

EXPLORING

mathematics with younger children

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INTRODUCTION

"If mathematics is not seen as restricted to a few conventionally accepted areas of experience, or constrained to follow a simple linear development, the teacher can encourage her pupils to range far and wide in their mathematical activity"

Notes on Mathematics in Primary Schools (ATM)

In putting together this booklet we set ourselves the task of presenting a collection of starting points that will enable younger children and their teachers to 'range far and wide in their mathematical activity.' In this way the requirements for the National Curriculum for Mathematics can be more than met, with the emphasis upon children constructing their own understanding from a wide range of experiences.

You can develop each starting point in a number of equally valid ways but we suggest that giving children plenty of opportunity to handle, play with, and talk about the materials is a useful way to begin. Working in small groups or pairs gives greater scope for ideas to be developed, for different questions to be asked, and for alternative ways of working to be shared. Sometimes you will be party to all, and sometimes to only part, of the talk that takes place. There will be moments when your interventions will help children either to make choices and decisions about what to try next or to consider 'what would happen if?'

In the same way, when it comes to recording work you may on one

occasion act as a scribe, on another suggest and discuss a particular format for recording, and on yet another, provide a listening ear. This will enable the children to clarify for themselves if anything needs to be recorded at all, and if so, for what purpose and how. Opportunities for observation and assessment can arise as a natural feature of working alongside children in this way.

"Activities should be balanced between different modes of learning: doing, observing, talking and listening, discussing with other pupils, reflecting, drafting, reading and writing".

NCC Non-Statutory Guidance for Mathematics B5.10

There are two distinct sections within this booklet:

On pages 1-18, each main starting point is worked through over a double page spread. Examples of children's responses to the starting point are given to provide a flavour of the kinds of things that can happen. Some suggestions as to possible directions to explore are provided for you to have in mind but not necessarily to use. On each spread, a second starting point is outlined which allows the children to meet some of the same mathematics as in the main starting point but embedded in a different context.

On pages 19-26, each page presents two distinct main starting points and some suggestions for directions to explore.


Pages 1-18

Main starting point

Suggestions and prompts for the teacher - the children may take you in a different direction - Follow the flow!

Children in action

How many Smarties in the pack?



Ask the children to compare the number of Smarties in different packs.
How can you be sure?
Count them in different ways.
How many more → red than yellow.
→ blue than green.

How many Smarties do you think are in the tube?


Don't you? Why not?

Well, how many do you think there are?

OK, let's see, you can count them how you like

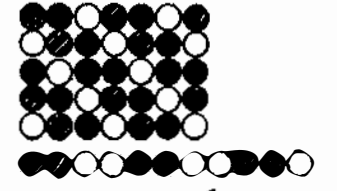
Can I put them into groups?

10, 20, 30, 40... and... er... a half!



Sorting
Grouping
Counting
Comparing
Making patterns
Adding


Arrange different coloured Smarties in as many ways as possible.



What if you had a box of Liqueur Allsorts?

How many different ways can you sort them?

Invent some more patterns.



Robot emptied the tube onto the table and proceeded to count them all.

Robot sorted them into groups of 10 and one group of 5.

Some of the mathematics

Turn to the back of the booklet for a summary of the links with the National Curriculum

The same context as the main starting point but exploring a different direction

A second starting point

Pages 19-26

Two different starting points and directions to explore

3 children each have a fancy bag containing a dotted, a striped and a plain paper bow tie.

Simultaneously the children take out a bow tie.

What are the chances of all the bow ties being dotted?

Smarties	Coins	Sum
all the same		10
2 of one		5
all three		2


Have 10 goes and add up your score.
Will you ever get $\begin{matrix} 507 \\ 277 \end{matrix}$?

Have a bag with an equal number of 5p, 10p, and 20p in it.

Take it in turns to grab a handful of money.

Discuss how many of each coin in a grab.

What happens?




Choose a shoe.
How big is the person who wears this shoe?
Make a life-size model or drawing of them.

How many slides would it take each person to cross the classroom?

Investigate the different footprints made by each shoe.

Try → drawing
→ pressing plasticine
→ paint prints

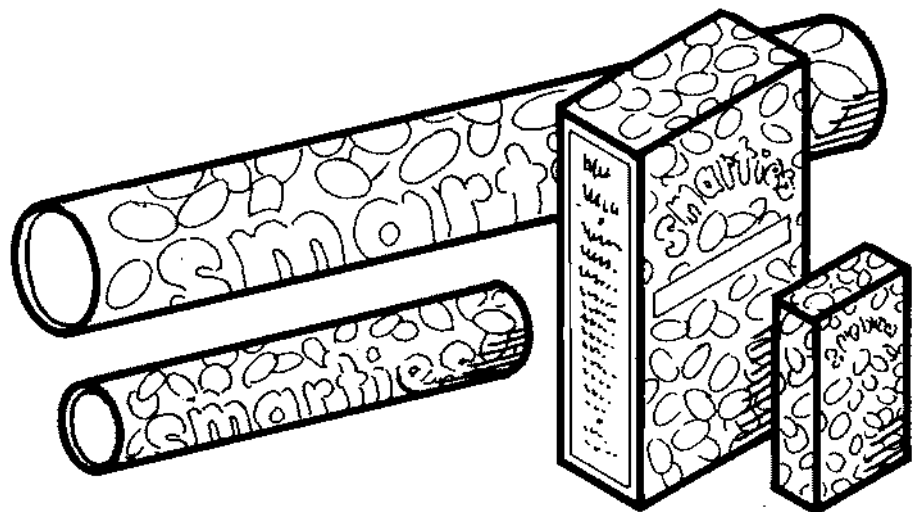
Same → for your teacher
→ smaller children



Measure your head round and compare this with your height.

What happens when you do the same → for your teacher?
→ smaller children?

How many Smarties in the pack?



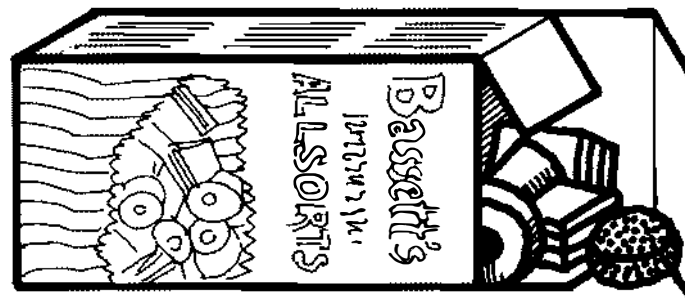
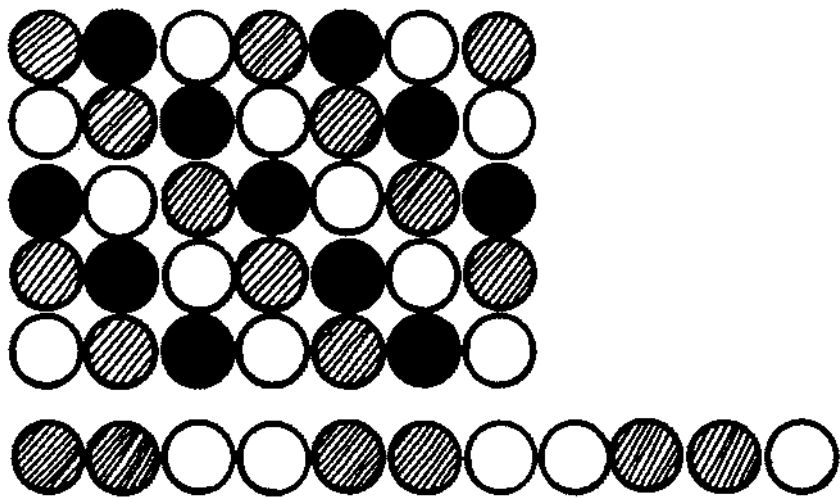
Ask the children to compare the number of Smarties in different packs.

How can you be sure?

Count them in different ways.

How many more \rightarrow red than yellow.
 \rightarrow blue than green.

Arrange different coloured Smarties in as many ways as possible.



What if you had a box of Liqueur Allsorts?

How many different ways can you sort them?

Invent some more patterns.

How many Smarties do you think are in the tube?

I don't like the white ones

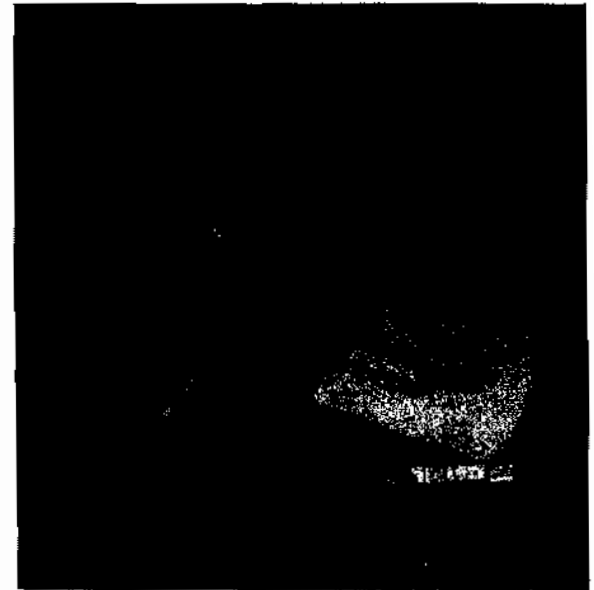
Don't you why not?

'Cos there are too many of them and I like the red ones

Well how many white ones do you think there are?

About six

OK. let's see, you can count them how you like



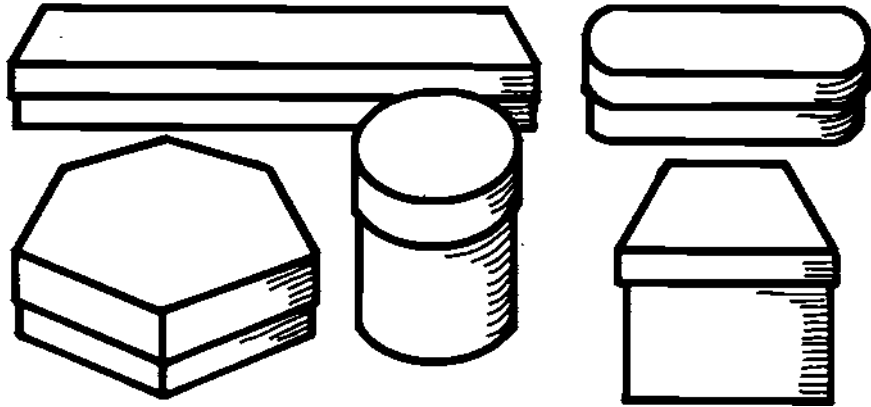
Robert emptied the tube onto the table and proceeded to count them all.

45.
Can I put them into groups?

Robert sorted them into groups of 10 and one group of 5.

10, 20, 30, 40...
and ...er... a half!

Sorting
Grouping
Counting
Comparing
Making patterns
Adding



Hide the lids.

Ask the children to choose a container and make a lid to fit it.

Encourage the children to talk about their containers.

What is a lid?

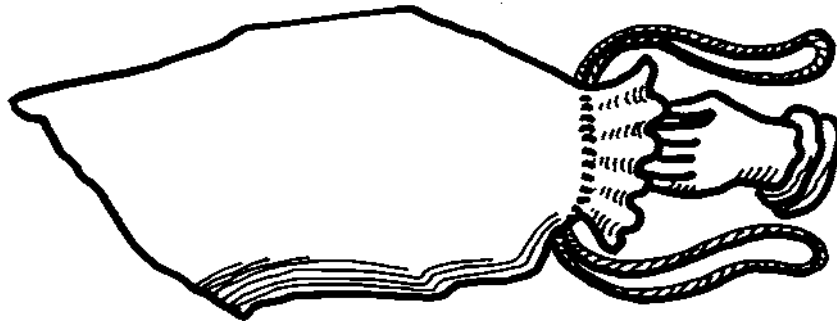
How can you be sure the lid will fit?

How many different designs can there be for the lid of your container?

Play with a partner.

Put a lid in a feely bag.

Can your partner find the matching container from your description?



Which containers will fit inside one another?

What different structures can you build with 3 of the containers?

Is this a hexagon?

No it's got too many sides. It's nearly a circle.

A circle with some straight bits.

A long square box with a sort of semi-circle lid on it. Funny, the lid should be sort of square too!

It's a circle at the top and round all the way down. It's a bigam mouse.

The box is square and it has got pins on the side it's got 8 corners...

These are circles at the top and all the way down.

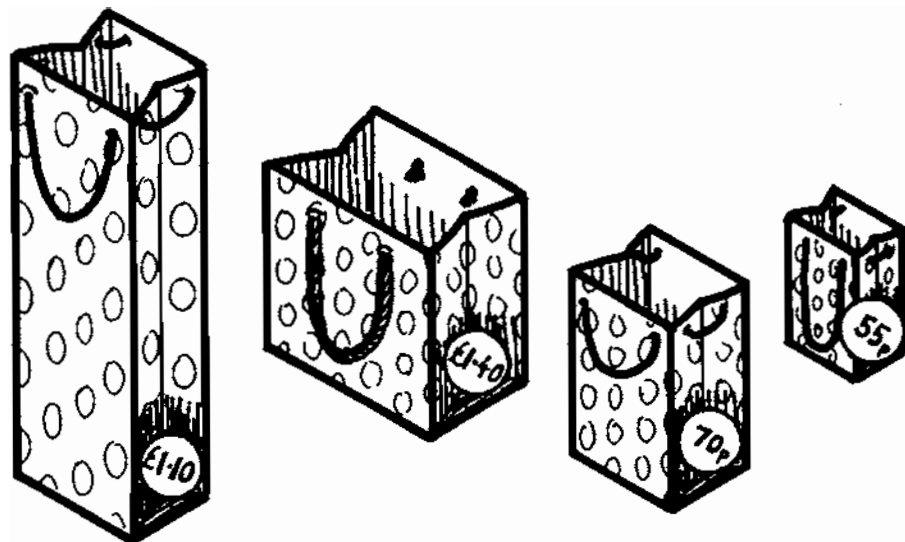
These are all square boxes.



Using non-standard measures

Designing, planning and making 3D shapes

Talking about 2D shapes



What can you tell me about the bags?

Encourage the children to discuss and compare the bags for size, number of spots, thickness of handles and cost.

How can you keep track of all the information?

How many dots altogether on $\left\{ \begin{array}{l} \rightarrow 4 \text{ bags?} \\ \rightarrow 3 \text{ bags?} \end{array} \right.$

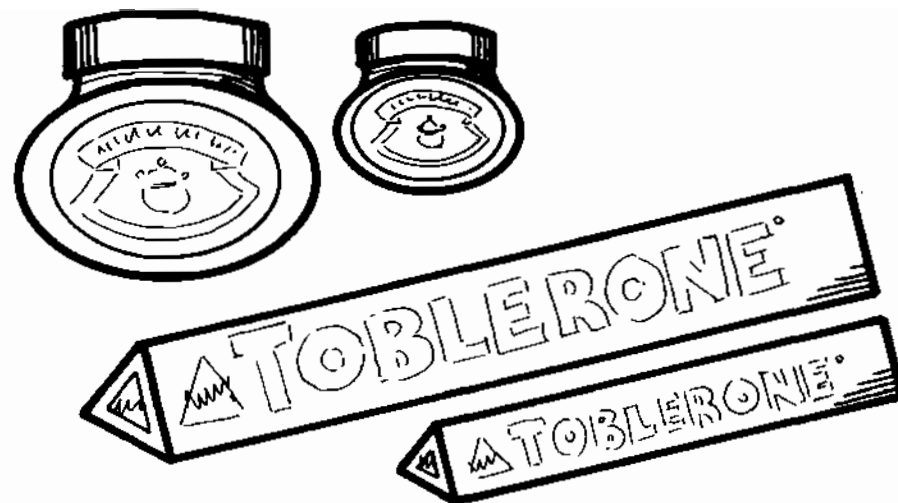
How much would 4 bags cost?

Can you make a bag?

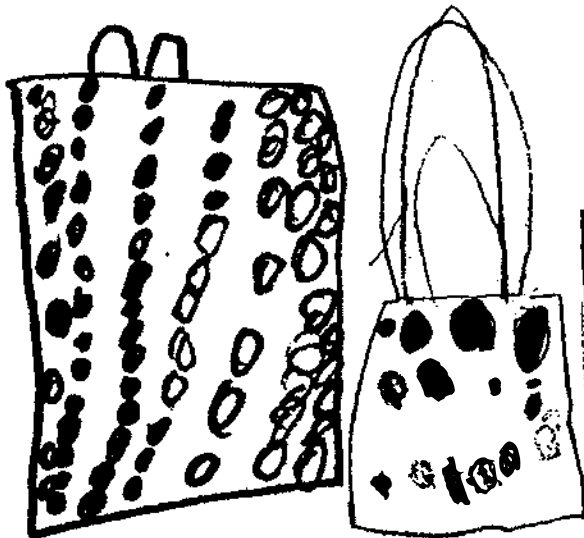
Investigate which bag holds the most.

Choose a bag and make a bag half the size.

Will it hold half as much?



Explore the relationships between other interesting tins, jars, containers.



Big and small circles on them.

The tallest bag had the less spots on.

1	2	3	4
57	59	67	55
4●	4●	4●	4
~	~	~	~
55p	P 2E		120



Counting, reading, writing and ordering numbers

Halving

Comparing and measuring

Adding

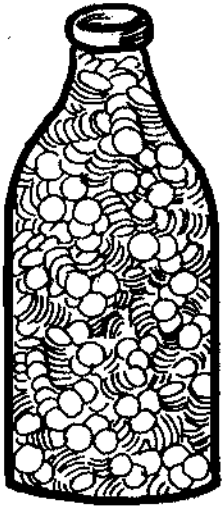
Money

Discussing, designing and making

Rosalind
 age 8½
 very colourfull
 the strings are fatter than others
 they squashed up at fast and you have
 to make it
 there are 55 spots on

Tu
 65
 70
 14
 01
 10

 14-10p



This milk bottle is full of pennies.

Estimate how many coins there are in a bottle.

Count the pennies in different ways.

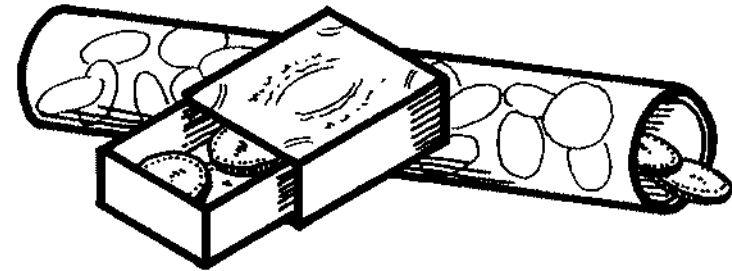
Compare the different ways of counting.

Investigate groups of 

If you collect a metre of pennies how rich are you?

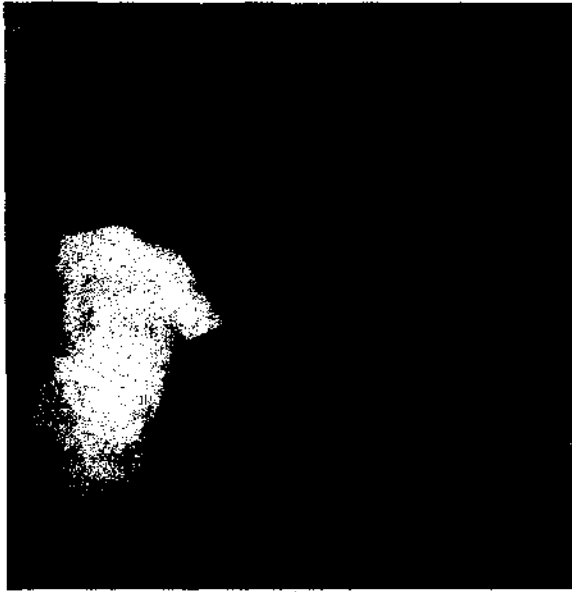


Fill a variety of containers.



Explore values for different coins in the same container.

Explore the same coins in different containers.



We can put them into piles of ten

You can pour them through the bottle

I know how to count them- let's tip them out on the table first....

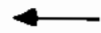
..and then we put them into the bottle one at a time.

You could share them out

Can I put them on the number line?

They would make a very long line on the floor.

- Grouping
- Counting
- Addition of money
- Working systematically
- Explaining



← Natasha

← Joyti

Arranging and re-arranging.

How many ways can the children arrange themselves in the three hoops ?

How can we remember who's been where ?

When Joyti is in the red hoop, how many ways can Natasha and Maxine be arranged in the other hoops ?

What happens with 3 hoops and 2 people?

What if we had 4 hoops and 4 children?

Hats can be as much fun as hoops.



Hoops

1) Show many ways can the children arrange themselves in the hoops

R
T
Z
N
T
R
Z
N
T
R
T
Z
N
T
R
Z
N
T
R
Z
N
T
R
Z
N
T
R

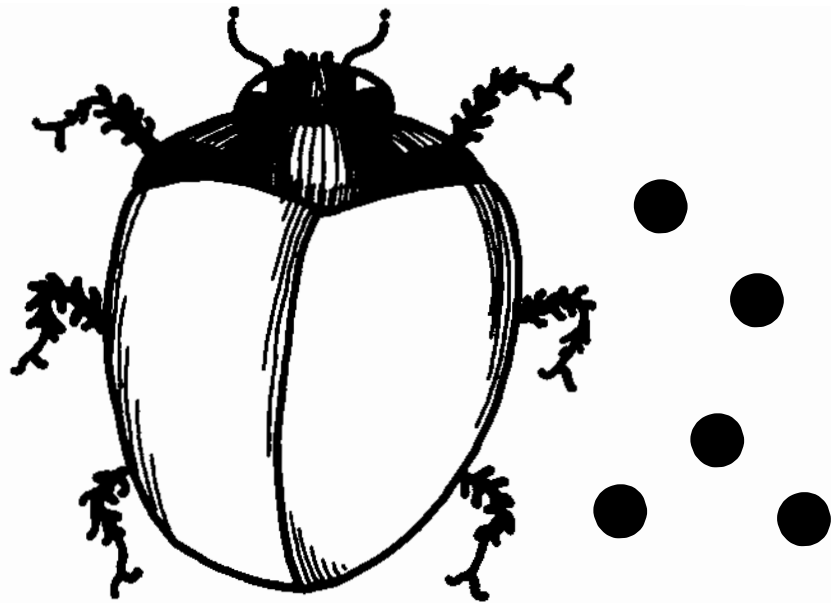
	1	2	3
1st			
2nd			
3rd			
4th			
5th			

1 2 sheun 3

1st
2nd
3rd
4th

	1	2	3	4	5	6	7	8	9	Extra
1st										
2nd										
3rd										
4th										
5th										
6th										
7th										
8th										
9th										

Systematic recording
 Talking and asking questions
 Making and testing predictions
 How many ways?



The Ladybird needs to have the same number of spots on both sides.

Ask the children to investigate which numbers work.

Why doesn't number 1 work?

Why does number 2 work?

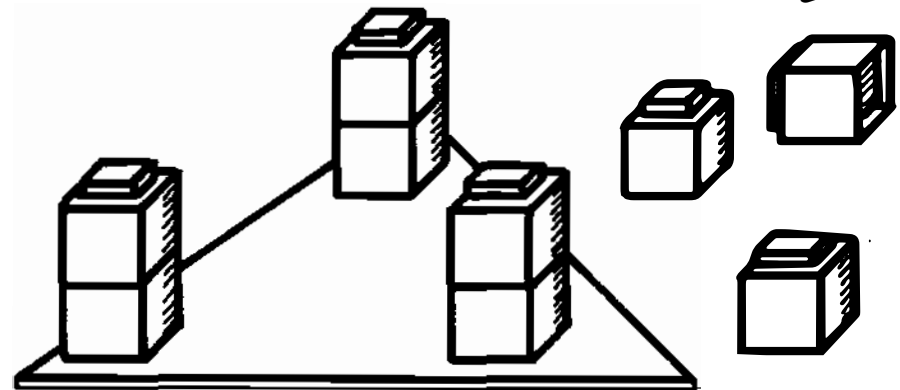
What about $\begin{cases} 9? \\ 10? \end{cases}$

Arranging $\begin{cases} 5 \text{ spots?} \\ 10 \text{ spots?} \end{cases}$



Explore symmetrical patterns.

Using Unifix cubes and triangles make towers of the same height.

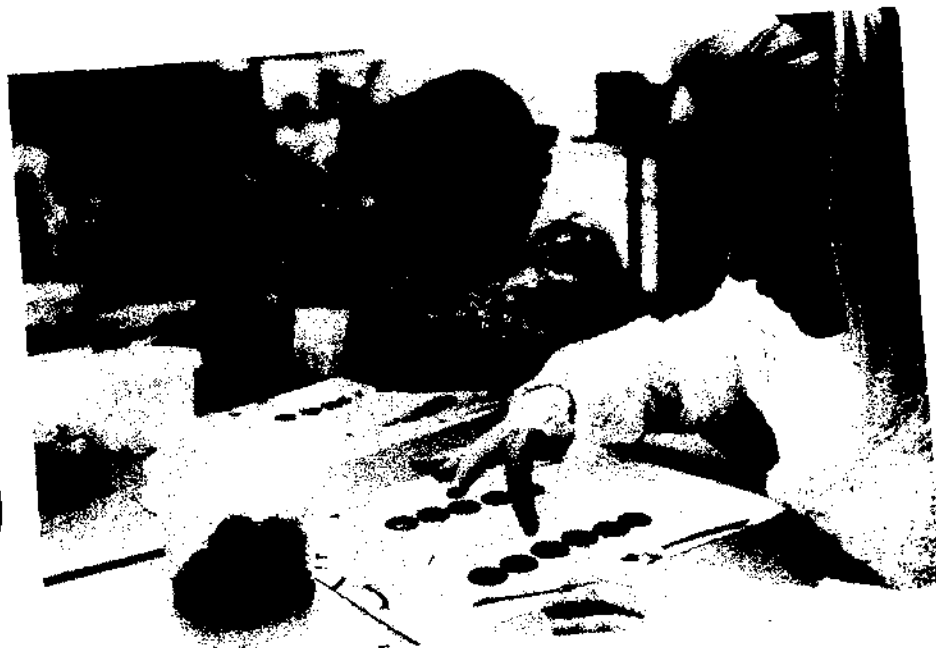


What if $\begin{cases} \text{Squares?} \\ \text{Pentagons?} \end{cases}$

I am wondering about ninety-one.
 You see, ninety-one is nine and a
 one, both of them are not all right,
 so I think ninety-one is not
 going to be all right.

I think 2 and 6 and
 them numbers are
 all right.

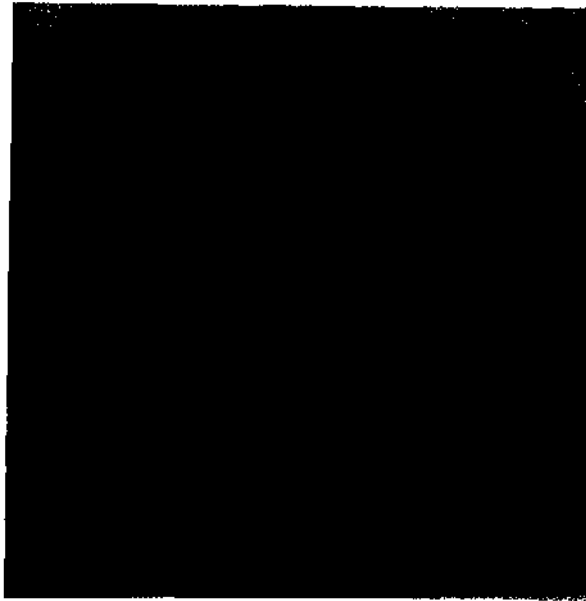
You can't share
 one out.



the ticks you will
 will. be the same

ticks
 if you
 pretty
 unt at

9 12 15 6



3 children stand on the carpet tile grid to make a total of 10.

How many ways can this be done?

Can you stand next to one another and make 10?

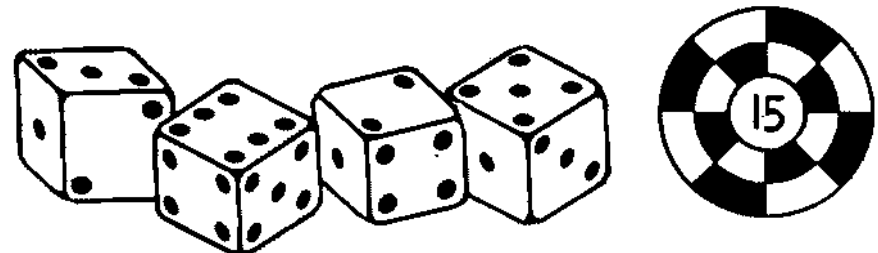
If one person stands on 5 where can the other two stand?

What if

- a different number of children.
- different tile numbers.
- a different total.
- a different sized grid.

3 out of 4!

Choose a target number.



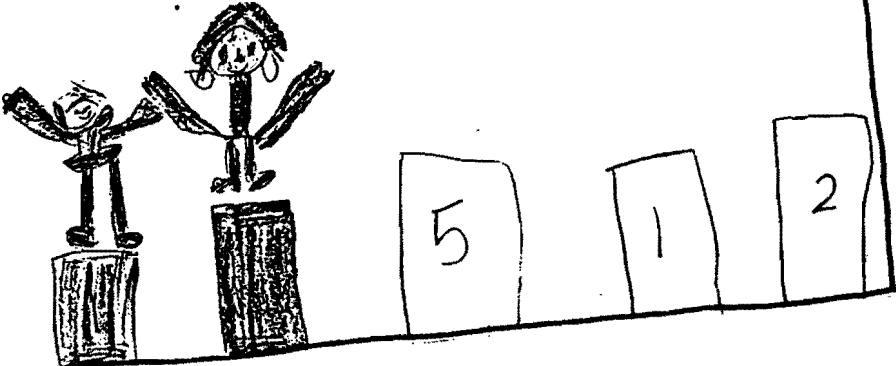
Roll 4 dice, then find which 3 will take you closest to the target number.



$$\begin{array}{l} 5 + 4 + 1 = 10 \\ 1 + 4 + 5 = 10 \\ 4 + 5 + 1 = 10 \\ 2 + 3 + ? = \end{array}$$



sara and James and Robert and me stood on some tiles there were 9 tiles altogether sara stood on a number 1 and James stood on number 5 and Robert stood on a number 2 and I stood on a number 2 and we all enjoyed the game?



How do you add three numbers?

Counting

Reading and writing numbers

Adding

Explaining



The badges show the age of each dog.

Ask the children to make up a set of questions about the dog's ages.

When you add together the ages of two of the dogs it makes 21.

Which two dogs could it be?

To calculate a digit total:

$$1959 \longrightarrow 1 + 9 + 5 + 9 = 24$$



The digit total of the year is 21. How old would the dog be?



Find out the ages of everyone in your family.

Investigate the differences in their ages.

How old would they be in dog years?

1 dog year = 7 human years.

Mine's older than yours.

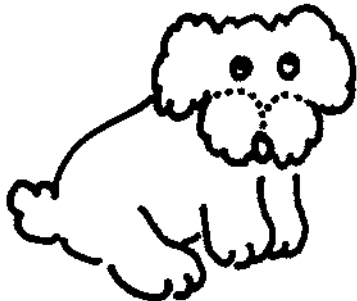
I've got the youngest.

I'm 36 that means I'm 30 years older than I was yesterday.



Does your dog have the same birthday as mine?

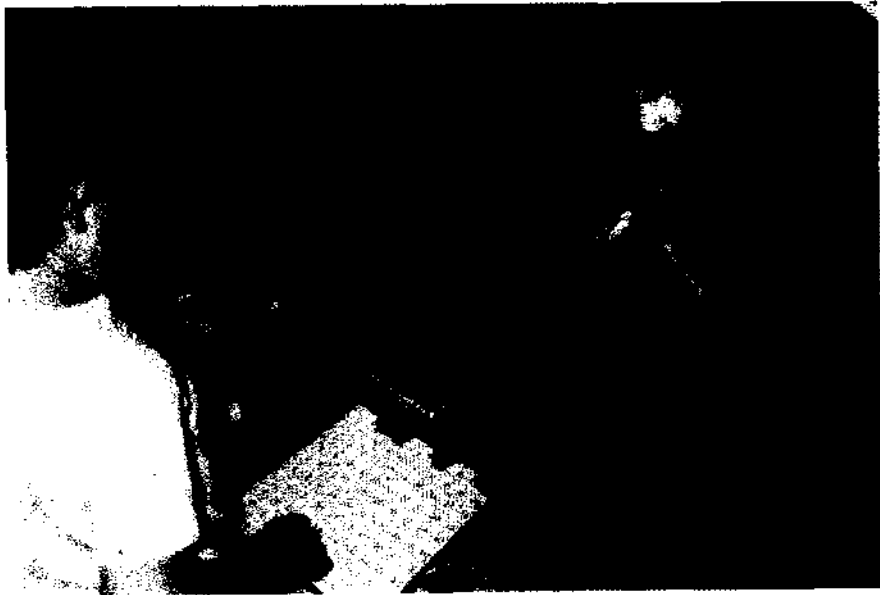
I want to be the oldest..... Which badge shall I choose?



I'm going to add together all the even dogs.



- Ordering
- Matching
- Cardinal number
- Adding
- Differences
- Odd and even numbers
- Ordinal number



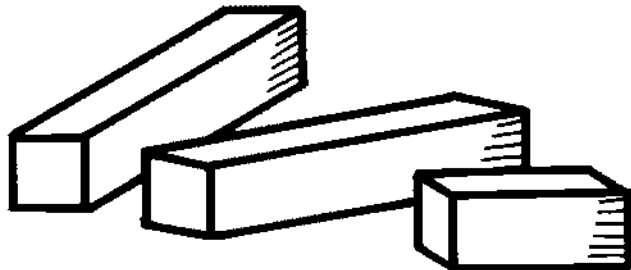
Red hot numbers.

How many numbers can you make with Cuisenaire rods?

Keep track by covering the numbers you have made with a unifix cube

How many numbers can you make using only reds and light greens?

Look at the patterns when only pink rods can be used.

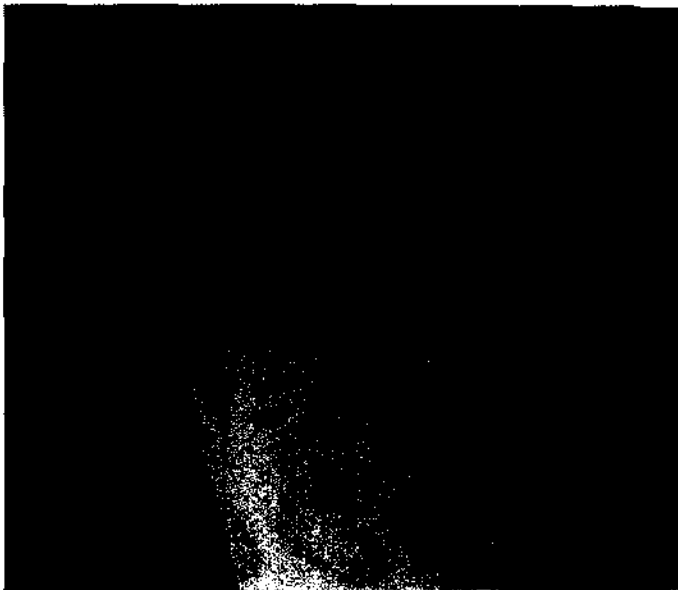
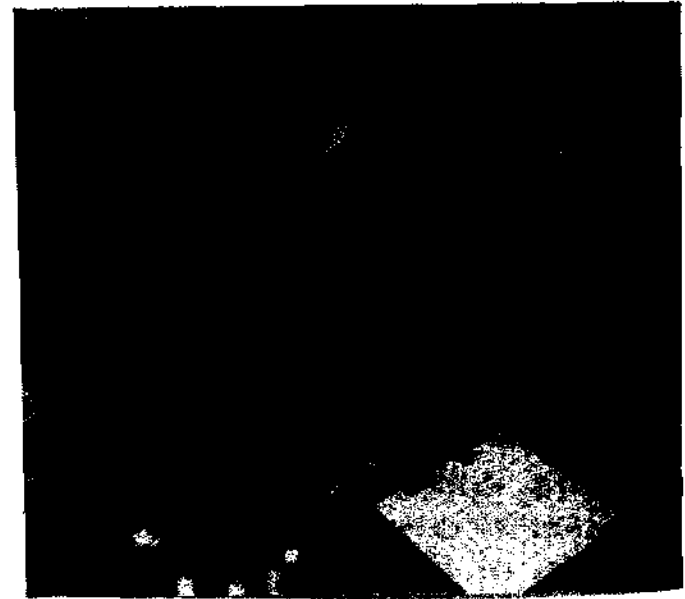


Which totals from 1p to 50p can you make?

You can use as many of each stamp as you wish.

If I use just light greens
and pinks it's easy peasy 'cos
you can get 3 and then 4 and
together that makes 7 and then
you just keep putting another
3 and another 4.

What if you placed them
together 3,3,3,4,4,4 is the
answer the same as
3,4,3,4,3,4? Why?



Adding
Cardinal number
Multiplying
Pattern spotting
How many ways?

Number Poem

You always have -
1 - sun in the sky
2 - shoes in a pair
3 -
4 -
5 -
6 -

In pairs, ask the children to discuss and compose a poem of their own.

Use shoes to practise counting in 2's.



Given 20 shoes how many pairs?

Explore counting in $\rightarrow 3$'s
 $\rightarrow 4$'s
 $\rightarrow 5$'s

Read -



Work with a partner.

Make up a multiplying story.

Some examples of wrapping papers with repeat patterns on them.



Design your own repeat paper pattern.



How many sheets would you need to wrap up your teacher?

How much paper does it take to wrap 10 multi-link?

Organize a pattern day when the children come to school wearing patterned clothing.

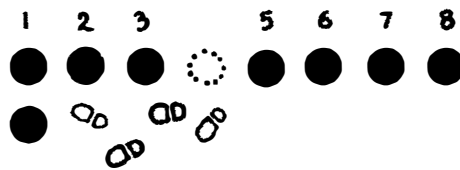
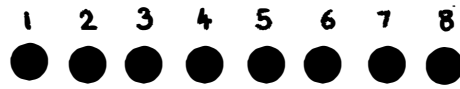
Look at the patterns discuss them, count them, draw them....



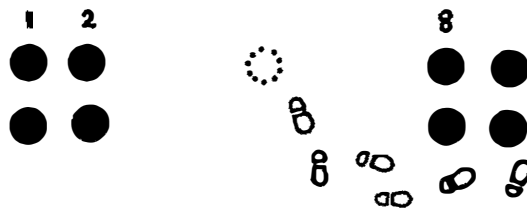


1 2 3 4 5 6 7 8

Make 4 pairs. For every move you must walk past 2 (and only 2) people.



final grouping:



What happens if you have 10 people in the line?

What must the last move but one look like?

Does it matter where you start?



Invent some "would you rather" with a mathematical flavour.

Would you rather have your height in a pile of pennies

or

your width (fingertip to fingertip) in 20 p coins put edge to edge.

Would you rather have 10p a day pocket money for 2 weeks

or

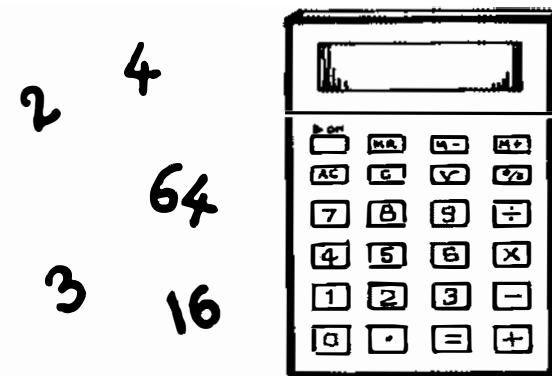
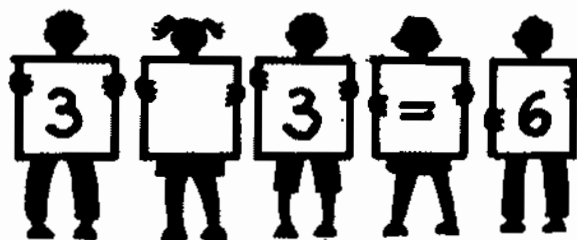
a penny on the first day, 2p on the second day, double again on the next etc...

3	20	50	500	-
2	5	30	200	300
+	+	=	-	=

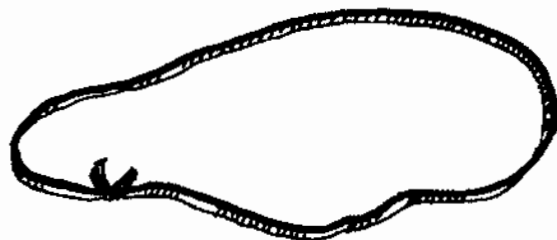
Invent some statements with missing signs or numbers.

Ask another group to find the missing link.

Make a set of large cards at least 30cm x 30cm. Children organize the cards to make a range of true statements.



Given a restricted set of numbers, ask the children to work in groups of 3 and explore the possible number sentences.



Take 3 metres of knicker elastic and tie it to form a circle

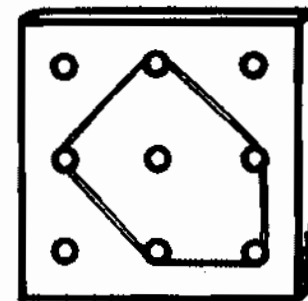
Ask a group of children to stand inside it and investigate making different shapes.

Ask two children to hold the elastic at two different points.

Ask a third to make as many different triangles as possible

How many different shapes can you make

with $\begin{cases} \rightarrow 3 \text{ people} \\ \rightarrow 4 \text{ people} \\ \rightarrow 5 \text{ people} \end{cases}$







Use the geoboard to make as many different 5-sided shapes as possible. Try including crossing the bands.

3 children each have a feely bag containing a dotted, a striped and a plain paper bow tie.

Simultaneously the children take out a bow tie.

What are the chances of all the bow ties being dotted?

Bowtie Game 		SCORE
all the same		10
2 of one		5
3 different		2

Have 10 goes and add up your scores.

Will you ever get $\rightarrow 50?$
 $\rightarrow 27?$

Have a bag with an equal number of 5p's, 10p's. and 20p's. in it.

Take it in turns to grab a handful of money.

Discuss how many of each coin in a grab.

What happens?



Choose a shoe.

How big is the person who wears this shoe?

Make a life-size model or drawing of them.

How many strides would it take each person to cross the classroom?

Investigate the different footprints made by each shoe.

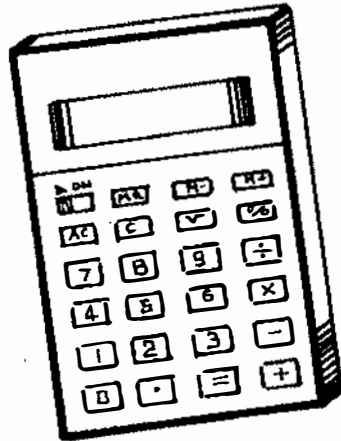
Try \rightarrow drawing round
 \rightarrow pressing plasticine
 \rightarrow paint prints

Same \rightarrow for your teacher
 \rightarrow smaller children



Measure your head round and compare this with your height

What happens when you do the same \rightarrow for your teacher?
 \rightarrow smaller children?



Set the constant function on the calculator to work in threes.

Investigate the numbers on the display.

will → 139 appear?
→ 245 appear?

Can you predict the 25th. number?

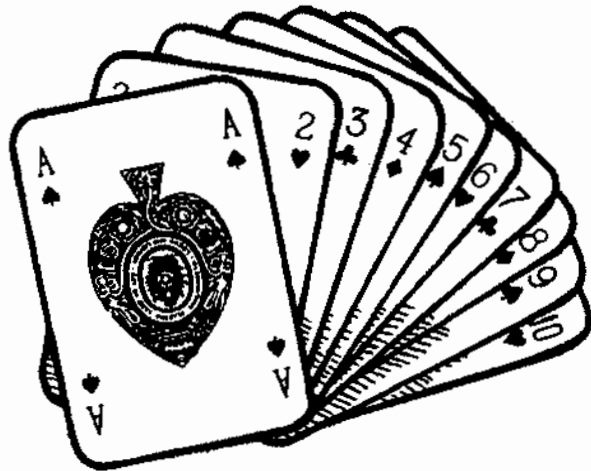
Experiment with different numbers as constants.

Use two calculators, one set on 3, one set on 4.

When will they show the same numbers?

Will it happen again?

When?



A set of playing cards minus the picture cards.

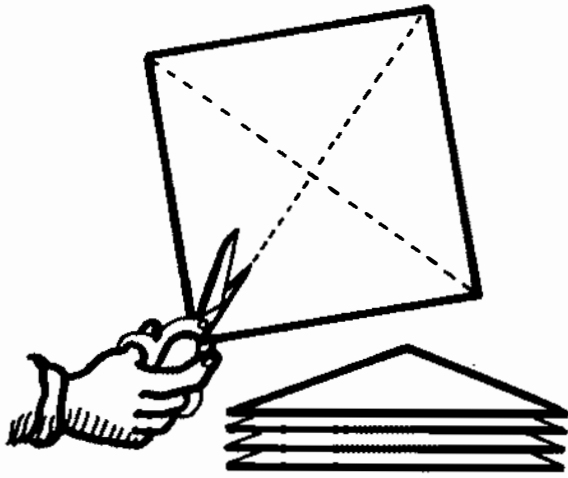
Investigate pairs of cards which make a total of 14.

what about → 3 cards?
→ different totals?

Use the complete pack of playing cards.

Be inventive!



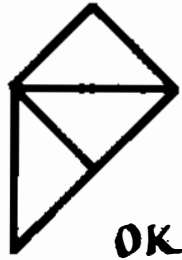


Make a pile of triangles cut from a square.

Take 4 triangles, fit them together to make new shapes.

Is a rectangle possible?

What if only full side touching is allowed?

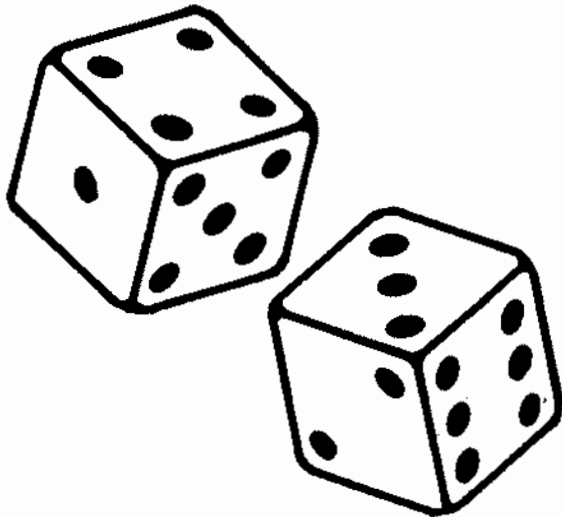


Investigate shape making

using → 2 triangles
 → 3 triangles
 → 4 triangles
 → 5 triangles

Use as many triangles as you wish to investigate

making → 3 sided shapes
 → 4 sided shapes
 → 5 sided shapes



Use two large dice.

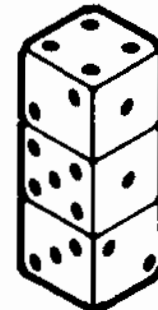
Place the two dice one on top of the other.

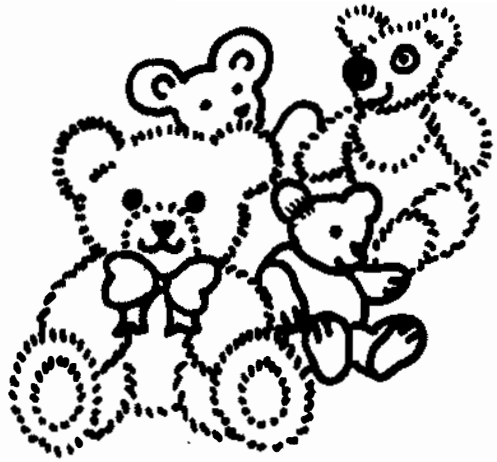
How many ways can seven spots be hidden?

How many ways can you

hide → 5 spots?
 → 12 spots?
 → ... spots?

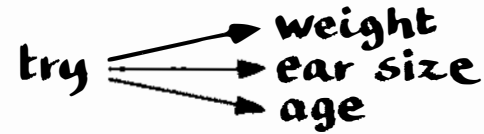
Investigate other hidden totals by using more than 2 dice.





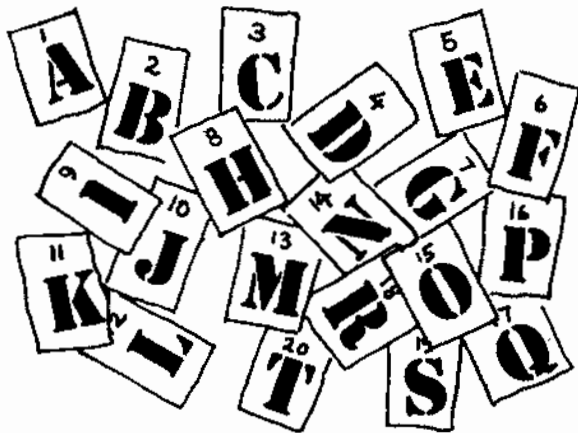
Make a collection of teddy bears.

Find different ways of ordering the teddy bears.



Ask the children to rate the bears on a scale of 1-10 for likeableness.

Collect the data and record.



Each letter of the alphabet has a value,
A=1 B=2 C=3.....Z=26

Investigate values of children's names

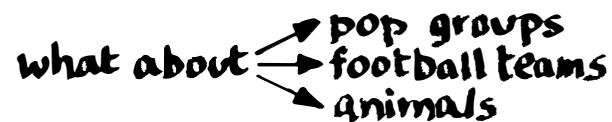
JACK $10 + 1 + 3 + 11 = 25$

SITA $19 + 9 + 20 + 1 = 49$

Find the most valuable word beginning with

A _____

Find the most valuable three letter word.

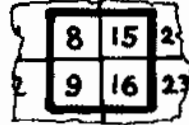




Use a calendar with the days arranged in a grid.

Choose any month of the year.

Look at any four days which form a square.



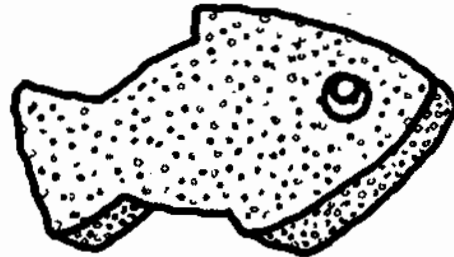
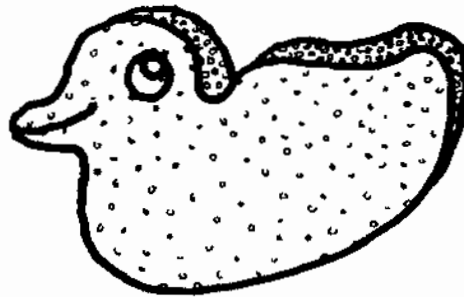
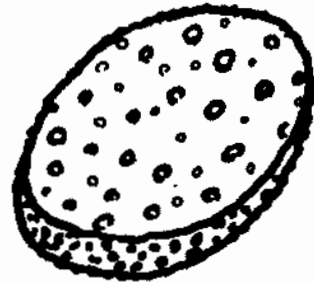
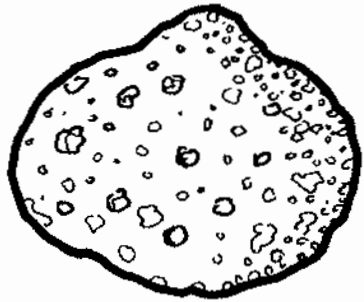
Investigate the totals of the diagonals.

Use a different 2x2 grid.

What about a 3x3 grid?

How many months start with a Wednesday?

Explore and record starting days.

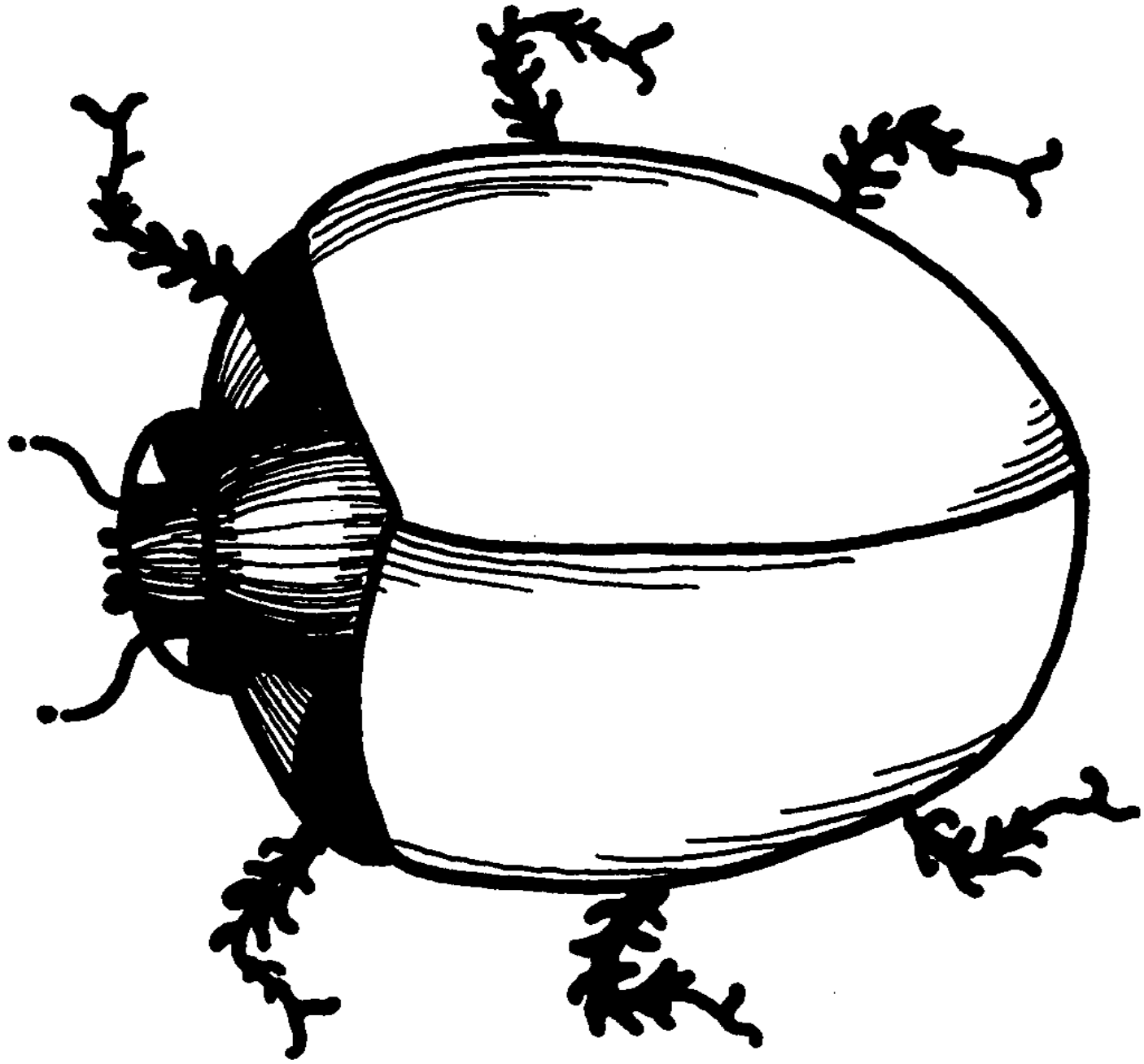


Make a collection of sponges of various colours, sizes and textures.

Which sponge covers the most space?

Investigate which sponge holds the most water.

Discuss fair testing.



National Curriculum Links

	Using and Applying	Number/Algebra	Measures	Shape and Space	Handling Data
smarties	•	•			•
containers	•		•	•	•
bags	•	•	•	•	•
milk bottle	•	•	•		
hoops	•	•			•
ladybirds	•	•		•	
carpet tiles	•	•			
Wendy's dogs	•	•			
red hot numbers	•	•	•		
number poem	•	•			
wrapping paper	•	•	•	•	•
arranging	•	•			•
would you rather..?	•	•	•		
people sums	•	•			
elastic shapes	•		•	•	•
bow tie game	•	•	•		•
shoes	•		•		•
calculators	•	•			
playing cards	•	•			
cutting and fitting	•			•	
dice	•	•			
teddy bears	•	•	•		•
alphabet	•	•			
calendar	•	•			•
sponges	•		•		•

The grid indicates some of the areas of mathematics that it is possible for children to encounter as they explore the activities.

With thanks to the children and staff of the following schools:

Albemarle JM&I, London SW17
Baring Primary , Lewisham, London
Honeywell Infant, Battersea, London
Jubil e Primary School, Bexley, Kent
Kinoulton Primary, Nottingham
Lynncroft Primary, Nottingham
Raynville Primary, Leeds
Redhills Combined, Exeter
Worple Road Primary, Hounslow, Middlesex

The books mentioned on pages 19 and 20 are :

page 19

Anno's Mysterious Multiplying Jar by Mitsumasa and Masaichiro Anno (1982)

ISBN 0-370-30958-8

Bodley Head Ltd.

page 20

Would You Rather... by John Burningham (1978)

ISBN 0-00-662394-8

Fontana Picture Lion

The ladybird enlargement for the activity on page 11 may be freely photocopied within the institution purchasing this booklet

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