



KEY STAGE 1

NUMERACY PRESENTATION

**CALCULATION STRATEGIES AND
PROBLEM SOLVING.**

THE NATIONAL CURRICULUM

The National Curriculum sets out clear, full and statutory entitlement to learning for all pupils covering 10 different subjects. It determines the content of what will be taught, and sets attainment targets for learning. It also determines how performance will be assessed and reported. An effective National Curriculum therefore gives teachers, pupils, parents, employers and their wider community a clear and shared understanding of the skills and knowledge that young people will gain at school.

Taken from: The National Curriculum 2000

THE NATIONAL CURRICULUM

The National Curriculum for maths.

For Key Stage 1 children the National Curriculum is divided into three areas:

- Using and applying Mathematics
- Number
- Shape, space and measures

At Key Stage 2 level this is extended to include data handling.

USING AND APPLYING MATHEMATICS

There are three strands of using and applying mathematics

Problem solving: To select and apply strategies to solve problems in different contexts, checking their results

Communicating: To organise their work, using correct language, symbols and notation

Reasoning: To reason logically, look for patterns. Make deductions and explain them.

PROBLEM SOLVING

Single step problems for Year 1:

Single step: A single step problem basically just needs an understanding of what is being asked. Here the language tells us what operation is being carried out.

- Lisa has 5 pens and Tim has 2 pens. How many pens do they have altogether? How many more pens has Lisa than Tim?

- Tina rolled double 6 on her dice. What was her score?

Other 1 step operation questions concentrate upon inverse operations- the question shows an addition sum but requires subtraction to find the answer.

- I think of a number, then add 2. The answer is 7. What was my number?

SINGLE STEP PROBLEMS

Single step problems for Year 2 concentrate upon a broader range of calculating skills

-I think of a number and then halve it. The answer is 9. What was my number?

-There are 16 plums. 8 children share them equally. How many plums does each child have?

-Two people have 8 cakes each. How many cakes have they altogether? One person gives 2 cakes to the other. How many does each one have now?

These examples for both Year 1 and 2 are closed questions- this means that they only have 1 correct answer.

TWO STEP PROBLEMS

Two step problem solving for Year 1:

Scores in a game:

Josh $2 + 3$

Sam $3 + 5$

Helen $4 + 2$

How many did Helen and Sam score together?

How many more did Sam score than Josh?

Here the problem requires an understanding of the question and the calculation can be broken down into smaller steps.

TWO STEP PROBLEMS

Other two step problems for Year 1:

Some hens lay 2 eggs, 4 eggs and 3 eggs. How many did they lay together?

Half of the cakes in a box of 10 are gone. How many are left?

Two step problems can be open ended and have a range of different answers.

Apples are 6p each. What do 2 apples cost? Which coins would pay for them exactly?

How many different ways can you make 10?

TWO STEP PROBLEMS

Two step problem solving for Year 2:

7 people are on a bus. 8 more get on and 3 get off. How many people are on the bus now?

There are 28 bean bags. Kim takes 11 and Amit takes 9. How many bean bags are left?

There are 2 red and 4 blue buttons on one button card. How many buttons are there on 6 cards?

You have three ten pence coins and two five pence coins.
You use three coins to buy a lolly. What might the lolly cost?

PROBLEM SOLVING

Changing money.

I have one 50p, one 20p, one 10p, one 5p, one 2p and one 1p in my pocket.

-How much money have I got altogether?

-If I pulled any two coins out of my pocket, how much might they be worth?

Activities such as the one above can be used to help children analyse the structure of problems in order to plan a route to a solution. Methods of problem solving include identifying the relevant information and operation to be used. Breaking the problem into smaller steps helps to identify which calculation strategy is the most appropriate.

Support for the child can be gradually withdrawn when looking at a range of similar problems to promote independence.

HELPING YOUR CHILD WITH PROBLEM SOLVING

Problem solving strategies can be taught by:

- Discussing word problems. Identify key words, discussing their meaning and relate them to the operations. Choose examples where more than one step is involved and alternative vocabulary.
- Change the numbers in the problem and discuss the new problem. Alter a word or phrase such as 'total' to 'difference' to change the meaning of the question and discuss the change in operation.
- Ask the children to make up their own problems for others to solve.
- Look at the differences between single or multi- step problems that are staged and those that offer less guidance.
- Take a staged problem and gradually remove the support in these multi- step problems.

COMMUNICATING

BIRTHDAYS.

Mum and Paul are talking about birthdays.

They take Paul's age and double it then add 5. The answer is 35.

Mum says that is her age.

How old is Paul?

Make up some problems of your own using these words:

Double

half

add

subtract

An activity like this teaches children how to interpret precise mathematical language, symbols, notation and diagrams to communicate their mathematics. This can be modelled for the children by producing drawings and written explanations for them.

COMMUNICATING

Mathematical communication can be taught by:

- Allowing the children to explain their thinking
- Encouraging written explanations through drawings or other means
- Show tables or diagrams with missing information. Ask children to select and use information to answer questions that require a calculation.
- Find different ways of solving the same problem.
- Show the child a problem solving question with the answer and then ask them how they would find the solution to the problem.

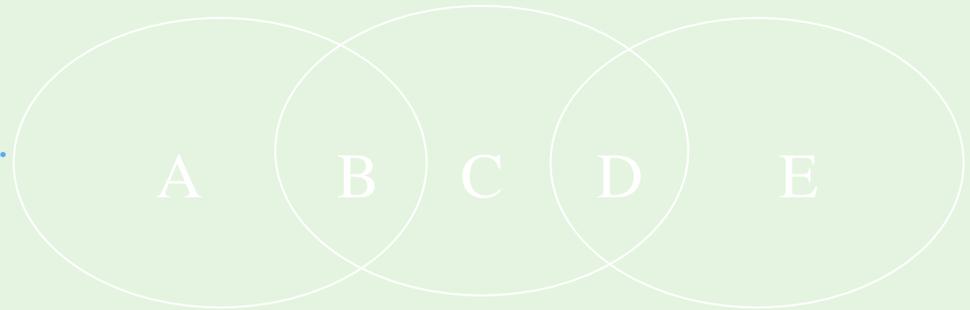
REASONING

CIRCLE SUMS.

Use each of the digits 1 to 5 once.

Replace each letter by one of the digits.

Make the total in each circle the same.



Repeat this activity with 4 circles and the number 1 to 7.

What if you used five circles and the digits 1 to 9?

This type of activity can be used to teach children to look for patterns and relationships and to explain even quite simple results. It encourages prediction and provides opportunities for trial and error judgements- refining their thinking each time. This style of problem teaches the children to work systematically and logically.

APPROACHES TO TEACHING- REASONING

Reasoning skills can be developed by:

- Present a diagram to discuss and complete.
- Place items on a diagram in the wrong place and ask the children to discuss why they think it is in the wrong place.
- Provide statement for children to investigate to see if they are always true, sometimes true or false.

ACTIVITIES TO ASSIST YOUR CHILD.



**Hill Castle
Tickets**
Adult **£5**
Child **£3**

How much does it cost for **2 adults** and **3 children**?

Show how you work it out in the box.

Hill Castle tickets (assessing problem solving)

For this question, children need to make decisions about how to use the ticket information and what calculations to do to find the cost for two adults and three children.

Most children will use repeated addition to find the cost for the adults and then for the children before totalling both amounts. A few children will be able to use multiplication and addition to solve the problem. Although the calculations necessary to solve this problem are quite basic, the need to interpret the information about ticket prices and decide what calculations to do increases the demand in terms of using and applying mathematics.

Ben's addition

(assessing communicating and reasoning)

The context of the question, which gives the addition and Ben's answer, encourages children to communicate a possible method. The question is also an open one that allows them to choose from a range of possible calculation strategies and explain or demonstrate the reasoning behind one of them.

Some children will choose to explain a method that usually involves jottings or is a written method. For example, children might demonstrate partitioning and record each calculation they would do to reach the final answer. Others will explain a partitioning method clearly in words.

A few children will show how to use a known doubling fact to start the calculation. Others will attempt to demonstrate or describe more practical methods such as tallying. This often leads to errors because the numbers are large. Others will attempt to record a 'counting on' method. This is a more sophisticated practical method than tallying but is difficult for children to record clearly.

Ben worked out the correct answer to $25 + 27$

His answer was 52



Show how he could have worked out his answer.

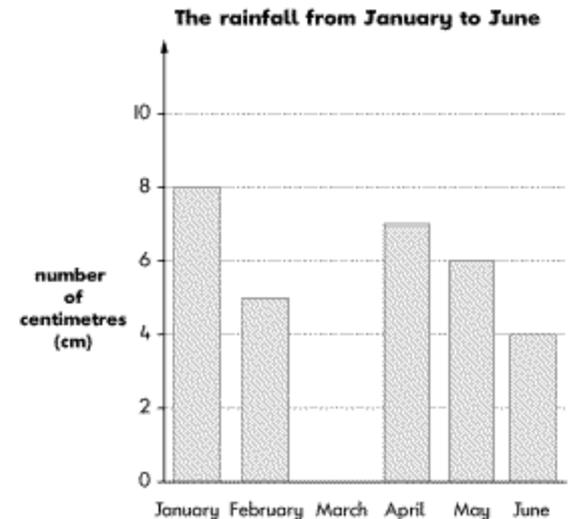
52

Class 2's rainfall graph, Part b (assessing problem solving)

For part b of this question, children need to interpret and use information in the question and on the graph to identify what they need to do.

Most children will use the information about rainfall in June, which is presented on the graph, alongside the total rainfall for June and July, which is given in the question, to find the rainfall in July alone. Most will work out the answer mentally but some children will record the subtraction they do to answer the question. Other children will attempt to use just the information in the question, ignoring information about June's rainfall on the graph. They will halve the total for June and July which leads to an incorrect answer. Part b is aimed at level 3.

Class 2 made a graph.



a 3cm of rain fell in **March**.

Show this on the graph.

b The total rainfall in June and July was **14cm**.

How much rain fell in **July**?

cm

NNS OBJECTIVES FOR PROBLEM SOLVING

- Choose and use appropriate number operations and ways of calculating to solve problems.
- Solve problems or puzzles recognise simple patterns or relationships generalise and predict.
- Investigate a general statement about familiar numbers or shapes: for example by finding examples that satisfy it.
- Explain methods of calculation and reasoning about numbers orally and, where appropriate, in writing.
- Solve simple word problems set in 'real life' contexts and explain how the problem was solved.
- Solve simple word problems involving money and measures and explain how the problem was solved.

SOME DIFFICULTIES & MISCONCEPTIONS.

- Children need much practise and consolidation of problem solving questions and assistance to build up a range of effective calculation strategies.
- They need a good understanding of the language of maths and of a variety of different ways of phrasing the question.
 - In some instances children find it hard to identify which operation to use.
 - Children can find it hard to break down the problem into pieces.
 - In multi step problems some children do not actually answer the question- they have become too preoccupied with one component of the problem. This is more evident with problems of greater complexity.

HOW TO HELP YOUR CHILDREN.

- Try to be specific when thinking about what you want your child to learn.
- Read through problems together directing their progress and modelling different ways of understanding and solving problems.
- Withdraw support for these activities gradually allowing your child to work increasingly independently.
- Encourage your child to explain what he/ she is doing at every step of the problem and where ever possible encourage the use of informal jottings, drawings or written explanations to aid their calculations. Use objects to help them visualise the problem.
- Ensure that the problems are matched to your child's ability.
- Give lots of encouragement and keep it fun!

USING AND APPLYING MATHEMATICS

Problem solving is largely based upon the attainment targets for using and applying Mathematics. These skills are demonstrated through activities using other aspects of the maths curriculum.

Level 1: Pupils use mathematics as an integral part of classroom activities. They represent their work using objects or pictures and discuss it. They recognise and use a simple pattern or relationship.

Level 2: Pupils select the mathematics they use in some classroom activities. They discuss their work using mathematical language and are beginning to represent it using symbols and simple diagrams. They explain why an answer is correct.

Level 3: Pupils try different approaches and find ways of overcoming difficulties that arise when they are solving problems. They are beginning to organise their work and check results. Pupils discuss their mathematical work and are beginning to explain their thinking. They use and interpret mathematical symbols and diagrams. Pupils show that they understand a general statement by finding particular examples that match it.