

Building firm foundations in mathematics ...with 5, 6 & 7 year olds

Developing children's mathematical well-being for future learning

The Early Childhood Mathematics Group would like to offer some support and encouragement to all adults in helping children to become confident young mathematicians. We all know that maths is very important for young children's lives and their future life options. If we can help them build firm mathematical foundations, we will have given them a really good start.

Everyday experiences and routines, rhymes and games provide excellent mathematical learning opportunities for children under seven. Opportunities for mathematical learning can happen anywhere and should be practical wherever possible. What matters is building young children's confidence and their willingness to have a go, whether at counting, construction or shape puzzles. Since supportive relationships are so important, it is imperative to find activities that not only children enjoy, but that adults can enjoy too. Recognising the maths in everyday activities helps to develop



[Community Playthings](#)

children's mathematical learning even further. When playing and in everyday activities, such as eating a snack, children can learn lots of maths.

Important mathematical learning for birth to seven years includes:

- counting by just saying number words
- counting objects; making and comparing small numbers of things
- comparing sizes and dimensions, capacities and weights
- exploring properties of shapes by fitting them together and building models
- exploring spatially, describing where to find things and giving directions
- spotting and discussing different patterns
- finding different ways to solve problems practically

Learning and enjoying being mathematical

Time for independent exploration

Young children need plenty of time to freely explore the mathematical resources and activities on offer; to pursue their own interests and to make sense of what they see, hear and are taught. They need to do this independently as well as with other children, and alongside adults, in order to deepen their understanding and develop the confidence to play with and extend their ideas. With unrestricted time, children's mathematical thinking can often surpass adult expectations and demonstrate the [Characteristics of Effective Teaching and Learning](#) (para 1.18), which are relevant for learning mathematics at all ages.

Working together

It is important that teachers, carers and families work together to support mathematical learning, exchanging ideas and observations of children's interests and responses. It helps to have regular sharing of mathematical activities and children's responses. Two-way dialogue, online or in person, supports the child's mathematical development at home and in school.



Games

Simple games can provide children with repeated opportunities to develop essential maths skills. Once an adult has modelled them a few times, children can take ownership, playing and developing these games in their independent time. In Key Stage One, children need access to manipulatives to give meanings to numbers, but games can be used to help children plan and think ahead strategically. Adults can model their thinking out loud and encourage the children to do the same.

Rhymes, books and apps

Books and rhymes provide many rich and meaningful contexts for young children's mathematical learning. Picture books contain powerful images of quantities and patterns for children to enjoy and discuss with each other as well as with adults. Stories often contain realistic problems for characters that have to be solved (*how many cookies will each person receive if there are 4 children?*); rhymes often present opportunities to practice and repeat number sequences of increasing complexity. The best apps combine aspects of direct instruction with play, they can be motivational and enjoyable whilst productively supporting learning. However, too many of the commercially available apps can be classified as 'edutainment' and fall short in terms of the learning approach and the mathematics content. Apps can support the mathematical learning of 5-7 years olds, but these need to be high-quality in terms of the mathematics content included.

Five and six year olds

Five and six year olds

At this age children often enjoy ...

- Maths which is practical, outdoors, in games, make believe and story contexts
- Really big numbers
- Mathematical role play
- Recording experiences in their own way
- Solving puzzles and clues
- Discussing and deciding how to tackle genuine problems
- Construction and puzzles
- Creating patterns and designs

Activities, games, rhymes, books and apps

Activities

- Small world play and pretend play, with dolls houses, cars and trains - discussing positions, giving directions, planning and making more complex routes (indoors or outdoors)
- Discuss routines e.g. breaktimes and tidying up, debating where things belong, the order we do things in, and when.
- Fill and empty containers - exploring how many of a smaller container it takes to fill a larger one
- Estimate and check at the [Estimation station](#)
- Make a linear calendar (all days in one long line), moving a peg along each day and talking about the date. Counting down to holidays and counting up to 100 days in school
- Block play challenges to make houses with staircases, rooms with ceilings, rockets with seats
- Pattern and shape challenges: tangrams, pattern blocks, mosaics, pegboards
- Introduce maths tools e.g. exploring and discussing scales, calculators, timers, tape measures, height charts, weighing scales
- Role play shops: garden centre, car boot sale, fruit & veg shops, with price offers



Five and six year olds

Games

Number games

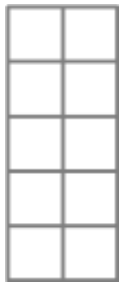


- **Number track treasure**

Counting, cardinality, ordinality and composition

You need:

- A ten frame for each player,
- A number track
- Some treasure (conkers, glass beads, Lego® blocks ...)
- A counter or game piece for each player e.g. cylinder
- Dice



How to play:

- Place your treasure at intervals along the track.
- Decide where to start - at whichever number you want.
- Roll the dice: move your counter forwards or backwards.
- If you land on a square with treasure, put it in your ten frame.
- First person to fill their ten frame is the winner.



Encourage children to talk about:

- *I had three and then I got two more, so I have five.*
- *I have six, so I only need four more to get to ten.*
- *You have more / fewer than I do.*
- *I was on 10 and I rolled a two, so now I'm on 12.*

Five and six year olds

Feel the number

Counting, cardinality,
ordinality and composition



You need:

- A ten frame for each player
- Some treasure (conkers, glass beads, Lego® blocks...
- Dice

How to play:

- Roll the dice: whichever number it lands on, collect that much treasure from the middle.
- Try and collect the right amount of treasure with your eyes closed.
- If it's not the correct amount, you have to put it all back.

Encourage children to talk about:

- I had three and then I got two more, so I have five.
- I have six, so I only need four more to get to ten.
- You have more / fewer than I do.
- I have eight- I can see eight is made from five and three.
- How many do you have? Can you tell me without counting each individual piece of treasure you have?

Five and six year olds

- **Zap!**
Addition to 20

You need:

- A dish of pennies or similar.
- Paper and pens
- One dice each, marked "1, 2, 3, 4, Zap, Zap"
- OR make a spinner with a paper clip like the one on the right.



How to play:

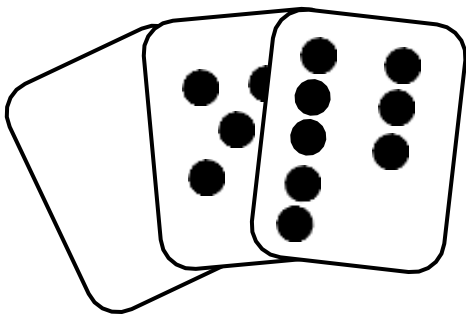
- Each player draws a wallet or a purse to keep their loot in.
- When it is your turn, roll the dice and take that number of pennies, but don't put them in your purse yet.
- You can roll the dice as many times as you like, but if you roll a ZAP you have to put all your pennies back.
- First player to have 20 pennies in their purse is the winner.



Encourage children to talk about what happens if:

- *You play until the pennies run out and see who has the most?*
- *You change the dice or spinner? You can decide how.*

- **Numberbond match**
Numberbonds within 10 (or above)



You need:

- A few sets of number cards with numerals and dots 0-10

How to play:

- Deal out all the cards to the players.
- Each player places a card on the pile when it is their turn.
- If the card placed goes with the previous card to make ten, then the first player to notice slaps their hand on the pile and says *Match!* They keep the pile.
- The winner is the one with the most cards at the end.

Encourage children to:

- Think ahead e.g. *I have 5 and 8, so I am waiting for 5 or 2.*
- Choose a new total e.g. *This round let's make the total 11.*

Five and six year olds

Shape and space games

• Barrier game

Shape and position



You need:

- Two identical sets of things, including some blocks or bricks and some toy characters, one set for each player
- A 'barrier' to stand between players, perhaps a large hard-back book.

How to play:

- Players make sure they each have exactly the same objects.
- Stand up the barrier.
- Player 1 uses all their things to build and arrange the toys in a way that the other cannot see. They then give instructions to Player 2 to create the same arrangement.
- Only Player 1 can peep over the barrier to check how Player 2 is doing, and to correct by not touching or pointing.
- When Player 1 is satisfied the two arrangements are the same, they call out "The same!" and the barrier is removed for them to compare.
- Swap roles and play again.



Encourage the children to:

- Discuss, *What are the most helpful things to hear and say?* (i.e. more precise language)
- **Cube challenge** (based on Hawes et al. 2017)
Spatial reasoning and position

You need:

- Sets of 4 multilink cubes or identical Lego® bricks

How to play:

- Players build as many unique shapes as they can using 4 cubes fitted together in some way.
- Players put all shapes together and eliminate any that are identical shapes (not unique).
- Count how many unique shape structures you have made.
- Repeat the game and see if you managed to make more unique shape structures the second time.
- Adapt the game by using 3 cubes or 5 cubes



Encourage the children to:

- Use spatial language, e.g. *on top*, *next to*, *turn it around*
- Visualize, by predicting, which shapes might be the same before rotating them to check
- Try using a shape they have made and adapting it slightly to make a new unique shape (using different compositions/decompositions and symmetry), e.g. *This is the only shape with two blocks sticking out, can we make another one with two blocks sticking out that is different?*

Five and six year olds

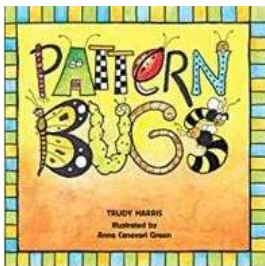
More Games

- Dominoes, Dot to dot, Snakes and Ladders type board games, Dot dice and number spinners for inventing games, [Shut the Box](#).

Songs & Rhymes

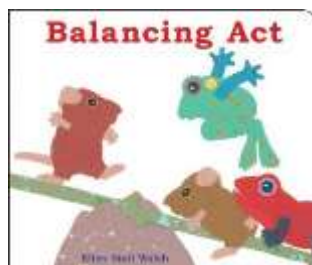
- [10 fat sausages](#)
- [Count to 100](#)
- [Ten again!](#)
- [Shape Song](#)
- [Macarena Count to 100](#)
- [Key Stage 1 Supermovers Collection](#)

Books



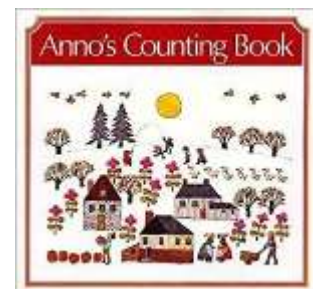
[Pattern Bugs](#)

Trudy Harris
Repeating patterns with words and colours analysed as ABBC, etc.



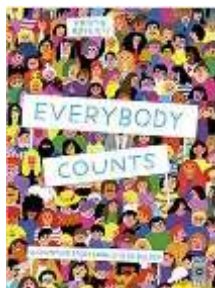
[The Balancing Act](#)

Ellen Stoll Welsh
Introducing equivalence and potential for the equals sign



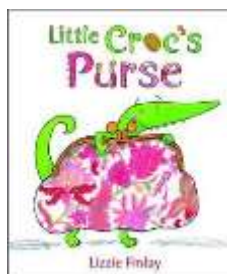
[Anno's Counting Book](#)

Mitsumasa Anno
Images of quantities. Look for number bonds and make up your own pictures



[Everybody counts](#)

Kristin Roskifte
A counting story from smaller to much larger numbers; images of quantities



[Little Croc's Purse](#)

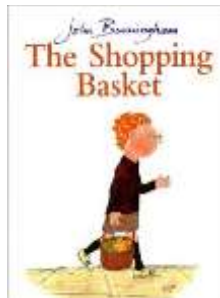
Lizzie Finlay
Decisions about how to spend a found purse of coins



[Man on the moon: a day in the life of Bob](#)

Simon Bartram
Ordering events

Five and six year olds



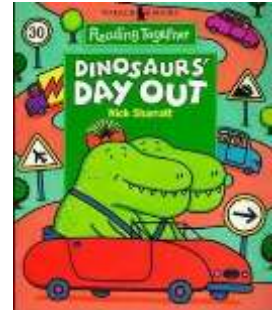
[The Shopping Basket](#)

John Burningham
Triangular number
pattern, changing
amounts



[How Big is a Million?](#)

Anna Millbourne & Serena Riglietti
Discussing big numbers with a fold-
out poster of 1 000 000 stars



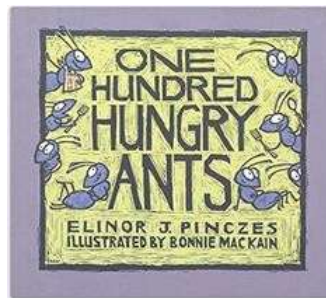
[Dinosaurs' Day Out](#)

[Nick Sharratt](#)
Following directions



[Diary of a Hungry Worm](#)

Doreen Cronin
Calendar dates through the
year ordering events



[One Hundred Hungry Ants](#)

Elinor J Pinczes
100 shown in different
arrangements



[Tangram Cat](#)

Maranke Rinck
Traditional 7-piece puzzle
(provided) arranged to form
many different beasts

Five and six year olds

- [123 section of Khan Academy Kids](#)

Open-ended activities for mathematics and problem-solving (2-7 years). Can be adapted for individual learning paths and teachers can set up a class account



Apps (paid) – explanatory videos

- [Finger Numbers](#)

Four games to develop number sense using fingers (counting, subitising, sets and calculation) (demonstration video is in German).



- [Numberblocks Card Fun](#)

Numbers 1 to 10 and activities to match, add and subtract with increasing complexity.



- [Numberblocks Hide and Seek](#)

This app focuses on addition and number bonds.



- [Dragonbox Numbers](#)

This app contains 4 different game activities to explore. Good for adults and children to use together to begin with.



- [Numbots](#)

Moving from counting to calculating addition and subtraction. This app supports subitising and uses familiar representations from school, including ten frames and bead frames.



- [Math Shelf](#)

Math Shelf supports geometry, place value, arithmetic, fractions, money, measurement and time. Can be adapted for individual learning paths.



Six and seven year olds

Six and seven year olds

At this age children often enjoy ...

- Maths which is practical, outdoors, in games, make believe and story contexts
- Mathematical role play
- Recording mathematics in their own way
- Solving puzzles and clues
- Discussing alternative strategies to tackle genuine problems, with two or more stages
- Finding many or all possible solutions
- Planning and making choices while constructing
- Designing and amending own patterns
- Playing traditional board games and card games



Which of these will make a pyramid?

Activities, games, rhymes, books and apps

Activities

- Use small world play to plan mazes and more complex routes then develop these into maps and recorded directions
- Consult calendars and create their own lists and plans over a day or a week, attaching times to these.
- Solve problems with containers of different volumes, e.g. ordering several from holding the most to the least.
- Estimation challenges involving weight, capacity and volume as well as number.
- More sophisticated block play challenges, involving measurements and comparisons, e.g. fitting 6 seats in the rocket, a high enough bridge for this toy lorry to pass under
- Pattern and shape challenges involving creating their own tangrams, pentominoes and pattern blocks
- Predict and visualise the 3D shape from the net
- Explore and compare maths tools in some depth, e.g. different types of weighing scales, rulers and tape measures, timers, calculators.
- Role play that involves mathematical problems to solve, e.g. a Pound Shop where customers have wallets containing differing amounts of money that has to last a week or an architect's office with plans to discuss and to build with blocks



Six and seven year olds

Games

Number games

- **21 or bust** (based on the traditional card game, Pontoon)
Place value, addition to 21

You need:

- Two tens frames for each player and dice
- Treasure to fill the ten frames (e.g. conkers, shells, toys)

How to play:

- Each player rolls the dice and collects that amount of treasure for their ten frame.
- Once their ten frame is full, they begin filling another ten frame.
- Each player must get as close to 21 as they can: they can choose to 'stick' at any time and give the other players a go.
- If a player goes over 21, they are bust and out of the game.
- Closest player to 21 is the winner.

Encourage children to:

- Discuss when to stop and when to keep going e.g. *I have 18 so it is sensible to stick.*
- Look for how their numbers compare to their friends' e.g. *He has 17, so I need to get 18 or 19 to win.*

- **Greater number wins**

Place value with hundreds, tens and ones

100's	10	1
8	5	1

You need:

- A hundreds, tens and ones place value grid for each player
- Two sets of digit cards 0-9 (cards with numerals on)

How to play:

- Place both sets of digit cards face down on the table.
- Player 1 chooses a digit card and decides where to put the number in their grid (either in the hundreds, tens or ones column). Once placed, it can't be moved.
- Player 2 does the same and both continue until both players have a three-digit number.
- The winner is the person who has made the greater number. The game can be adapted so the smallest number wins or the closest to a target number, such as 400.
- It can help children to have Dienes base10 apparatus or sets of 100s, 10s and 1s straws, matchsticks or similar so that they can see how many 800 is and how this is different to 80 or 8, for example. [Arrow cards](#) (place value cards) can also be helpful to show how many each digit represents (e.g. 80 when the 8 is in the tens column).

Encourage children to:

- Talk about which digit card will help them to win
- Discuss, *If I pick up a 1, should I put it in the hundreds column if I want to win?*

Six and seven year olds

- Think about the best place to put the digit during the game e.g. *my friend has a 4 in the hundreds column, I need a 4 or larger if I want to try and beat them.*

Shape and space game

- **Symmetry game** (based on Hawes et al. 2017)
Spatial reasoning involving position, direction and symmetry

You need:

- Two sets of the same shapes and a board (this can be magnetic shapes on a metal board, or paper/card shapes on a sheet of card). Draw a line (or establish a line with a rubber band, stick or piece of string) down the middle of the board. This is the line of symmetry in this game.
- Two players (or two teams of players)

How to play:

- Each player is in charge of one side of the board.
- Player 1 places one or two shapes on their side of the board.
- Player 2 creates the mirror image on their side, and then places one or two new shapes for player/team 1 to recreate as a mirror image on their side.
- Continue the process until the board is filled or all of the shapes have been used.
- The game can be developed by introducing a cover or similar to hide the act of placing the shape so the opponent has to find the difference when the cover is removed before placing the same shape on their side. This game can also be played outdoors with natural materials (such as conkers, shells, leaves, pebbles and sticks with a piece of string or a stick for the line of symmetry).



Encourage children to:

- Use spatial language, e.g. *next to, between, above, below.*
- Predict what the pattern might look like when both sides are complete and explain why they think this.
- Think about what the line of symmetry means for which way around the shapes need to be (orientation) and how close or far away shapes need to be from one another and the line.
- Visualise where their partner's piece will go, before the partner puts it down. Visualise what the whole pattern will look like.
- Talk about or show which way around the mirror imaged piece will be, e.g. *mine is going this way so I think yours will go this way (turns the shape).* As an adult, you might even make a deliberate mistake and ask the child to fix it for you or playfully add two shapes instead of one.

Six and seven year olds

More Games

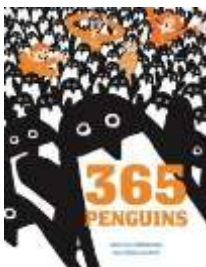


- Play the same Barrier Game as for Y1, but with 8-10 pieces of the same familiar resource e.g. Lego or different shapes of the same colour. Discuss what makes a construction really easy (e.g. placing items in rows) or what makes it really tricky for the other player (e.g. placing items diagonally or partially covering another item)
- Bingo: Every player draws a 4x4 grid and writes in any 16 numbers between 1 and 99. From a bag of Dienes 10s and ones, a Caller scoops some out and calls out the number they have scooped. Players cross it out if they have it on their board. First to get 3 numbers in a line calls out BINGO!
- Children inventing their own games with dot dice and number spinners for collecting or moving
- Ludo and similar games moving around a board
- Uno card game
- Monopoly

Songs & Rhymes

- [Key Stage 1 Supermovers Collection](#)
- [Macarena Count to 100](#)
- [2 times table](#)
- [5 times table](#)

Books



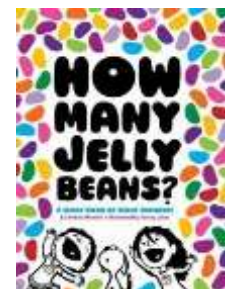
[365 Penguins](#)

Jean-Luc Fromental and
Joelle Jolivet
One more, counting on



[The Great Pet Sale](#)

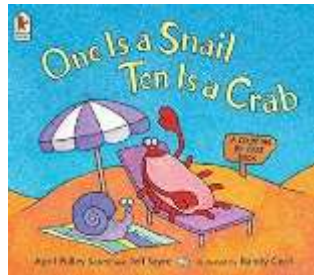
Mick Inkpen
Money with totals up to £1



[How many Jelly Beans?](#)

Andrea Menotti
Large numbers up to a million

Six and seven year olds



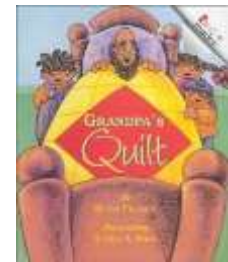
One is a Snail and Ten is a Crab

April Pulley Sayre and Jeff Sayre
Number composition and commutativity with numbers to 100



My Map Book

Sara Fanelli
Personal maps of many places and things, including time and relations



Grandpa's Quilt

Betsy Franco
Cutting up and rearranging the quilt pattern – a visualisation challenge

Apps (free)

- [123 section of Khan Academy Kids](#)

Open-ended activities for mathematics and problem-solving (2-7 years). Can be adapted for individual learning paths and teachers can set up a class account



- [Geoboard \(Math Learning Centre\)](#)

Virtual geoboard tool where children stretch bands around the pegs to form shapes and learn about perimeter, area, angles, congruence and fractions.



Apps (paid)

- [Math Shelf](#)

Math Shelf supports geometry, place value, arithmetic, fractions, money, measurement and time. Can be adapted for individual learning paths.





Five, six and seven year olds

Adults can help 5, 6 and 7 year olds learn by:

- **building on their interests**
e.g. giving space, time and resources for children to follow their mathematical wonders e.g. *Am I taller than 100 cubes? How many blocks can I stand in a row without them falling?*
- **sometimes playing alongside and silently offering choices, watching what the child does**
e.g. encouraging children to build ever more complicated structures, offering ideas about a wider base to support taller structures. Asking children to talk through/record their plans before building.
- **talking about numbers**
e.g. *I wonder how many children are here today? How could we find out? I wonder how many cubes are in this tray. What is the most efficient way of finding the answer?*
- **using maths words to talk about what you notice and what you are doing**
e.g. *straight, curved, on top of, between, longer, further, more, fewer, greater, less, equal, representation, subitise.*
- **being enthusiastic and encouraging, showing interest in how they think**
e.g. *you are so good at counting, Why did you choose that one? How did you know that was the answer?*
- **being playfully wrong**
e.g. *counting incorrectly or making silly suggestions which can often bring light to common misconceptions, like counting some items twice or saying 20 after 90 whilst counting in tens.*
- **providing easy, then harder, puzzles and challenges, sometimes teaching helpful strategies or directing attention to key features**
e.g. [NRICH](#)
- **discussing options**
e.g. *wondering how can we work this out. Is there another way? What happens if..?*



Acknowledgments

Community Playthings

Hawes, Z., Moss, J., Caswell, B., Naqvi, S. & MacKinnon, S. (2017). Enhancing children's spatial skills through a dynamic spatial approach to early geometry instruction: effects of a 32 week intervention. *Cognition and Instruction*, 35 (3) 236-264

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The Early Childhood Mathematics Group (ECMG) is a UK based group of early years mathematics enthusiasts and experts that includes teachers, researchers and teacher educators. We work together to promote early childhood mathematics.

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