

Patriotic Alternative Framework For Mathematics

Lines Of Development In The Early Years



When Do Children Start To Learn Mathematics?

When they are ready! Which could be at any stage of their development. Some children might show signs of understanding number concepts at a very young age whereas others might be much older. There are those born with a flair for maths and those who have no interest. Whatever the personal inclination of the individual, everyone needs to develop a degree of numeracy and it's not enough to sit back and say 'but in this day and age we have calculators!'

In mathematics, there is a term “**number sense**,” that refers to a conceptual framework that enables a person to understand relationships between numbers and to solve mathematical problems. This can be developed from **birth** and starts with the **language of mathematics**. Counting is part of our lives and can be included when doing the most mundane activities such as getting breakfast ready or sorting out the laundry.

The more you talk about maths at home, the more your child will think about maths. It's really that simple! It's crucial, though, to use age-appropriate language to help them learn. For example, with very young children, it's enough to simply count numbers — perhaps the cups needed for tea or the eggs required in a cake recipe.

When your child shows **readiness**, it's appropriate to ask questions, such as, “If I take out three biscuits, one for each of us, and then Granny pops in - how many will I need to take out?” but it should remain a discussion rather than an extended quiz session. Children need to talk through the solution without interruption.



The Problems With Learning Mathematics In A Classroom.

Teaching maths to children is a really straightforward business. State trained teachers have over complicated the process (as they have every other subject)! and schools like Montessori, The Forest School and Steiner are based on 'methods' which despite being revolutionary at their inception are now commonplace and little more than common sense. They also cost a fortune!

If you want to look up the Waldorf method for example you will find:

'it does not teach mathematics in isolation of other subjects' and

'it is part of a holistic learning approach. It is a kinaesthetic (or whole body) learning experience....

It is a slow and unhurried approach that does not push the child to count (or read) too early, which has been found to taint a child's passion to learn.'

Most of us would agree with these statements and most of these ideas have become fairly mainstream - as well as their ideas of linking the learning of mathematics to the natural world. The practicalities of teaching using these methods, however, don't work in a modern state primary school. The child/adult ratio is unworkable and there are countless other restraints beyond the scope of this summary.



The national mathematics curriculum for England and Wales makes **long, and tedious reading** although there's nothing actually wrong with it. There are a number of other 'versions' of the curriculum and they are all very similar. The other striking problem with existing curricula (apart from the **multi-cultural books and resources!**) is the **dependence on computer games** to introduce concepts. In a classroom setting a teacher has to teach the same concept to the same group of children at the same time and even though it's acknowledged a blanket approach is ineffective, it's difficult in reality not to do it any other way. And the reason, of course that he or she will turn to websites such as: [Topmarks](#) or [Twinkl](#)

Swiping, pinching and clicking are no substitute for taking a walk along a beach and looking for ten white pebbles or making comparisons of the different sizes of leaves collected in the park.



Teaching Mathematics At Home

The PA framework for mathematics in the early years simply aims to distill the curriculum and link to great websites on child development, learning theories and suggested activities. There is no need to buy any special equipment or books or resources. This set of beautiful natural objects retails for £45. Look carefully and you can see a set of 0 - 9 wooden numeral templates (available in the pound shop), some dice (often found down the back of the sofa) and the rest are objects found in the woods or at the beach.

What is important, is to **keep the concepts in a logical sequence**. It can't be emphasised enough that approaching concepts step by step is crucial and it is equally important that parents check their child is secure (or confident) at each level before moving to the next. If additional material is required for consolidation or practice, links to websites can be provided or parents can contact the creators of the website.

What teachers or (parents) teach is always in accordance with the stages of learning identified by psychologists. As practitioners we only really need to know what to teach and how to teach it - not the whys and wherefores behind each stage (unless of course we really want to)!

Early maths can be taught effectively in the home utilising resources found in the kitchen, the garden or the wider environment.

Remember: Step 1 - **Introduce every concept in a practical way using arbitrary or random items**

Step 2 - **Concepts can be represented pictorially**

Step 3 - **Only introduce numerals and symbols and expect children to use worksheets when they are able to think in the abstract**

<https://pin.it/60TUwQv> learn maths outdoors



Mathematics Readiness - Concepts to Understand

Before children are ready to think in the abstract and 'do maths,' it is important they are aware of the underlying concepts behind each mathematical process. For example we can't expect children to do 'sums' i.e. $4 + 2 = ?$ unless they are able to count out four items and then find two more of the SAME item.

They need to understand so much before they are ready to cope with what numerals and symbols represent. It's quite important, therefore to be able to make an assessment as to when a child is ready to learn computation skills. Assessment can be subjective though in the early years, and most parents insist they know their child better than any teacher. That is perfectly true but a standardised 'checklist' can always help.

Assessment is a specialised field in the world of education and understanding how it's done can be like making your way through a minefield. If parents have any concerns about their child's cognitive development it is important to seek advice early as there is nothing worse than the worry of wondering whether he or she matches up to others of the same age and stage in development. One of the main benefits of homeschooling is the fact that children are removed from the stresses of all this and can be extended or given extra attention according to their individual needs.



Assessing Mathematics Readiness

It is also important not to over complicate the assessment process and remember that what follows is a guide only. These are all headings and links are provided for further information further information. So to assess mathematics readiness, ask and be able to tick off most of them.

Can Your Child:

Sort objects: by size, shape, colour or quantity into sets, then subsets?

Match objects: i.e. find two socks the same?

Do a simple jigsaw?

Continue a repeat pattern?

Copy and repeat a simple rhythm?

Find the odd one out?

Count to five - backwards and forwards. Then be able to count to ten and beyond?

Sing simple number rhymes and songs - 'five little monkeys jumping on the bed - One fell down and bumped his head?'

Talk about size and weight. Identify biggest/smallest, heaviest /lightest?

Describe and talk about shape - two dimensional or flat shapes, then 3 dimensional. Identify squares, triangles, rectangles etc.

Use positional language: before, after, in-between etc?

Have a concept of distance - further away, close by, near etc?

Money and coins - understand that money has value and a coin or a note can be exchanged for an item?

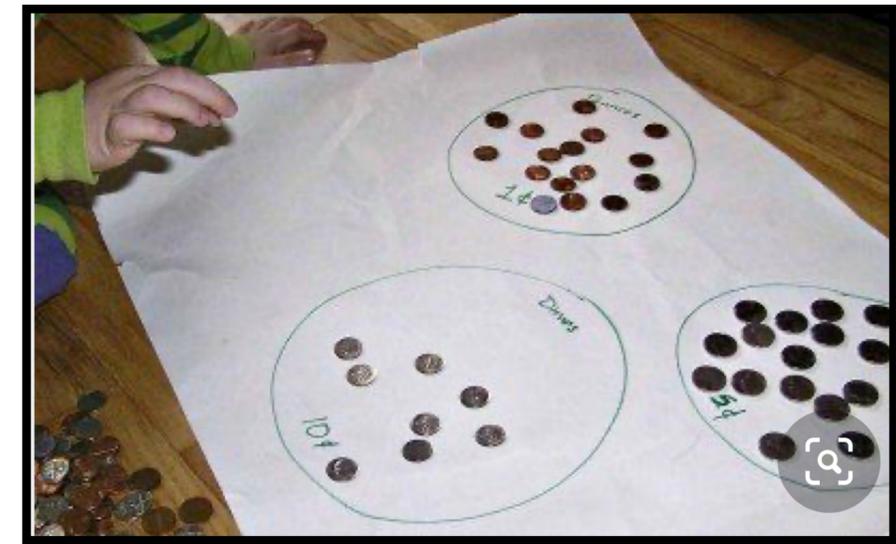
Time - afternoon, morning etc. what happens on the different days of the week, months of the year etc?

Good! Now We Are Ready To Start!

Early Mathematical Concepts

Here is a list of basic concepts with links to websites and ideas for activities. These early concepts are roughly in this order although much of it can be taught simultaneously. Every concept needs to be covered in a practical way, then pictorially before expecting children to think and work in the abstract. The list does not end here and will be updated and added to each week.

1. **Sorting**
2. **Counting** .
3. **One to one correspondence**
4. **More about counting**
5. **Repeat patterns**
6. **Using a number line** How many more? How many less?
7. **Ordinal and Cardinal number**
8. **Formation of numerals** (this skill is not aligned to a child's mathematical ability)
9. **Symmetry Doubling and halving**
10. Identifying and recognising **shape**: 2 dimensional, 3 dimensional
11. **Odd and even numbers**
12. Collecting and displaying **data**
13. **Measuring**: height, length, width
14. **Weight** - heavy, light, the same as, balance etc. **Capacity and volume** - full, empty etc.
15. **Time Money shopping and coins**



Sorting is a mathematical skill and one of the first children master. When children sorts objects, they are analysing data, finding relationships among objects, and applying rules to groups.

They are also thinking logically and critically about a given set. It may seem like an easy skill, but sorting is so very much more. Sort by colour, shape and size.

Remember practical activities first, then pictorial. Children need to have as much experience with arbitrary units as possible in order to transition smoothly to thinking in the abstract. These are a few ideas but there are countless more found in the home and in daily interactions with nature,



Counting

There is so much more to counting than you think.

Count everything with young children.

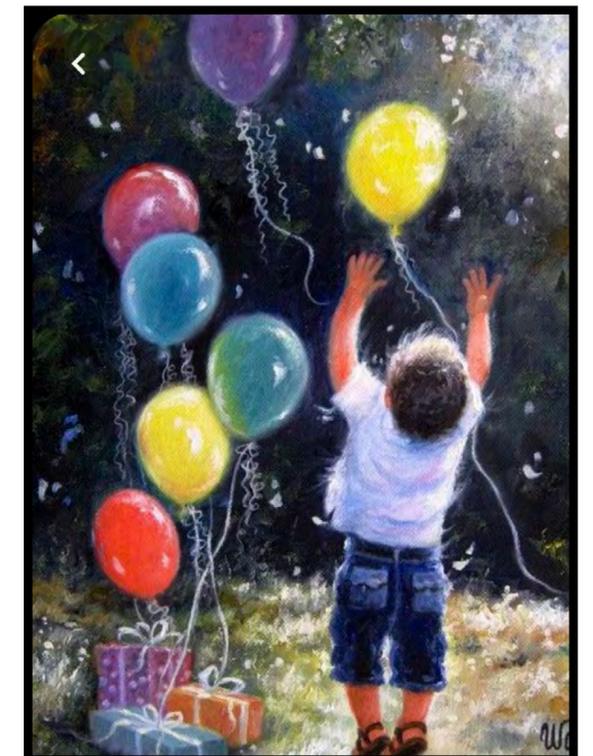
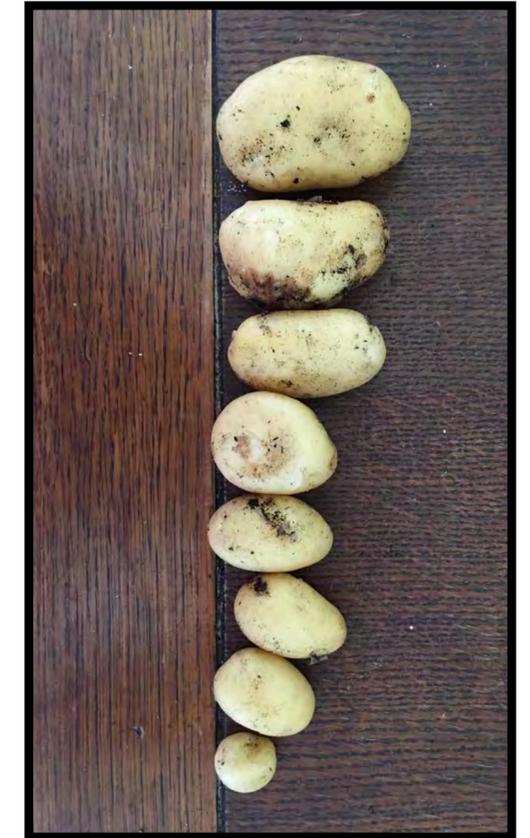
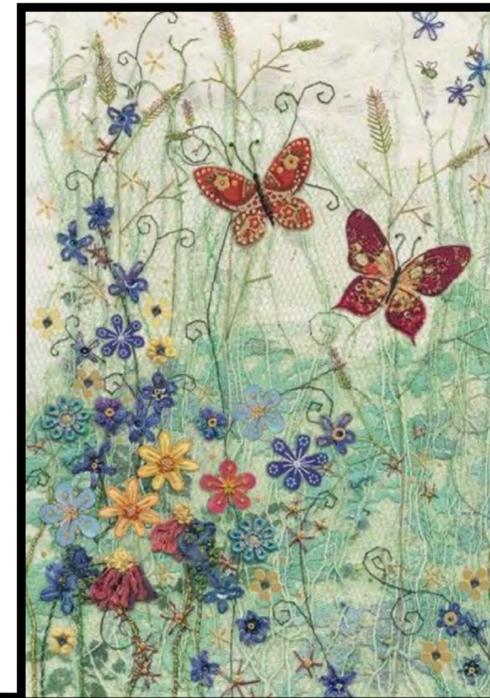
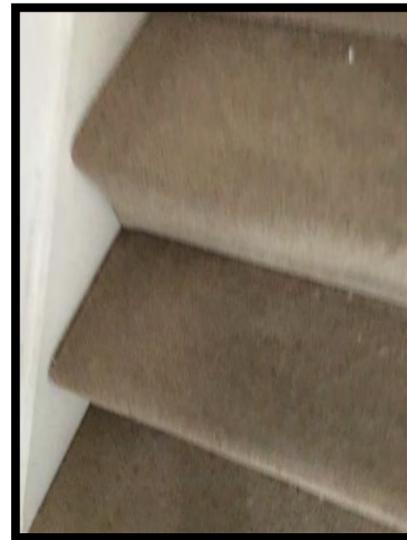
Count the stairs, count the cutlery, count the crayons, the flowers, the insects, count the steps you take to the garden.

Just remember:

Being able to recite number names is NOT counting.

It is really important to know that there is one number for one item. This is called one to one correspondence.

<https://www.ukessays.com/essays/psychology/the-importance-of-counting-in-early-number-development-psychology-essay.php>



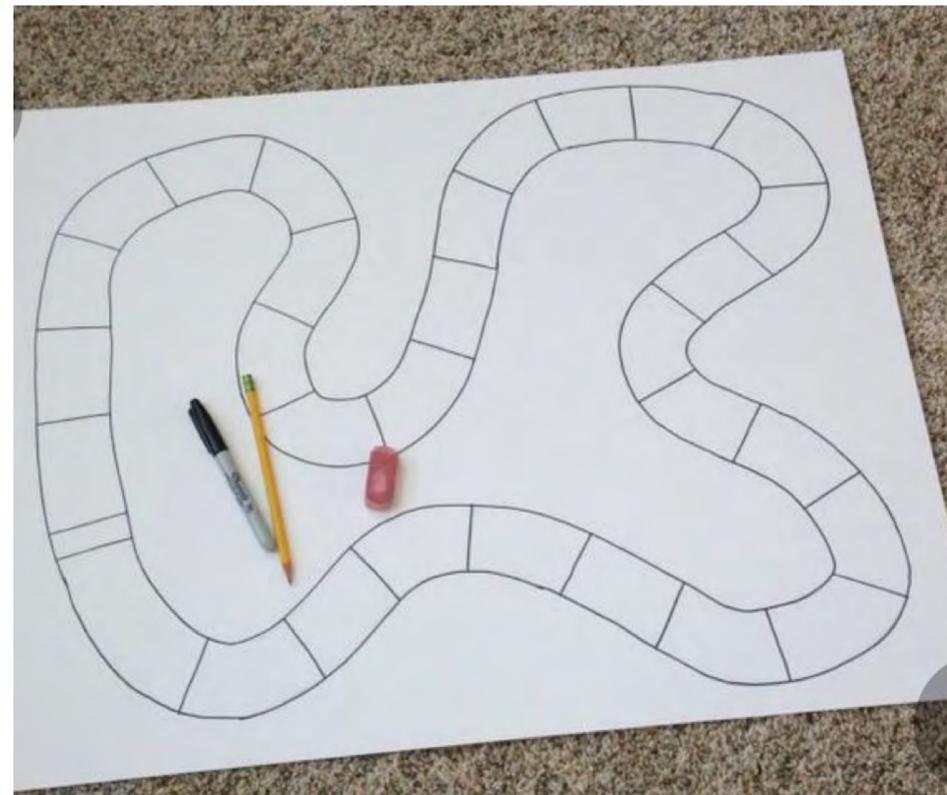
Counting; One To One Correspondence

Children can count when they understand that one number represents one object. A really great way to develop this concept is to play simple boardgames. These have been duplicated and are available as computer games but there is no substitute for the interaction between adults and children when playing a game. Reception teachers (of the traditional variety!) swear by them!

They are so simple to make. Games like Ludo and snakes and ladders are available but they are only useful for children who understand the concept of one-to-one correspondence. Make your own as shown in the picture below and use any idea you like. For example: you could have the three bears racing to get home to check if Goldilocks is in their house. You could draw two or three spaceships and make the game a race to the moon. You could use racing cars as your inspiration; ponies or princesses or whatever your children are into.

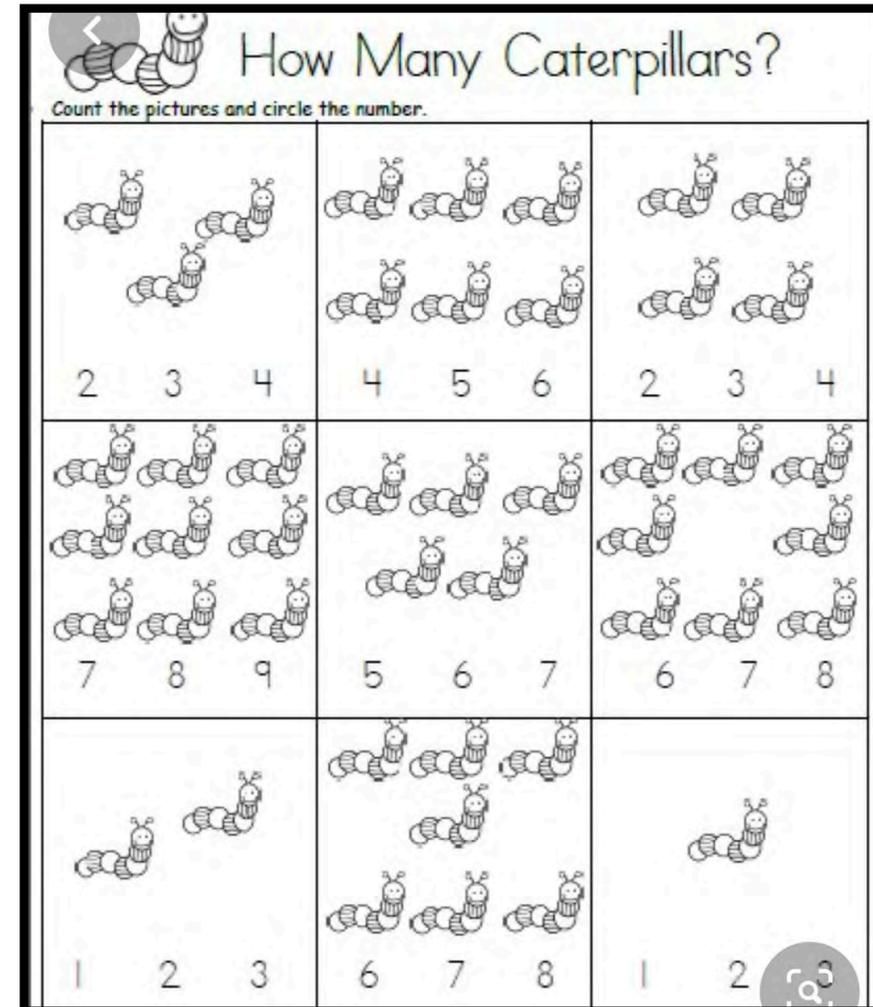
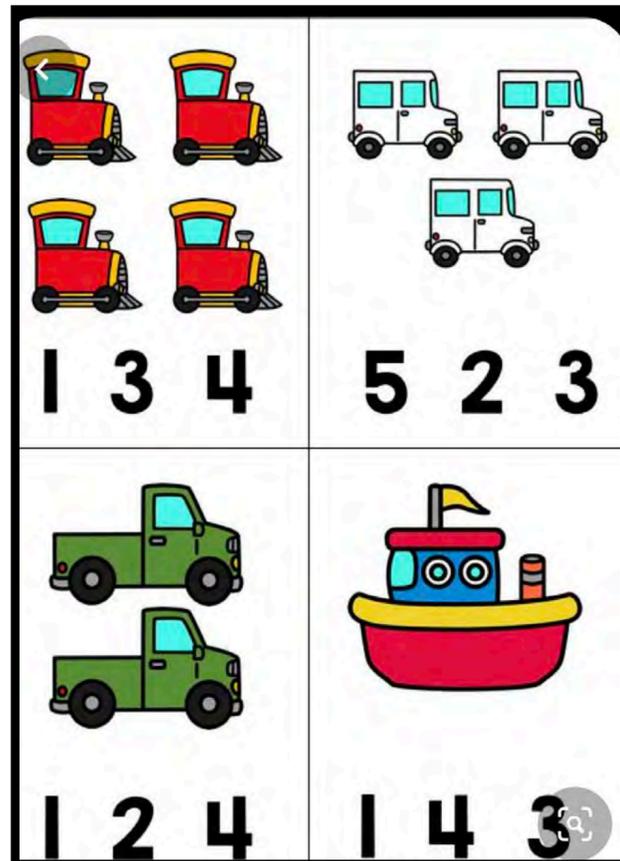
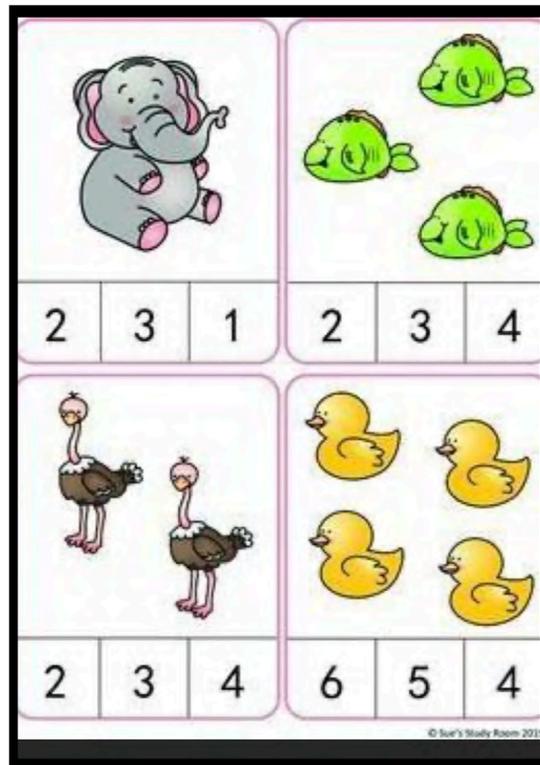
Later to make board games more challenging, give two dice and encourage children to add the total and count on the corresponding number

<https://www.ukessays.com/essays/psychology/the-importance-of-counting-in-early-number-development-psychology-essay.php>



Counting is very important educationally and developmentally.

Studies have shown that “number sense” begins at a very early age. Even before children are able to count properly, at around two years of age they can identify one, two or three objects. Later, as a child’s mental powers develop, around the age of four, groups of up to four objects can be recognised without counting. In a familiar arrangement, such as six dots arranged into two rows of three (such as in dice or playing cards) six can be instantly recognised because of the way they are presented. Try giving lots of opportunities for children to recognise a number, then count out the corresponding number of objects. Then move on to pictorial activities as shown.

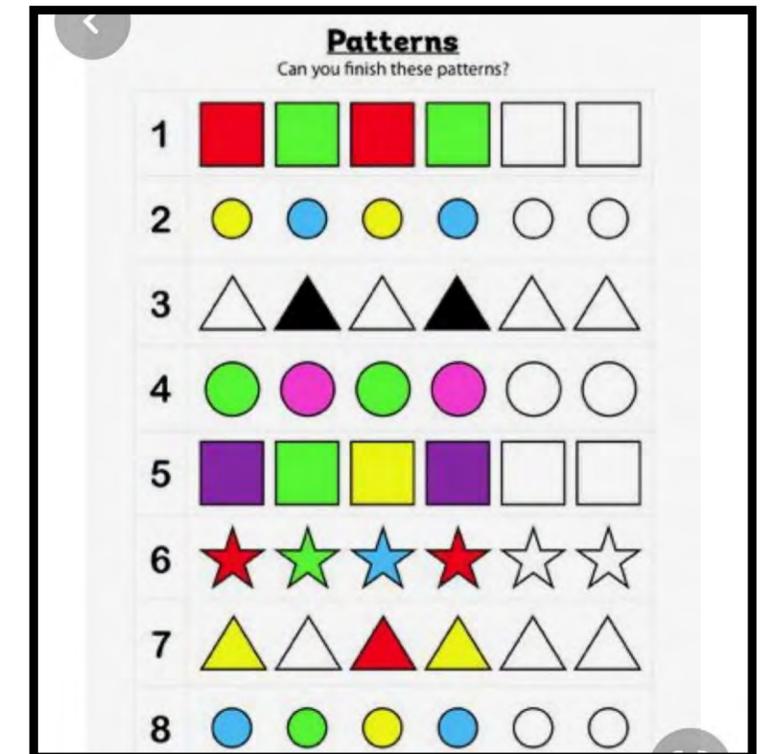
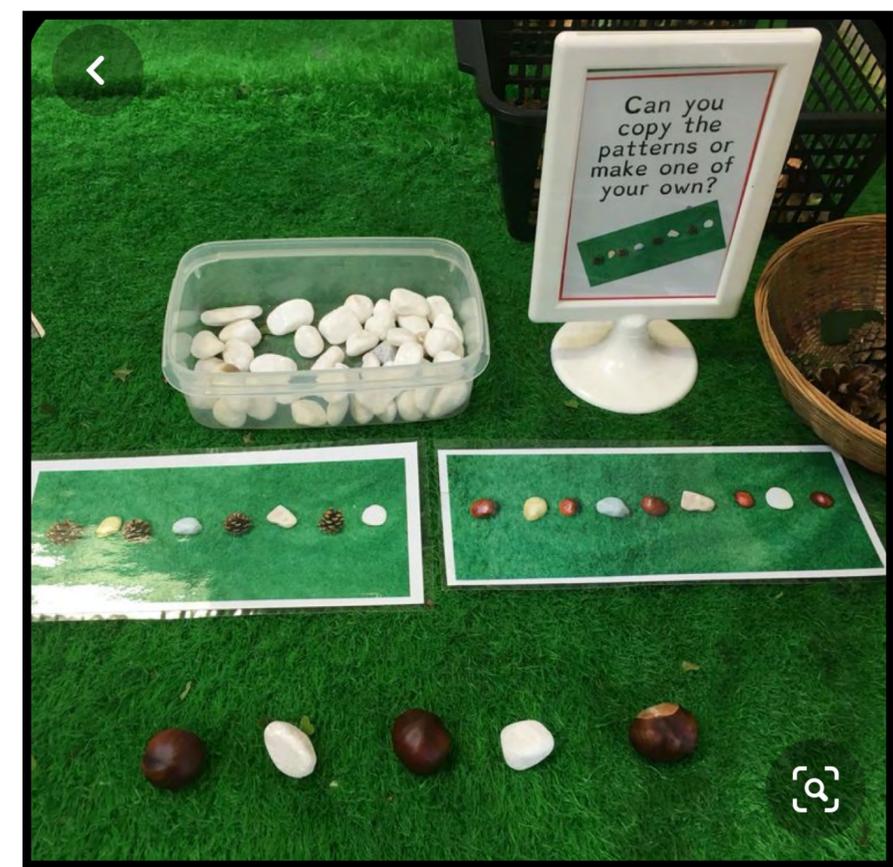
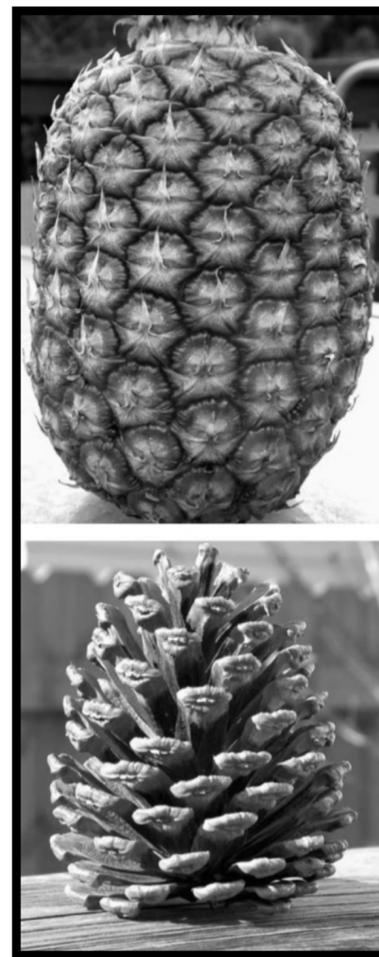


Repeat Patterns

A **pattern** is a series or sequence that repeats. You can observe patterns (colours, shapes, actions, or other sequences that repeat) everywhere. Think about words or melodies in songs, lines and curves on buildings or waves and spirals in nature.

One of the most common places to find patterns is in mathematics. **Maths patterns** are sequences that repeat according to a rule or rules. In maths, a **rule** is a set way to calculate or solve a problem.

Children love making patterns and to start them off, let them experiment first with objects such as shells or beads, then with colours and shapes.

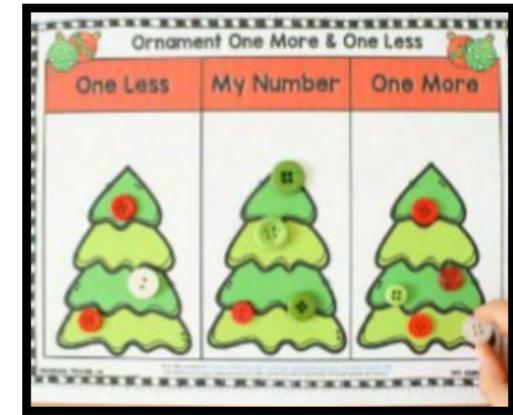
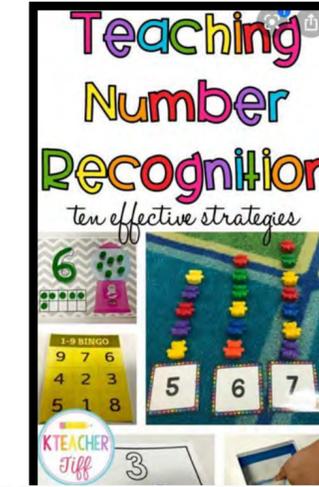
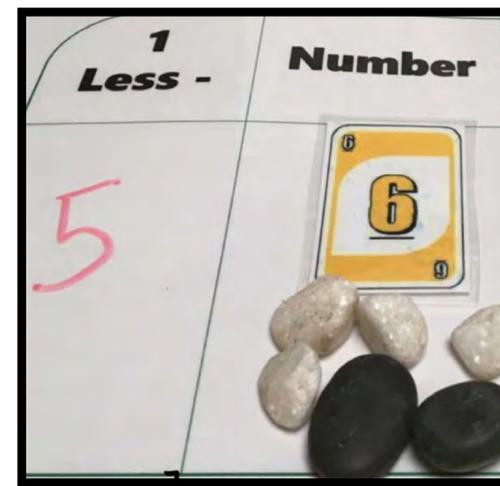
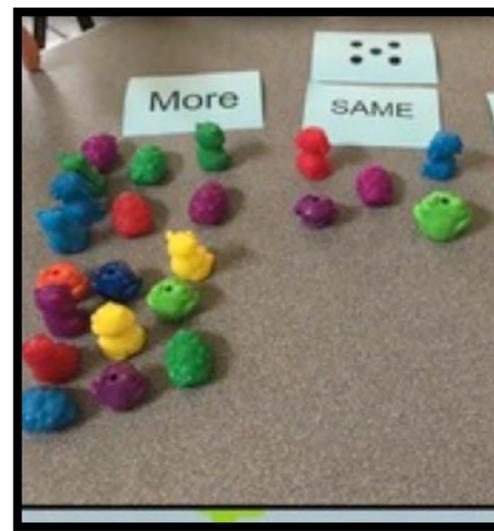


Using A Number Line

Recognition of numerals 0 to 9

How many more?

How many less?



Although we can find most resources needed to teach early maths outdoors, a number line is invaluable. Start with 0 to 10 and then 0 to 20 and remember: **number lines can go in any direction - top to bottom, left to right; whatever feels right.**

Later a hundred square plays an essential part in most maths lessons. It is also important to have a set of movable numeral cards which can be written on scraps of paper. Printing them out, however, and laminating them is not time wasted as there are so many fun ideas that involve holding up and showing numbers. For example:

Show children a number five and ask: Can you find five blocks?

Can they show you the correct number if you ask to see a number 6?

Can children put numbers in the correct order? Can you mix them up and ask them to put them back in order?

Can they show you **one more** than a given number?

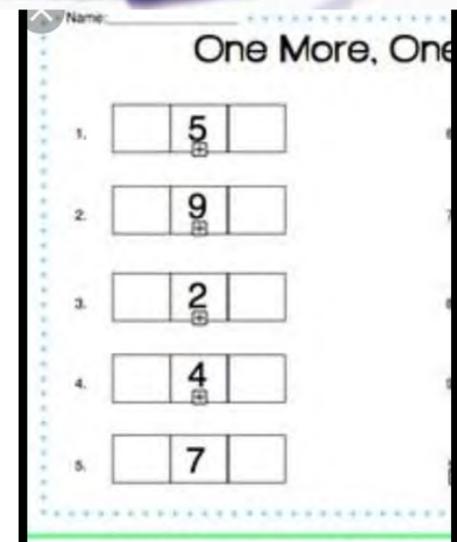
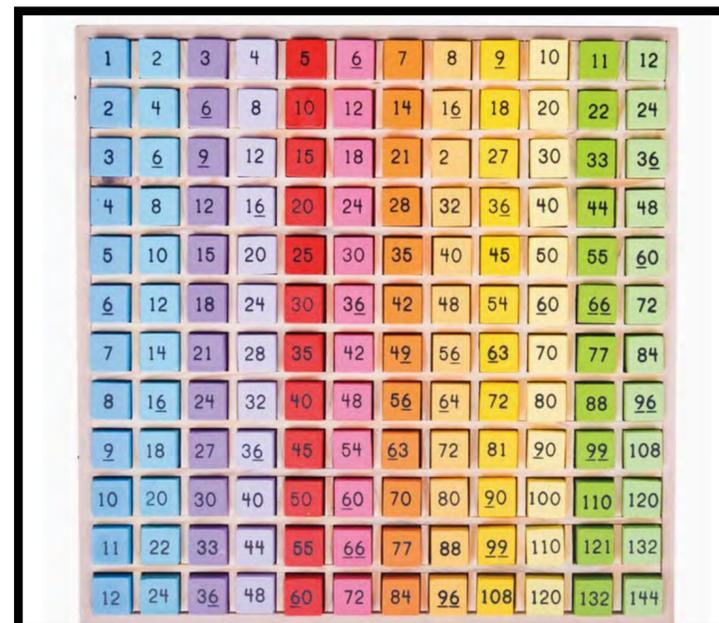
One less than a given number?

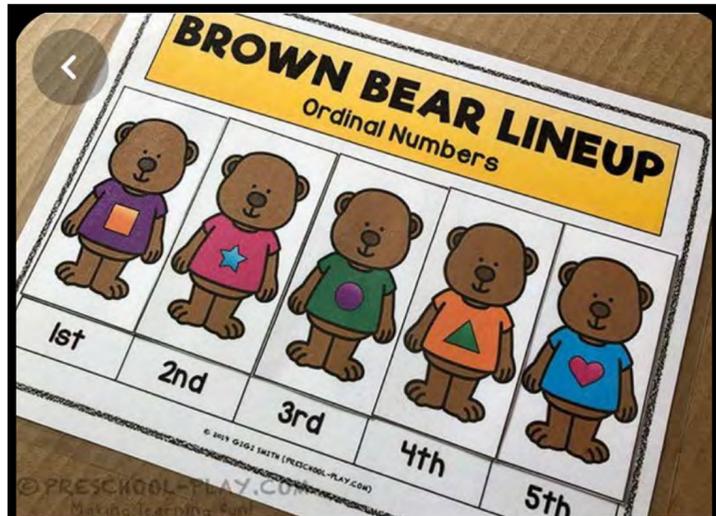
Two more than a given number?

Two less than a given number?

If you hide a number can they tell you **which one is missing**?

Can they tell you the number **in-between** 7 and 9?





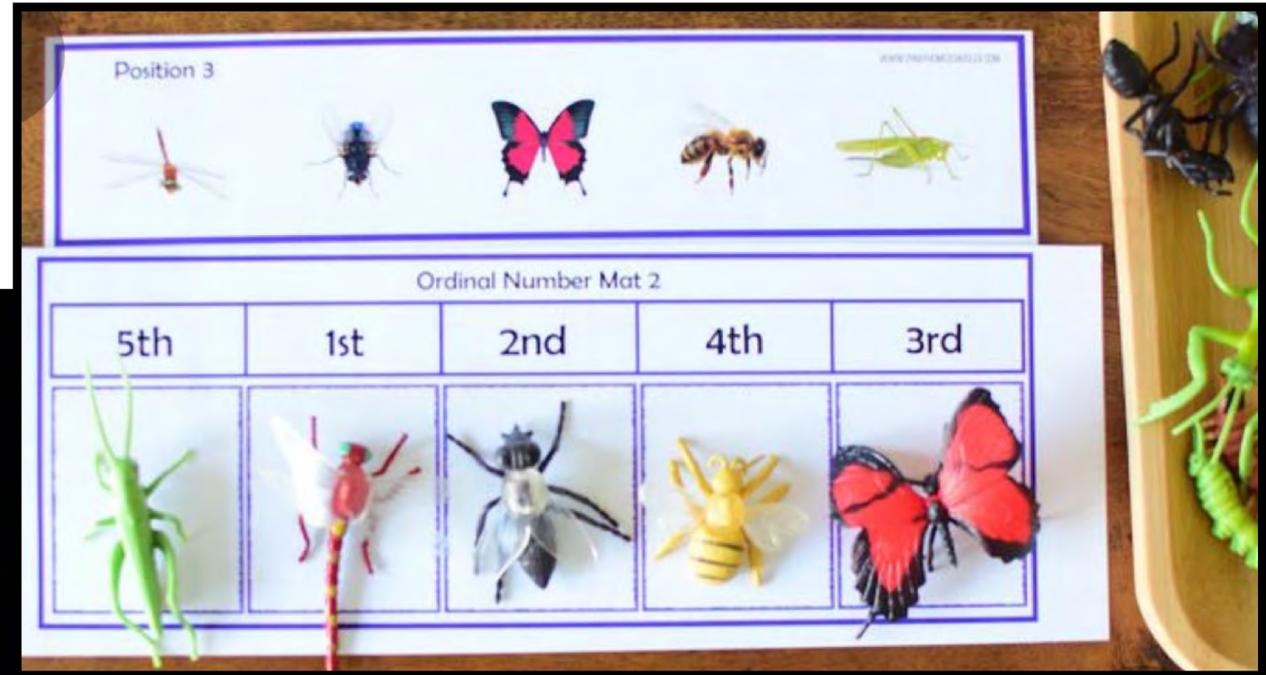
BROWN BEAR LINEUP Ordinal Numbers



Ordinal And Cardinal Number

<https://www.mathsisfun.com/numbers/cardinal-ordinal-nominal.html>

A Cardinal Number is a number that says how many of something there are.
 An Ordinal Number is the number that tells the position of something in a list.



Numeral Formation

The ability to form or write numerals (this skill is not aligned to a child's mathematical ability)

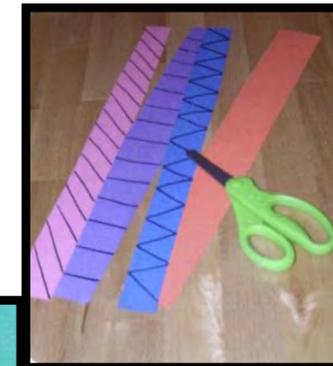
It is really important that children learn to form numbers correctly. The ability to do this depends upon their fine motor skills. It takes a while for children to develop their hand eye coordination and often it is out of sync with their mathematical ability. It is perfectly normal to reverse numbers (letters too). An 8 may well be made by placing two zeros on top of each other and a 9 will be a circle with a stick by the side (usually the wrong side)!

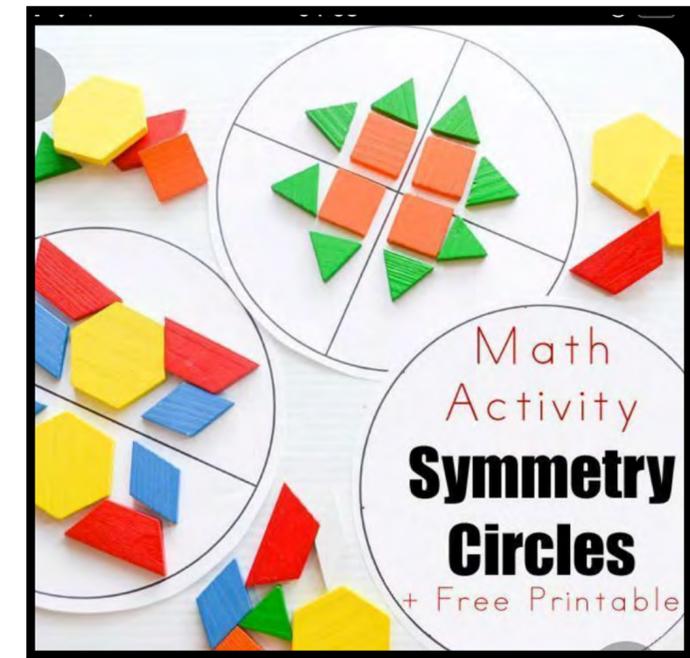
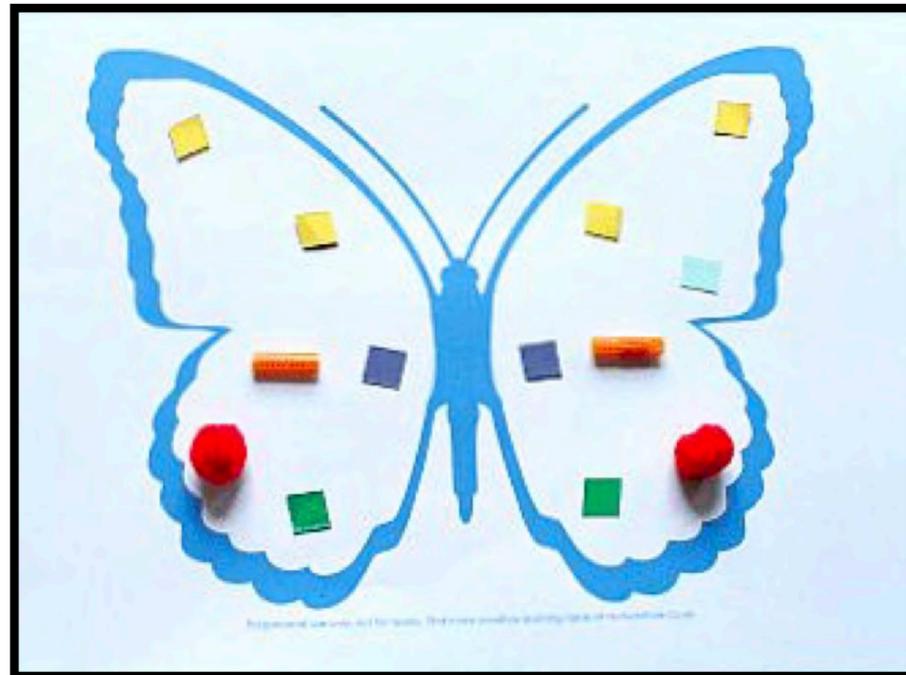
So **pre-writing skills** are essential. Children need lots of activities which will develop the muscles in their hands. Holding a pencil is quite tricky for a young child so try giving lots of play dough to experiment with.

Here is a fantastic **recipe** once given to me by a lovely Filipina teaching assistant : **2 cups flour, 2 cups water, 1 cup salt, 4 teaspoon of cream of tartar, 4 tsp.of cooking oil and some food colouring. Mix all the ingredients and cook!**

You can make huge batches at a tenth of the price of the shop bought stuff. Use food colouring, and involve your child in making it. Add glitter, hide stones or coins inside to encourage the use of finger muscles to pick them out.

Don't expect children to hold a pencil correctly for ages, Give chunky crayons first. They love chalk on blackboards; they love applying paint with a thick brush and they enjoy mark making with their fingers. Oh and don't forget scissors! Cutting needs to be taught but it's an activity young children can't get enough of.

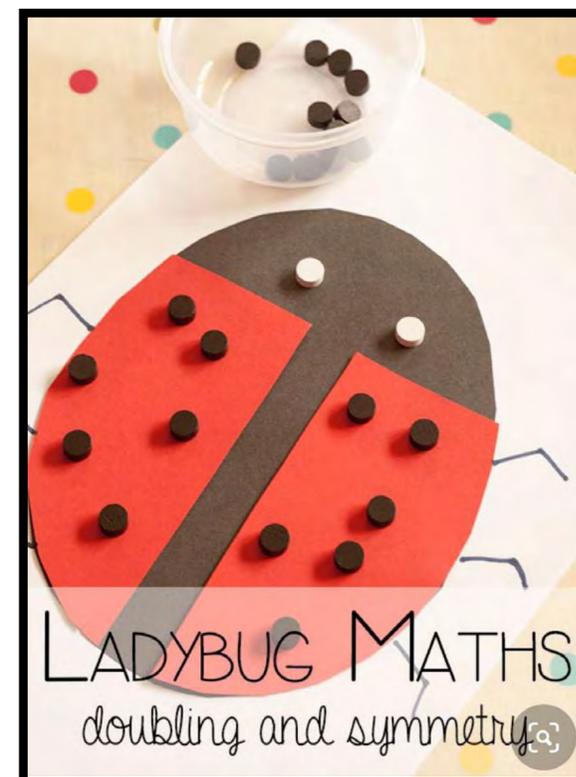
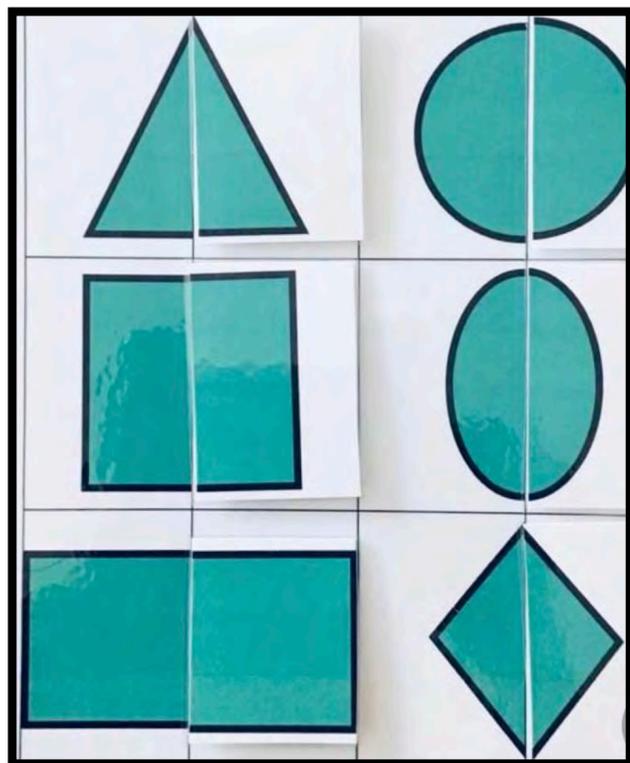




Symmetry

Symmetry is a topic that most children enjoy as it lends itself to some very creative activities. It is closely linked to the teaching of **doubling numbers** and in turn **halving numbers**.

In Mathematics, symmetry is defined as one shape being exactly like the other shape when it is moved, rotated, or flipped. Have a look on this page for some ideas and teach new vocabulary: symmetry, mirror imaging, the same etc. and have fun. It's also about basic geometry but small children don't need to know that!



Shape (or early geometry!)

Children need to **identify** and be able to **describe two dimensional shape: squares, triangles, circles, and rectangles**. You can later introduce **pentagons, hexagons, and octagons**

Cubes, cuboids, spheres, cones, pyramids, and cylinders come next.

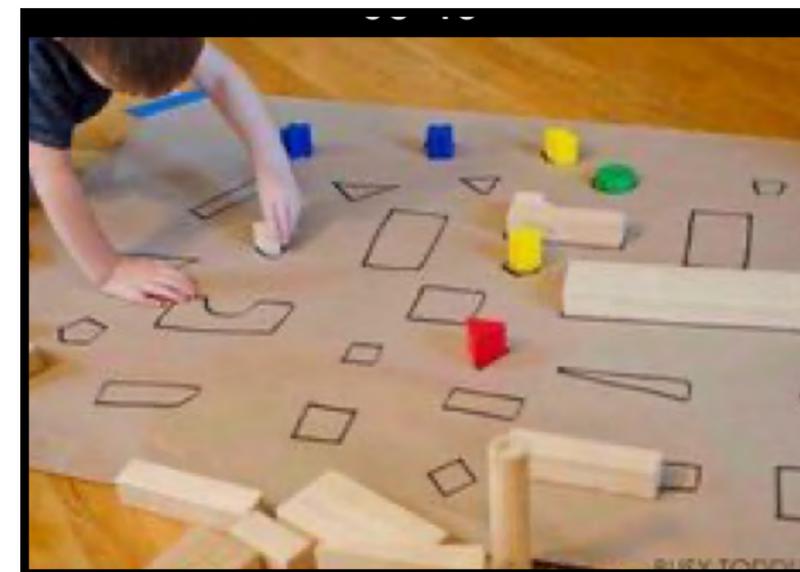
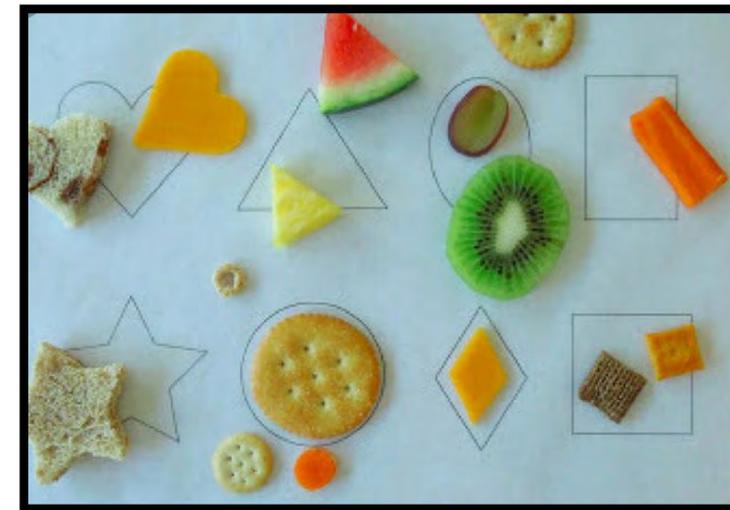
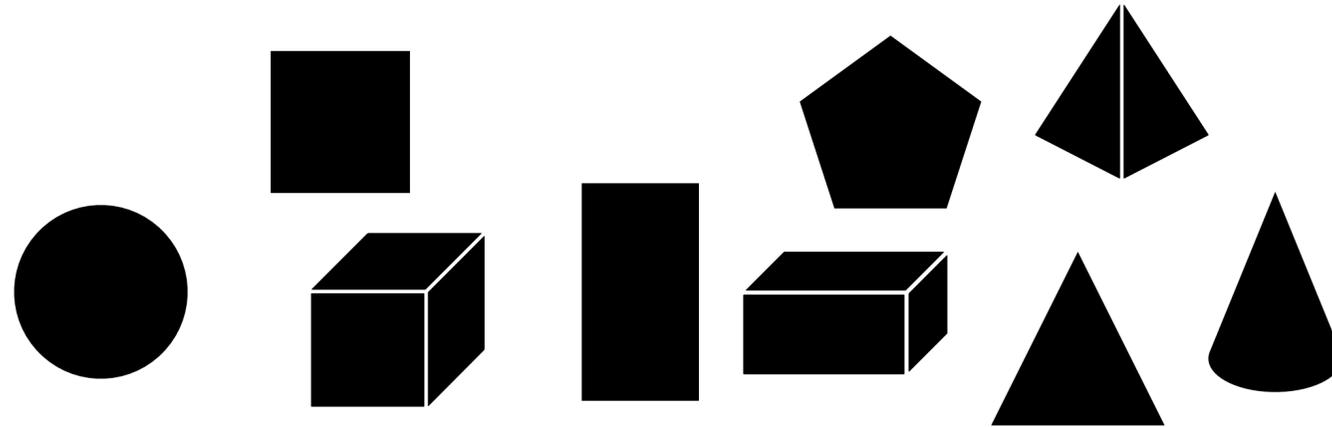
Teach children to tessellate using tiles

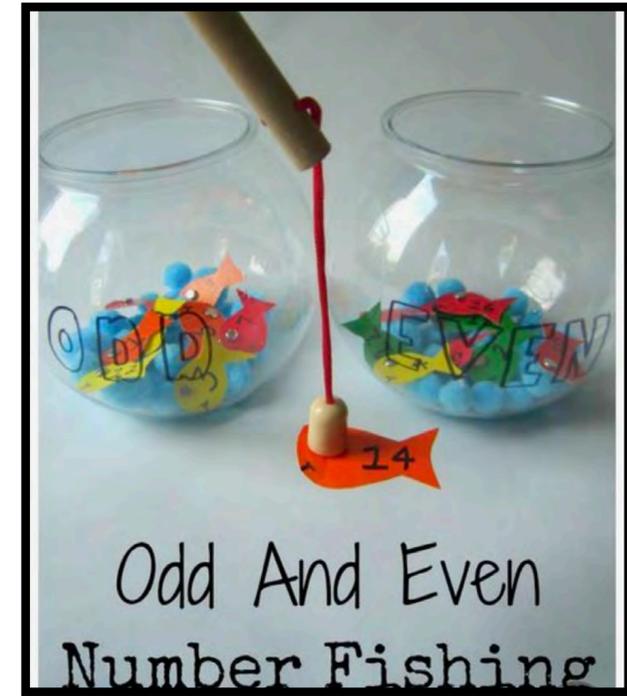
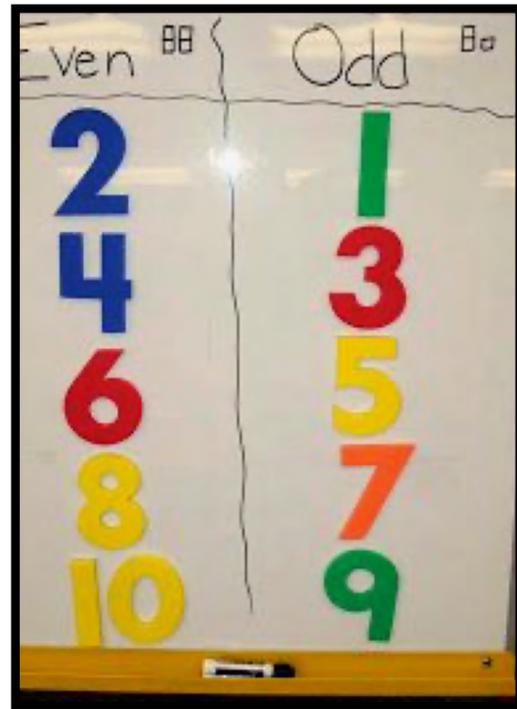
Use shapes as templates to draw round to create patterns and pictures

Use 3D shapes to make models from cartons and other junk material

Go on a shape walk. Look for shapes in the environment and list them

Describe shapes i.e. a triangle has three sides and three corners



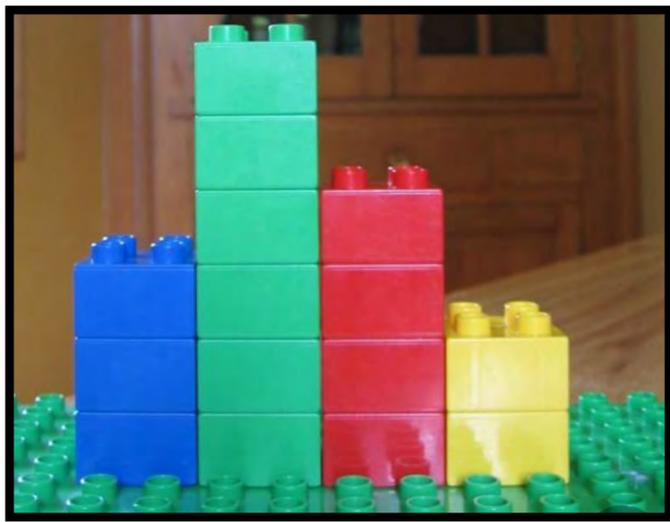


Odd and even numbers

Being able to identify even and odd numbers is an important ability that children need in order to understand our number system. It helps them to learn about division, prime numbers and even square roots. ... An odd number is not divisible evenly by two. You can try pairing objects (toy animals, shells, flowers etc) and explain that an odd number never ends up with a friend :(

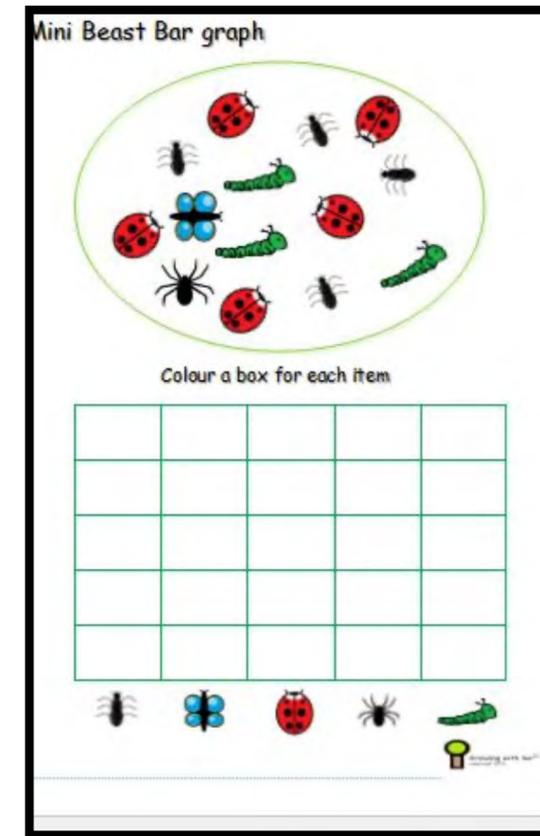
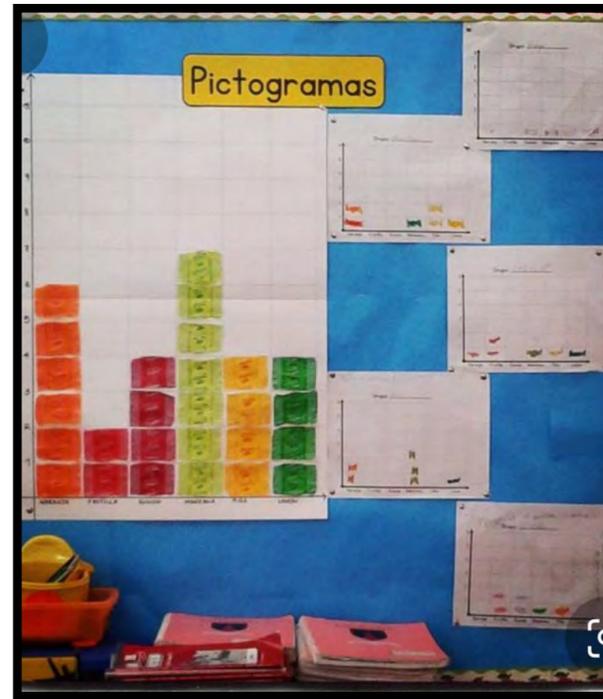
Go for a walk, looking and noticing how odd and even numbers are on different sides of the street.





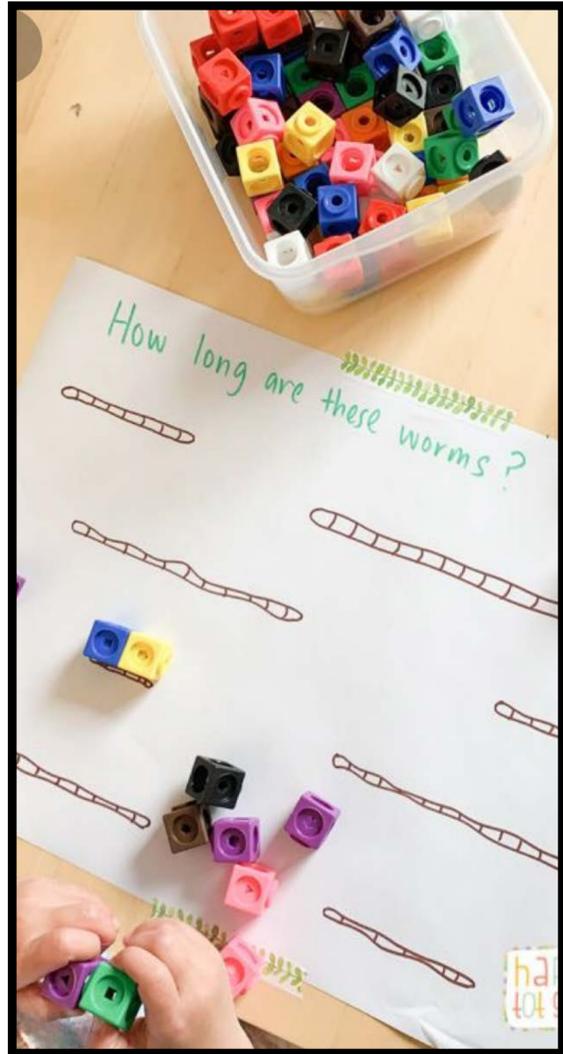
Data Collection And Representation

This is another activity children love. They might be given little clip boards to collect and display data I.e.favourite colours or different insects spotted in the park etc. Try making a variety of sandwiches, sharing with family and friends then help children create their own pictorial bar graph depicting the most popular sandwich.

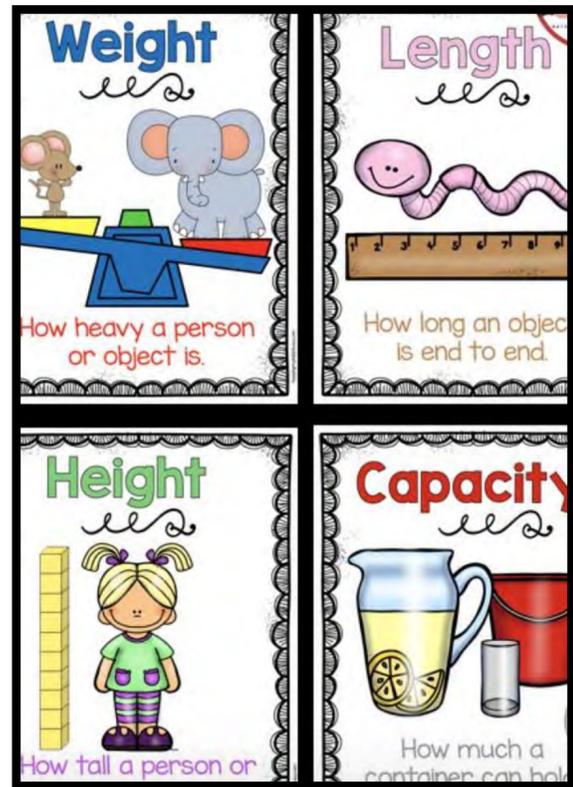
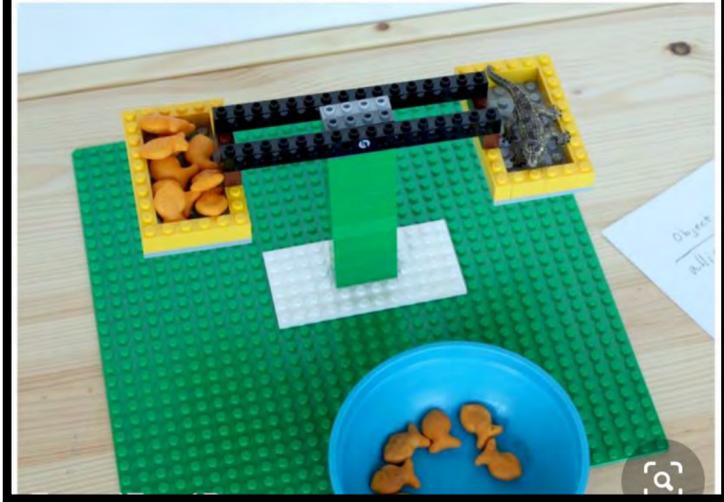


Measurement - length height width

Young children will not be able to understand the idea of a 'standard measure.' The numbers involved are far too high. A non-standard unit such as a footprint cutout, a large piece of lego or a handspan cutout are fun to make and help children to understand the **need for a standard measure**. They soon learn that a great deal depends on the variation in the size of the unit. I.e. a new play area, 10 footsteps long and 8 steps wide might be best measured by Daddy than by 5 year old Sarah!! Children see very quickly that a play dough snake six bricks long is shorter than one that is ten bricks long. It's all about making comparisons!



Build a LEGO Balance



Weight heavy light balance

Capacity/Volume full empty

Measuring weight or mass is more difficult for young children to understand as neither can be **seen**. Parcels, identical in size (photograph below) could be filled with varying amounts of weights so that some are heavy and some are light. Only the balancing scales will accurately show the parcels with a small variance. Weighing scales can be homemade but a good set is worth the investment. Collect all kinds of containers for children to fill and to make comparisons. Cooking and baking are wonderful activities for introducing the concept of measuring weight.



Which is heavier?	
Compare the two on your balance and circle the one that weighs more.	
5 cubes	20 paper clips
4 crayons	10 counters
7 square blocks	5 hexagon blocks
10 popsicle sticks	6 dominoes
2 glue sticks	8 dice
<small>You come up with your own!</small>	<small>You come up with your own!</small>

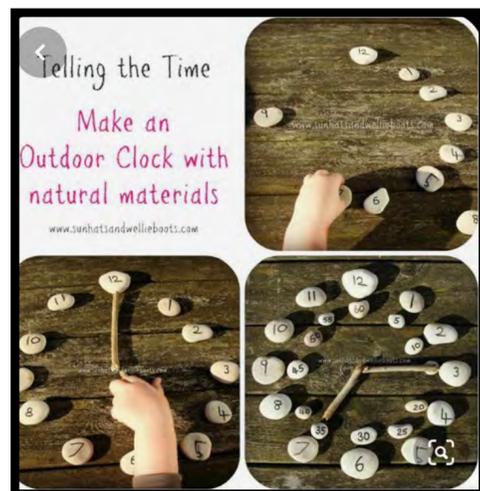
Shopping Money Coins

Nearly all maths topics in the early years are linked to play. The more time children spend playing at shops or in any imaginative play area the better. The concept of 'group and exchange' or exchanging coins for goods is easily done without them needing to know that a pound is made up of a hundred units. Simply use counters or buttons and give children a certain number. If they have ten buttons, an ice cream is 6 buttons, a pencil is three, then they won't have enough for the teddy which is five!



Time

Children can't learn to tell the time until they are much older and have a better understanding of our number system. However, a play or real clock face is a good idea for display as they show the **passing of time**. All children need in the early years is an understanding of the language of time. So introduce vocabulary such as morning, evening, next week, last week etc. talk about months of the year, days of the week; keep a calendar and record events.



a.m. or p.m.

Read the event and decide if it happens in the a.m. or p.m. Color in the box that matches.

Eat dinner	a.m.	p.m.
See the sun rise	a.m.	p.m.
Get dressed	a.m.	p.m.
Take a bath	a.m.	p.m.
Go home	a.m.	p.m.
Go to school	a.m.	p.m.
Eat breakfast	a.m.	p.m.
Turn on the lights	a.m.	p.m.
Eat lunch	a.m.	p.m.