



How to encourage your child to **LOVE** maths



Your baby is born with an amazing cognitive capacity, our role is simply to **nurture them** to understand concepts that exist in the world around them. Many parents **feel a lack of confidence** at the thought of having to impart any mathematical knowledge to their child and this might be because they have had a particularly negative experience with maths along the way.

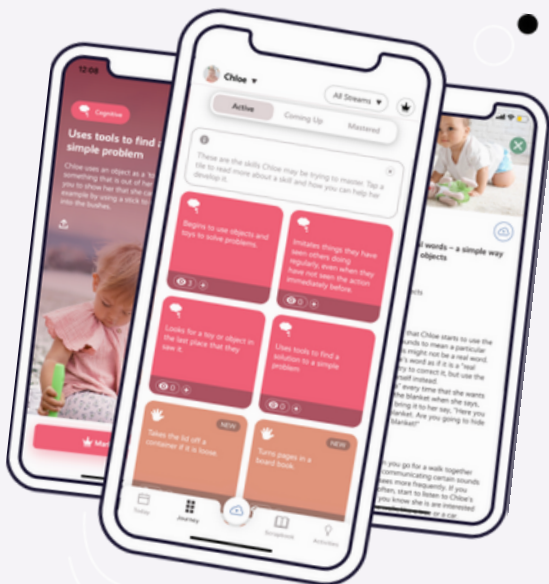
But maths does not need to be seen as something we have to sit down and formally teach our child and nor does it have to be done in a way that is boring and dull, in fact some of the best ways to support your child in becoming a mathematician are part of everyday life.

Babies are **born primed and ready** to acquire mathematical knowledge, in fact a study done in 2001 found that babies have an awareness of number and quantity from birth, and when changes were made to a group of objects they were found to respond in surprise [1].

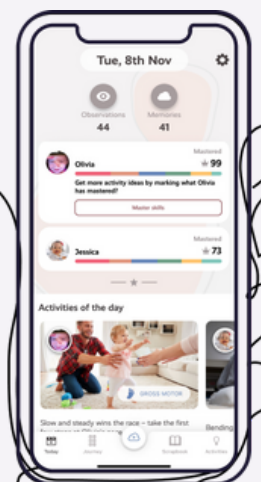
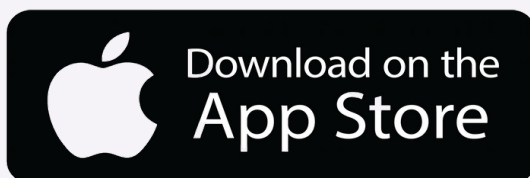


In this PDF, we are going to investigate some of the mathematical concepts that you can explore with your child during their first five years, with examples of how you can do it through play.

For more information about your child's individual journey to becoming a mathematician, with hundreds of play ideas, download our app.



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Shape, space and measure

When we think about mathematics, we often think of numbers, but research suggests that children who are particularly aware of space as a concept (spatial awareness) are more likely to succeed in mathematic achievements throughout their academic studies [2].

In reality, many children engage well with the concepts of shape, space and measure because it is more accessible than number and can be felt and explored through their day-to-day play and via things that interest and engage them.

From the day a child is born, they begin to explore the world around them through concepts of shape, space and measure. In the early days, they explore the properties of objects using their mouths and other senses.



They learn about the immediate space around them from being held in their parents' arms and then go on to kicking and reaching at things in their view. Then, once mobile, they explore the space beyond the immediate and subsequently test the properties of any objects they come across that are new to them.

This is why you often find babies will try to hold, bang or drop new objects.

With movement comes an urge to explore the world using their body and how it moves and fits within the surrounding space.

They will experiment with getting into small spaces like a doll's bed and boxes, to gain an awareness of how their body fits within the constraints of these objects. All of this allows them to develop a blueprint of information in their brain about how the environment works in terms of shape, space and measure [3].

Children learn these concepts by being given the opportunity to play and explore. Toys such as jigsaws, shape sorters and stackers are brilliant for supporting these concepts but there are also lots of things you can do with everyday objects to support their learning.



For example, putting lids onto Tupperware, filling different sized tubs in the bath with a ladle, pushing toy cars down cardboard ramps to see whose goes the furthest and filling a box with cushions and blankets.

We can support this area of mathematical development by allowing lots of opportunities to explore and experiment, in addition to providing them with plenty of language about shape, space and measure.

Mathematical language helps to consolidate their learning and it all starts with an adult using vocabulary to describe properties of objects, such as their sides, edges, and corners [4].

Take opportunities to describe the size, shape, weight, and properties of objects in everyday conversations, for example, “Can you pass me the big spoon?” or “Is it too heavy to pick up?”

Counting

When we think about the maths skills we want our children to learn, particularly in their first five years, we often focus on counting. Reciting numbers is very often the first mathematical skill we celebrate for our little ones, but pre-counting experiences are so important to build up to that moment and to make counting meaningful rather than simply a set of words they have learnt.

Pre-counting skills are often being learnt in children's play without any real intention from adults to be 'teaching maths', and through play our children are testing and refining their understanding of some pre-counting concepts [5].



Toddlers love to get busy sorting items. Maybe they will decide to put all the red blocks together, or divide their animals by type, or separate big and small beads. This act of identifying groups on the basis that the items are in some way the same is key to understanding what should be counted later on, and importantly, when to stop counting once you have identified a set of items.

Our little ones are also developing an understanding of number and mathematical concepts while their language skills develop. Understanding the meaning of phrases like "one more" and "no more" in the context of food or play will inform their understanding of this when they reach the counting stage.

Reading books and telling stories which feature groups such as The Three Little Pigs or Goldilocks and the Three Bears will benefit overall number sense, in fact using stories to learn mathematical concepts has been proven to improve mathematical achievement [6].

Using the language of number in your everyday life can be done from when your baby is tiny.

Reading counting books and counting out loud as you climb stairs, put items on their plate or pack a bag, and even narrating what you do as you change their nappy (“I will use two wipes. Oh, we need one more! One, two, three wipes.”) are all simple ways to bring the language of maths into your child’s world.



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Once your child has discovered counting out loud, they often recite numbers wherever they go! Although this is not counting in the strictest sense, as they are not connecting the numbers to an item, they are consolidating the fact that numbers always come in this same order – and this is a vital understanding to enable accurate counting later on.

An important aspect of mathematical knowledge is understanding that each number is one more than the number before it, something that seems obvious but for children who are starting to learn the order of numbers, it might not be [1].

When your child is counting, make sure you use this language to help them make the connection, as you climb steps you can count “One, two, and one more... three!”

From a young age, children can identify small groups of things without having to count each object, this is called subitising and we go into more detail on this in a moment.

Counting as we usually think of it often begins with your child pointing to or picking up an item and assigning it a number. This is often called the one-to-one principle. This involves a lot of skill as children have to understand not only when to count, and what number comes next each time, but also when to stop – we will look into this concept of cardinality in more detail later in this PDF.

For children, the concept of numbers can be confusing and abstract, so linking it to real, physical items is important.

Children learn with all of their senses so being able to touch, move and interact with the items they are counting will embed the knowledge they're developing.

Many children (and adults) use their fingers to help them count, and this should be encouraged [7] as you just can't beat the tactile experience of using your fingers, and they're always available when you need to count, no matter where you are!

Remember that we can find opportunities to count in our everyday routines – at snack time, when tidying our toys and when collecting precious sticks on a walk. Although there are many wonderful toys and tools designed to help our children understand mathematical concepts, nothing can beat real hands-on experience which is meaningful for your little one.

Once your child has mastered the idea that the order of numbers is fixed, and can use one-to-one or subitising skills to count visible objects, their next challenge is in applying this knowledge to more abstract events, such as being able to count things they can't see or touch, like movements or sounds.

Playing games which require counting claps, steps or jumps can be a joyful way to introduce this idea to your child.

As their mathematical knowledge grows, children will also begin to understand that the number of items they can see stays the same, even if those items are moved into a different arrangement or counted in a different order [1].

This understanding that a number always represents itself can sometimes be described as ‘the oneness of one and the twoness of two’, a simple way to highlight that although lots of factors can change (such as the items being counted, or the way they are displayed), one will always be representing one and two will always be representing two, and so on.



Once this underpinning concept of number is embedded for your child, they will have the foundations in place to move their mathematical knowledge on as they learn and grow.

Using their knowledge of number, their ability to count and often their subitising skills, they will become able to identify quantities that make each number, realising that $4 + 2$ makes 6, but so does $3 + 3$, or $5 + 1$. Research has shown that being able to view number using a part-part-whole system like this can improve their overall mathematical understanding [8].

Numerals and representing numbers

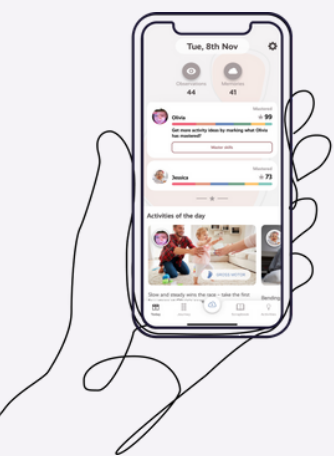
Maths doesn't always look like the maths we expect. Even before the stage at which your child recognises and can write numerals, you will probably have seen your little one recording their mathematical knowledge. When they draw their family and include a representation of a person for each family member, or draw a spider with eight legs, or doodle a line for each bead they are playing with, they are representing a number or mathematical concept [9].

Linking their understanding of the concept one, two, etcetera to the numeral used to represent it is another real milestone for children in their journey to becoming a mathematician.

Much like developing an awareness of letters and realising that these squiggles can be used to communicate with other people, children will discover that there are numerals to learn so that they can represent a number in a way that everyone understands.



Involving numerals in your play in meaningful ways, for example showing your child how you write a '5' next to five objects or counting along a number line to familiarise your child with numerals, will help them to make this connection when they are ready to do so. Talking about numerals you see when out and about will also help.



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Subitising

Even before they're able to count with true understanding, toddlers can recognise how many items there are in small groups of up to three things [5, 9].

If your child is in preschool or older, you might have started to hear their educators talking about subitising.

This is the name we give to the ability to look at a set of things and know how many there are, without needing to count. It is linked closely with an awareness of the patterns in the world around us, highlighting how interconnected the different skills required to become a mathematician truly are.

An ability to subitise seems to appear very early in children's mathematical learning and, like cardinality, children tend to build this knowledge from small numbers to large ones.



Recognising a small number like two or three (known as perceptual subitising because it is not reliant on any specific mathematical process) is followed by conceptual subitising, where it is the arrangement (or pattern) of the items which is used to identify the number [5].

Think of dice or dominoes, we can glance at one of these and know if it is showing five or six without needing to count each dot individually, because the pattern is consistent.

Children are learning about mathematical concepts from the world around them all the time. Knowing people have two arms and one mouth for example, and then representing this when they draw, is showing an ability to subitise small numbers in things they see frequently.

You can bring this knowledge to your day-to-day activities by noticing sets of items in your environment and encouraging your child to talk about them. If you're doing some baking, encourage your child to think about how they put biscuits on the tray, and perhaps wonder "What do you see here?" They might choose to count each ball of dough, in which case reinforcing the cardinal number will help them to recognise the total, so you might say, "Six, yes, we have made six all together!"

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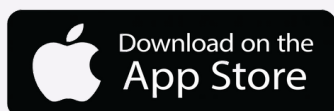
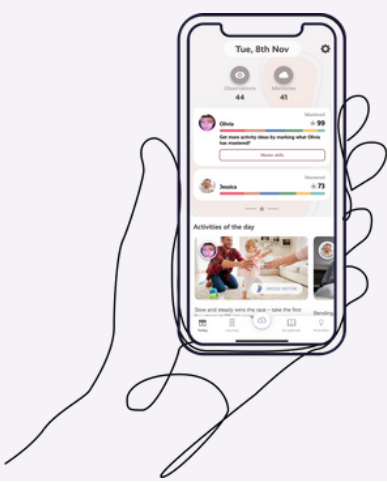


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Some children might identify the number without counting, in which case you could add to the challenge by rearranging the balls of dough to show that it remains six even when the pattern is changed.

At My First Five Years, we know that our children learn all the time, and there is no need to set up a time-consuming activity especially to teach one mathematical skill! Maths-focused activities are wonderful, but children learn through every interaction with us.

Our app is full of ideas to make the most of the little moments you have together.



Subitising is also a valuable method to rely on as our mathematical skills develop, because it links to fundamental concepts about how numbers work. When faced with a larger group of objects to count, we often do so by automatically subitising several smaller groups and then adding them together.

In this photograph there are nine sheep, but take a moment to notice how you counted this. Some people might count three groups of three, others might see a group of three, a group of four and a group of two. However you see the groups, you were able to use subitising alongside your knowledge of addition to identify that there are nine sheep, rather than counting each sheep individually.

We can combine our subitising skills with other mathematical skills to understand the rich and complex concepts that underpin mathematics, such as knowing that quantities can be divided in different ways but the cardinal amount remains the same.



Subitising is an important skill for enhancing overall number sense, and it can be explored with much joy from the earliest years with children [8].

To discover more ways to share the joy of maths with your child, wherever they are in their mathematical development, download the **My First Five Years app**.



Concepts of cardinality

When we talk about mathematical learning, some of the terminology can be intimidating, especially if your own experience of learning maths was stressful or negative.

When children are learning about number, they have a lot to remember and understand, requiring lots of connections between their experiences, language and what is in front of them [5].

When children first begin counting, they're often repeating a list of numbers they've learnt in order. As their understanding of the concept of number develops, they begin to get a sense of cardinality, understanding that each number word represents a specific quantity [12].



When they are counting a group of items, your child will come to learn that the last number they counted is the total number for the group, the cardinal number. Research shows that children develop the concept of cardinality over time.

They will initially be able to identify 'one' as a cardinal number with larger amounts being viewed as 'more than one'. Over time, children extend this knowledge to grasp the concept of two, three, four and five. It's after they have understood the cardinality of the number five that children then become cardinality-knowers, and they are able to extend this knowledge showing they truly understand the concept of counting [12].

Remember, this will be influenced by other streams of development because skills such as vision, language and memory are all important for children learning about mathematical concepts.

A key step in understanding cardinality (how counting relates to numbers) comes when children can differentiate between ordinal and cardinal numbers.

The number three, for example, can be an ordinal number representing the third thing in a group (like when we see it on a clock or house), but can also be a cardinal number representing the total value of a group of three items. This is confusing, and understanding when to use which concept takes time and practice, so you might find yourself explaining the difference in many contexts!



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Pattern

Studies have shown that children who develop pattern awareness in their early years are more likely to have a deeper understanding of mathematical concepts such as numbers, sequencing, cardinal counting and shape recognition [13].

Pattern awareness is a relationship with some sort of consistency between the components. This could be a repeated sequence, a growing pattern like the steps of a pyramid or shapes with regular features [14].

A child who has developed an awareness of patterns will be able to spot pattern regularity in their day to day, be able to create and recreate patterns and predict the continuation of the sequence.

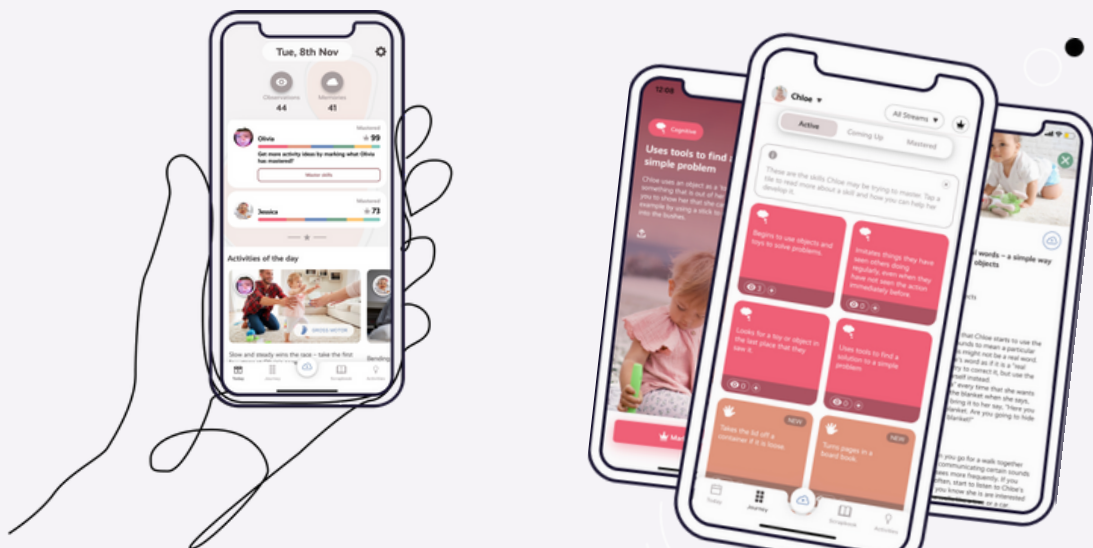
There are lots of simple ways that you can support your child to develop pattern awareness through play, for example, ask them to continue an 'ABAB' pattern where you say the pattern out loud, such as "yellow, green, yellow, green". Then encourage them to repeat patterns that they can see in front of them (such as the picture below). It is thought that copying a pattern increases their awareness of patterns and their structures [14].



Your child may do this one by one at first, and over time will pick up all the objects they need to finish the pattern. You can then introduce more complex patterns such as ABC or ABB. As their pattern awareness develops, you can also ask them to spot any mistakes in patterns, such as when you join the wrong part of a nursery rhyme to an action (for example, pointing to your shoulders first in 'Heads, shoulders, knees and toes'). Patterns can be developed through bricks, mark-making, objects found outdoors and objects from in your kitchen cupboard, the list goes on and on.



To learn more about how to support your child's development from the day they're born, download our app!



Maths Top Tips

1. Utilise what your child is interested in to engage them in mathematical concepts (animals, diggers, water and so on).
2. Rather than ask them how many they have, start with "I think there are four, can you check for me?" This takes the pressure off – nobody enjoys being quizzed or put on the spot, but treating your child as an expert who can offer you help is a great way to get them to articulate their thinking.
3. Writing a number down is not the only way to record numbers. Lines, dots and other marks can make more sense to your child as they become more aware of number formation.
4. Have fun with maths and recognise that children are more likely to understand maths by involving themselves in physical play that relates to mathematical concepts.



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