

# **Mathematical thinking**

Early childhood learning trajectory



#### What is mathematical thinking?

Mathematical thinking is embedded in children's everyday lives. Research shows mathematical thinking and learning starts in infancy and develops into adulthood. It includes learning about mathematical concepts and applying them in everyday situations. Mathematical thinking involves 4 subdomains, including skills and ways of thinking listed below.

- <u>Patterns and predictions:</u> noticing patterns (repetition of 2 or more items) and predicting what comes next, which is the foundation of mathematical and logical thinking.
- <u>Shapes and spatial thinking:</u> describing physical objects, including what type of object they are (and why), their position relative to each other and their direction of movement.
- <u>Measurement and data:</u> understanding units of measurement (for example, length, weight and area) and using broader mathematical knowledge to answer simple questions through a process of collecting, interpreting, representing and communicating information.
- Quantity and counting: naming numbers in sequence and connecting them to quantities, and using actions, objects or numbers to represent quantities symbolically.

# Early Years Learning Framework

AERO's early childhood learning trajectories align with the Principles, Practices and Outcomes of the

#### Early Years Learning Framework V2.0.

The learning trajectories <u>user guide</u> provides further information and demonstrates how the Learning Outcomes can be mapped to domains.

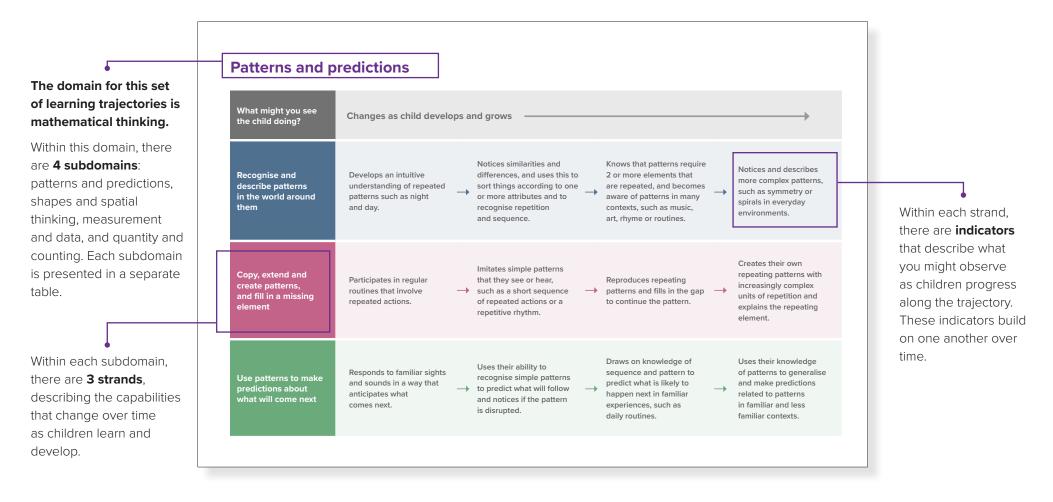
#### **National Quality Standard**

Quality Area 1 - Educational program and practice

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## How to use the early childhood learning trajectories

These learning trajectories will help you observe children's progress in mathematical thinking. They will give you language and ideas for documenting children's learning and development, and for your conversations with families and colleagues about children's progress. The trajectory is not a checklist. You are encouraged to use your professional knowledge and judgement in determining how each child may demonstrate progress along each trajectory, and how best to support their learning.



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## **Patterns and predictions**

What might you see Changes as child develops and grows the child doing? Notices similarities and Knows that patterns require Notices and describes Recognise and Develops an intuitive differences, and uses this to 2 or more elements that more complex patterns, understanding of repeated sort things according to one describe patterns are repeated, and becomes such as symmetry or in the world around patterns such as night or more attributes and to aware of patterns in many spirals in everyday recognise repetition contexts, such as music, them and day. environments. and sequence. art, rhyme or routines. Creates their own Imitates simple patterns Copy, extend and repeating patterns with Participates in regular that they see or hear, Reproduces repeating create patterns, increasingly complex patterns and fills in the gap routines that involve such as a short sequence and fill in a missing units of repetition and repeated actions. of repeated actions or a to continue the pattern. element explains the repeating repetitive rhythm. element. Draws on knowledge of Uses their knowledge Uses their ability to Responds to familiar sights sequence and pattern to of patterns to generalise Use patterns to make recognise simple patterns and sounds in a way that predict what is likely to and make predictions predictions about to predict what will follow anticipates what happen next in familiar related to patterns what will come next and notices if the pattern experiences, such as in familiar and less comes next. is disrupted. familiar contexts. daily routines.

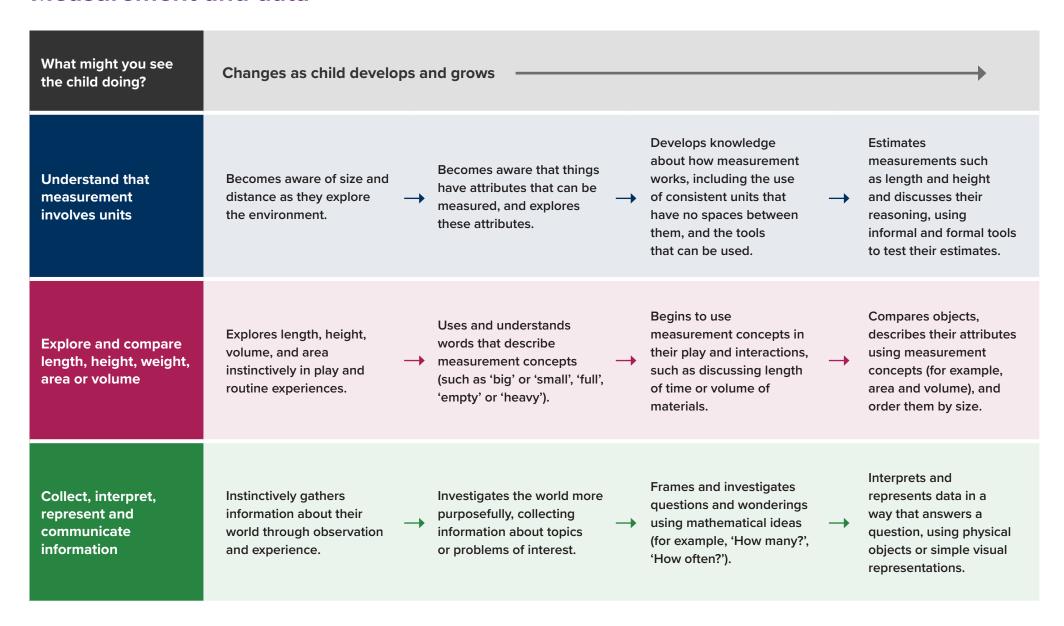
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## Shapes and spatial thinking

What might you see Changes as child develops and grows the child doing? Uses more precise Describes more complex Begins to match shapes language to describe attributes of shapes Recognise and (for example, same), and shapes (for example, (for example, sides, describe shapes and uses simple words and Uses their body to explore pointy, round), location corners) and explains spaces in the world the shapes and spaces. gestures to describe (for example, 'near') or relative positions around them location and direction direction (for example, (for example, on top, (for example, 'there', 'up'). 'forwards'). in front). Flips, slides, and rotates Changes the position of Manipulates shapes and Manipulate shapes Manipulates shapes their body or an object, objects experimentally to shapes and objects and objects purposefully and objects to create or looks at objects from change their form in accordance with new forms or positions and accurately. different perspectives. or position. a mental image. Connects Uses words to describe representations of Moves their eyes or body the location of things in Describe and Sorts or stacks objects places and shapes with in the direction of a desired relation to each other (for physical realities (for represent the relations by shape, and organises object and recognises example, beside, next to, between shapes or groups of objects into example, uses a simple items are still there even if between) and classifies positions desired positions. map or identifies a threenot visible. shapes according to their dimensional object using similarities and differences. a 2-dimensional image).

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### Measurement and data



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## **Quantity and counting**

What might you see Changes as child develops and grows the child doing? Uses body movement to Understands the Represents increasingly Uses drawings to represent indicate simple concepts of relationship between words large quantities, Represent quantity quantity or small objects quantity, such as showing for quantity and physical beginning to use symbolically to show what a specific when they have had objects (e.g., some, more numerals as well as quantity looks like. enough or want more. or less). objects or drawings. Shows an understanding Begins to count small of order, such as first, Tells the difference Uses body parts or objects sets using one-to-one second and third and between quantities in what to simulate or imitates correspondence, naming **Count objects** recognises that the they see and notice when counting, such as in numbers while pointing last number of a set to or touching the quantities change. counting songs or rhymes. represents the total relevant object. amount. Says or signs number Says or signs some number Says or signs number Say or sign number Counts verbally or words sometimes running words clearly, although words in the correct words in the correct recites number words into one another in a not necessarily in the sequence up to 5 and sequence back from 10. correct order. then to 10. sing-song way.

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## Creating opportunities to support children's mathematical thinking

#### Patterns and predictions

- Help children to notice patterns in their everyday experiences, including following predictable routines for pre-verbal children.
- Talk about the unit of the pattern that repeats, such as designs on fabric, table settings (such as spoon, fork, cup) or events in the day.
- Help children to become pattern finders by encouraging them to learn about and find 'units of repeat' such as ABCABC or blue-red-blue-red.
- Encourage children to create patterns and play with variations, including drawing, painting, play dough actions and songs.

## Shapes and spatial thinking

- Provide a range of shapes and objects in the physical environment, including large obstacles to navigate and smaller objects to move around.
- Find opportunities to support spatial thinking in interactions with children, describing the position of an object and using shape language.
- Notice and discuss children's purposeful manipulation of shapes and spaces, including in block play, jigsaws, dancing or tidying up.

#### Measurement and data

- Encourage children to investigate measurement concepts through play such as exploring size, length, height, and weight.
- Demonstrate effective
  measurement strategies (for
  example, lining blocks up to
  measure the length of the table
  and showing consistency with
  start and end points, consistency
  with units of measure (the
  blocks), and knowing there are
  no spaces in between each unit).
- Encourage children to estimate the length and height of an object or area and then use informal and formal tools to check and reflect on their initial ideas.

#### Quantity and counting

- Show children that counting tells us how many. Draw attention to numerals in the environment (for example, in books, on the clock or on posters).
- Use every opportunity to count verbally (such as in songs and rhymes or in routines) and support children in learning the number words.
- While you count, point to the objects you are counting and move them to one side to show which ones still need to be counted.
- When children tell you 'how many' without counting, ask how they know, count together to check, and emphasise the total number.

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### **About this resource**

Our early childhood learning trajectories are designed for teachers and educators working in early childhood education and care (ECEC) services with children in the years before school. They can support ongoing professional learning, for individuals, and entire ECEC services and teams.

The early childhood learning trajectories describe how children learn and develop in these key domains:

- Executive functions
- Social and emotional learning
- Mathematical thinking
- · Language and communication
- Physical development.

While each learning trajectory describes children's progress in a single domain, they are designed to be used in interconnected ways. A single experience may support progress in multiple domains at the same time. Progress in one domain may depend on progress in another.



For more information on our learning trajectories research

- Early childhood learning trajectory user guide
- Early childhood learning trajectories: The evidence base

## **More information**

The AERO website features further guidance, including practice guides, case studies for early childhood practice. Visit the Practice Hub at edresearch.edu.au for more information.

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