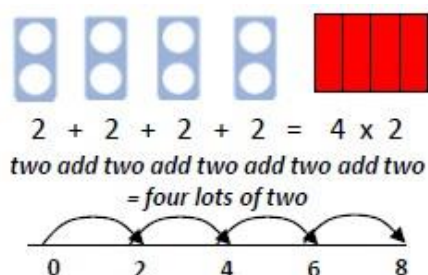
four lots of two is eight

two lots of four is eight

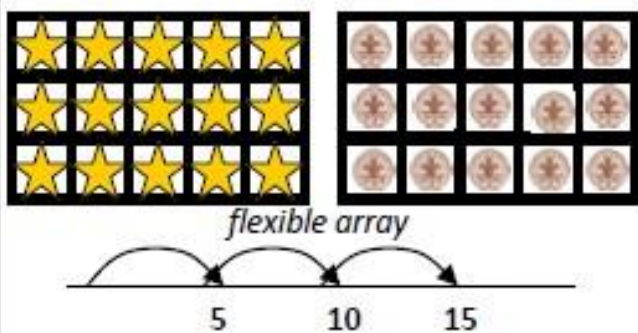


YEAR TWO:

Repeated addition: Understand multiplication as repeated addition & calculate mathematical statements for multiplication within the tables and write them using symbols.



Partitioning & Recording : Children understand and solve problems involving arrays. They know that multiplication is commutative (can be done in any order.)



Record practical work as number sentences



$$4 \times 2 = 8$$

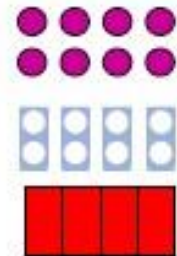
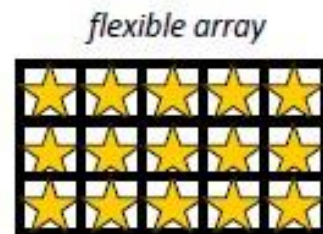
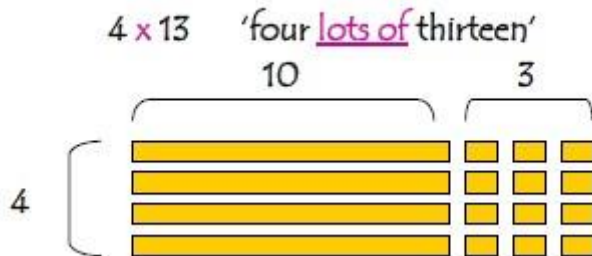
$$2 \times 4 = 8$$

Multiplication - Key Stage Two

YEARS THREE & FOUR:

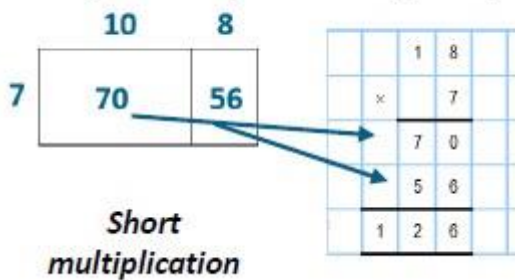
Arrays and introduction to expanded method: Solve problems involving multiplication including correspondence & develop reliable written methods

Children must use manipulatives alongside algorithms



Column Multiplication: Develop fluency in short multiplication using formal written layout

Children might use manipulatives alongside algorithms



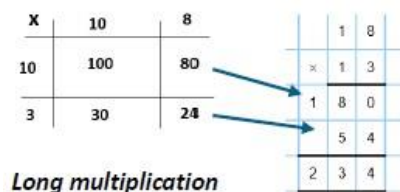
Progressing to developing fluency in short multiplication

$$\begin{array}{r} 13 \\ \times 4 \\ \hline 52 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 133 \\ \times 4 \\ \hline 532 \\ \hline 11 \end{array}$$

YEARS FIVE & SIX:

Applied written method: Children solve problems involving all four operations where larger numbers are used by decomposing them into their factors



$$\begin{array}{r} 1324 \\ \times 6 \\ \hline 7944 \\ \hline 112 \end{array}$$

$$\begin{array}{r} 3.24 \\ \times 6 \\ \hline 19.44 \\ \hline 12 \end{array}$$

Calculation Efficiency : Children multiply numbers up to 4-digit x TU & multiply numbers with up to two decimal places x whole number

$$\begin{array}{r} 1324 \\ \times 26 \\ \hline 7944 \\ 26480 \\ \hline 34424 \\ \hline 111 \end{array}$$

$$\begin{array}{r} 3.24 \\ \times 26 \\ \hline 19.44 \\ 64.80 \\ \hline 84.24 \\ \hline 11 \end{array}$$

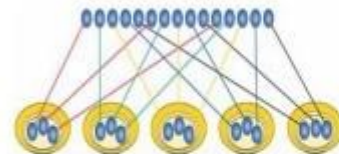
Division - EYFS & Key Stage One

EYFS:

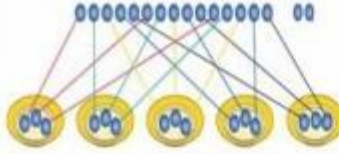
Sharing and grouping with real world manipulatives:

Sharing:

15 marbles shared equally
between 5 children



17 marbles shared equally
between 5 children



Cut the pizza in
half. How
many pieces
are there?

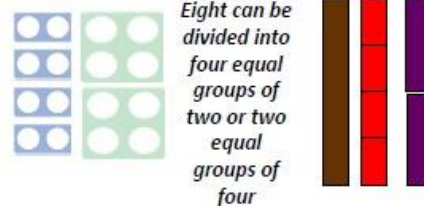


YEAR ONE:

Grouping and sharing: Understand division as grouping and sharing & use the language of 'sharing equally between'



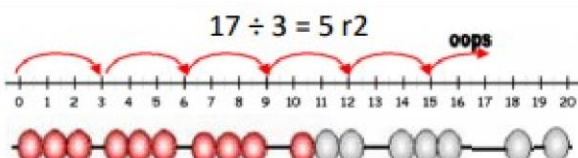
Numicon and counter arrays



Eight can be
divided into
four equal
groups of
two or two
equal
groups of
four

YEAR TWO:

Formal recording: Work with a range of materials and contexts in which multiplication and division relate to grouping and sharing discrete quantities and to arrays



Record as number sentences using $\div$ and $=$

$$8 \div 4$$

Eight divided into four equal
groups = two in each group

$$8 \div 4 = 2$$



Division - Key Stage Two

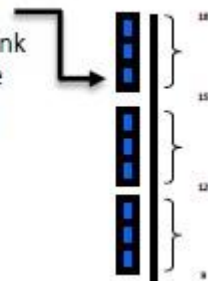
YEARS THREE & FOUR:

Arrays and introduction to expanded method: Develop a reliable written method for division & understand the link between unit fractions and division

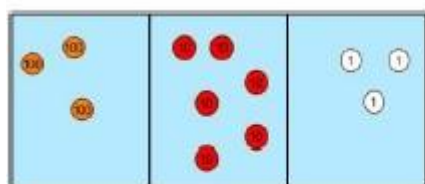
Children should use manipulatives alongside algorithms



Repeated subtraction - chunking
Ensure children see/understand the link between grouping on a number line and vertical recording for chunking



Introduction to short division: Children become fluent in the formal written method of short division with exact answers when dividing by a one-digit number



$$321 \div 3$$

$$\begin{array}{r} \div 121 \\ 3 \overline{) 363} \end{array}$$

$$321 \div 3$$

Short division-
no remainders

$$560 \div 4$$

$$\begin{array}{r} \div 140 \\ 4 \overline{) 560} \end{array}$$

YEARS FIVE & SIX:

Applied short division: Children practise and extend the formal written method of short division:

Children might use manipulatives alongside algorithms

without
remainder

$$560 \div 4$$

$$\begin{array}{r} 140 \\ 4 \overline{) 560} \end{array}$$

remainder as a
fraction

short division

$$564 \div 5$$

remainder as
a decimal

$$\begin{array}{r} 112.8 \\ 5 \overline{) 564.0} \end{array}$$

$$\begin{array}{r} 112 \frac{2}{5} \\ 5 \overline{) 564} \end{array}$$

Long Division : Children divide numbers up to 4-digits by a 2-digit whole number using formal written methods of long division, interpret remainders as whole numbers, fractions or by rounding, as appropriate for the context

$$\begin{array}{r} 23 \text{ r } 8 \\ 24 \overline{) 560} \\ \underline{-48} \\ 80 \\ \underline{-72} \\ 8 \end{array}$$

remainder as a
whole number

$$\begin{array}{r} 23 \frac{8}{24} (1/3) \\ 24 \overline{) 560} \\ \underline{-48} \\ 80 \\ \underline{-72} \\ 8 \end{array}$$

remainder as a
fraction in its
lowest form

$$\begin{array}{r} 23.3 \\ 24 \overline{) 560.0} \\ \underline{-48} \\ 80 \\ \underline{-72} \\ 80 \\ \underline{-72} \\ 0 \end{array}$$

remainder
as a decimal

Suggested Fun Activities to do at home

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.

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 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. $10 = \square + \square$). 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.

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.

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.
- ❖ 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 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.

