Numeracy

Introduction

In the Australian Curriculum, students become numerate as they develop the knowledge and skills to use mathematics confidently across other learning areas at school and in their lives more broadly. Numeracy involves students in recognising and understanding the role of mathematics in the world and having the dispositions and capacities to use mathematical knowledge and skills purposefully.

The *Melbourne Declaration of Educational Goals for Young Australians* (MCEETYA 2008) recognises that numeracy is an essential skill for students in becoming successful learners at school and in life beyond school, and in preparing them for their future roles as family, community and workforce members. More broadly, a numerate population is critical in ensuring the nation’s ongoing prosperity, productivity and workforce participation.

Scope of the Numeracy

Numeracy encompasses the knowledge, skills, behaviours and dispositions that students need to use mathematics in a wide range of situations. The Numeracy learning continuum identifies the related mathematical knowledge and skills, and contextualises these through learning area examples.

When teachers identify numeracy demands across the curriculum, students have opportunities to transfer their mathematical knowledge and skills to contexts outside the mathematics classroom. These opportunities assist students to recognise the interconnected nature of mathematical knowledge, other learning areas and the wider world, and encourage them to use their mathematical skills broadly.

For a description of the organising elements for Numeracy, go to Organising elements.

Numeracy across the curriculum

In the Australian Curriculum, much of the explicit teaching of numeracy skills occurs in Mathematics. Being numerate involves more than the application of routine procedures within the mathematics classroom. Students need to recognise that mathematics is constantly used outside the mathematics classroom and that numerate people apply general mathematical skills in a wide range of familiar and unfamiliar situations.

Using mathematical skills across the curriculum both enriches the study of other learning areas and contributes to the development of a broader and deeper understanding of numeracy. Therefore, a commitment to numeracy development is an essential component of learning areas across the curriculum and a responsibility for all teachers. This requires that teachers:

- identify the specific numeracy demands of their learning area
- provide learning experiences and opportunities that support the application of students’ general mathematical knowledge and skills
- use the language of numeracy in their teaching as appropriate.
Teachers should be aware of the correct use of mathematical language in their own learning areas. Understanding mathematical terminology and the specific uses of language in mathematics is essential for numeracy.

The Numeracy capability is addressed through the learning areas and is identified wherever it is developed or applied in content descriptions. It is also identified where it offers opportunities to add depth and richness to student learning in content elaborations. An icon indicates where Numeracy has been identified in learning area content descriptions and elaborations. A filter function on the Australian Curriculum website assists users to find where Numeracy has been identified in F–10 curriculum content. Teachers may find further opportunities to incorporate explicit teaching of Numeracy depending on their choice of activities. Students can also be encouraged to develop capability through personally relevant initiatives of their own design.

- **Numeracy in English**  
  (www.australiancurriculum.edu.au/English/General-capabilities)

- **Numeracy in Mathematics**  
  (www.australiancurriculum.edu.au/Mathematics/General-capabilities)

- **Numeracy in Science**  
  (www.australiancurriculum.edu.au/Science/General-capabilities)

- **Numeracy in History**  
  (www.australiancurriculum.edu.au/History/General-capabilities)

**Background**

This background summarises the evidence base from which the Numeracy capability’s introduction, organising elements and learning continuum have been developed. It draws on recent international and national research, as well as initiatives and programs that focus on numeracy across the curriculum.

The identification of numeracy as a general capability or competence to be addressed across the curriculum is supported by the literature. In Australia, the National Numeracy Review Report (Commonwealth of Australia 2008) argued for an emphasis both on mathematics as a distinct area of study and numeracy as an across-the-curriculum competency. In order to develop the ability to communicate numeric information effectively, students should engage in learning that involves using mathematics in the context of other disciplines. This requires a cross-curricular commitment and is not just the responsibility of the Mathematics Department (Miller 2010).

The Numeracy capability and learning continuum have been informed by a range of findings identified in the literature over a considerable period of time. Steen (2001) pointed out the ever-increasing gap between the quantitative needs of citizens and their quantitative capacity, while Miller (2010) continues to argue that quantitative literacy is a proficiency that is essential for people to be able to participate fully in a democratic society. Most recently, concerns about low levels of financial literacy shown by young people in Australia prompted the development of a National Consumer and Financial Literacy Framework to support the development of financial literacy skills in young people (MCEECDYA 2011).

The approach to the Numeracy capability, reflected in an optimal approach taken in schools, is informed by aspects of numeracy that were highlighted in the literature, including that:
• mathematics that people use in context is better understood than mathematics taught in isolation (Carraher, Carraher and Schliemann 1985; Zevenbergen and Zevenbergen 2009)

• knowledge is not automatically transferable from mathematics to other contexts (Lave 1988); numeracy requires contextual and strategic knowledge as well as mathematical skills (AAMT 1998)

• in numeracy there may be more than one suitable answer or method (Cohen 2001)

• numeracy moments often arise in unexpected situations (Thornton and Hogan 2005).
References


Organising elements

The Numeracy learning continuum is organised into six interrelated elements:

- Estimating and calculating with whole numbers
- Recognising and using patterns and relationships
- Using fractions, decimals, percentages, ratios and rates
- Using spatial reasoning
- Interpreting statistical information
- Using measurement

These elements are drawn from the strands of the Australian Curriculum: Mathematics as shown in the table below:

<table>
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<tr>
<th>Numeracy Continuum</th>
<th>Australian Curriculum: Mathematics</th>
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<td>Using spatial reasoning</td>
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<td>Interpreting statistical information</td>
<td>Statistics and Probability</td>
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<tr>
<td>Using measurement</td>
<td>Measurement and Geometry</td>
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</table>

The diagram below sets out these elements.
Estimating and calculating with whole numbers

This element involves students using numbers for different purposes. Students apply skills in estimating and calculating with whole numbers to solve and model everyday problems in a wide range of authentic contexts using efficient mental, written and digital strategies. They identify situations where money is used and apply their knowledge of the value of money to purchasing, budgeting and justifying the use of money. In developing and acting with numeracy, students:

- understand and use numbers in context
- estimate and calculate
- use money.

Recognising and using patterns and relationships

This element involves students identifying trends and describing and using a wide range of rules and relationships to continue and predict patterns. Students apply their understanding of patterns and relationships when solving problems in authentic contexts.

Using fractions, decimals, percentages, ratios and rates

This element involves students developing an understanding of the meaning of fractions and decimals, their representations as ratios, rates and percentages, and how they can be applied in real-life situations. Students visualise, order and describe shapes and objects using their proportions and the relationships of ratios, rates and percentages to solve problems in authentic contexts. In developing and acting with numeracy, students:

- interpret proportional reasoning
- apply proportional reasoning.

Using spatial reasoning

This element involves students in making sense of the space around them. Students visualise, identify and sort shapes and objects, describing their key features in the environment. They use symmetry, shapes and angles to solve problems in authentic contexts and interpret maps and diagrams, using scales, legends and directional language to identify and describe routes and locations. In developing and acting with numeracy, students:

- visualise 2D shapes and 3D objects
- interpret maps and diagrams.

Interpreting statistical information

This element involves students gaining familiarity with the way statistical information is represented through solving problems in authentic contexts that involve collecting, recording, displaying, comparing and evaluating the effectiveness of data displays of various types. Students use appropriate language and numerical representations when explaining the outcomes of chance events. In developing and acting with numeracy, students:
• interpret data displays
• interpret chance events.

**Using measurement**

This element involves students learning about measurement of length, area, volume, capacity, time and mass. Students estimate, measure, compare and calculate using metric units when solving problems in authentic contexts. They read clocks and convert between time systems, identify and sequence dates and events using a calendar and use timetables for a variety of purposes. In developing and acting with numeracy, students:

• estimate and measure with metric units
• operate with clocks, calendars and timetables.
# Numeracy Learning Continuum

## Estimating and calculating with whole numbers

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### Understand and use numbers in context

- **demonstrate concepts of counting using every day experiences**
- **connect and order number names, numerals and groups of objects using numbers up to two digits**
- **model, represent, order and use numbers up to four digits**
- **identify, describe and use numbers larger than one million**
- **compare, order and use positive and negative numbers to solve everyday problems**
- **use different ways to represent very large and very small numbers including scientific notation**

#### Examples
- showing anticipation that something will happen on the count of 1, 2, 3
- sorting numbered objects into ascending order or identifying how many members there are in the school sport’s team
- estimating growth of living things and representing prediction by making a chart
- estimating the quantity of supplies for the First Fleet
- recording different boiling and freezing points in an experiment
- comparing the Gross Domestic Product (GDP) of nations or representation of atoms in different materials

### Mathematics
- ACMNA001
- ACMNA027
- ACMNA073
- ACMNA123
- ACMNA280
- ACMNA210

### Science
- ACSSU003
- ACSSU075
- ACSSU078
- ACSSU184

### History
- ACHHS015
- ACHHS081
- ACHHS116
- ACHHS147

### Estimate and calculate

- **recognise the effects of adding to and taking away from a collection of objects**
- **solve everyday addition and share stories**
- **estimate the solution to a problem and then calculate the answer**
- **estimate a solution to a problem and then check the solution by recalling addition, subtraction, multiplication and**
- **solve problems and check calculations using efficient mental and written strategies**
- **solve complex problems by estimating and calculating using efficient mental, written and digital**
- **solve and model problems involving complex data by estimating and calculating using a variety of efficient**

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<tr>
<td>- recognising that a pile of books gets bigger when adding to it</td>
<td>- modelling a number story on a favourite book or multimedia presentation</td>
<td>- calculating the total for two purchases at the school canteen</td>
<td>- calculating the difference between the number of convicts who left Britain on the First Fleet and the number who arrived in Australia</td>
<td>- measuring and estimating the growth of plants</td>
<td>- calculating the running costs of a range of household appliances with different energy ratings</td>
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<tr>
<td>Mathematics ACMNA004</td>
<td>Mathematics ACMNA030</td>
<td>Mathematics ACMNA076</td>
<td>Mathematics ACMNA128</td>
<td>Mathematics ACMNA183</td>
<td>Mathematics ACMNA232</td>
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### Use money

<table>
<thead>
<tr>
<th>Identify situations that involve the use of money</th>
<th>Recognise the different value of coins and notes in the Australian monetary system</th>
<th>Identify and use combinations of coins and notes for simple purchases</th>
<th>Estimate the change from simple purchases</th>
<th>Create simple financial plans, budgets and cost predictions</th>
<th>Identify and justify ‘best value for money’ decisions</th>
<th>Evaluate financial plans to support specific financial goals</th>
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<tbody>
<tr>
<td><strong>Example</strong></td>
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<tr>
<td>- using pictures of the local community to identify places where money can be used</td>
<td>- naming the value of different coins and notes</td>
<td>- selecting the right money to buy lunch from the school canteen</td>
<td>- working out change from $5 when buying a drink</td>
<td>- creating a simple budget for a birthday party for 10 friends</td>
<td>- comparing different phone plans and presenting a reason for purchasing the chosen plan</td>
<td>- developing a budget/financial plan to save for a desired item taking into account the interest earned</td>
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<td>Mathematics ACMNA106</td>
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## Recognising and using patterns and relationships

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### Recognise and use patterns and relationships

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</tbody>
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**Example**

- recognising patterns in everyday contexts
  - describing patterns using different colours or repeating a pattern in music
  - creating a pattern based on the petal structure of a flower
  - creating a pattern that could be used to produce a mosaic
  - creating a pattern based on the petal structure of a flower

**Examples**

- Mathematics [ACMNA005](#)
- Science [ACSSU004](#)
- History [ACHHK001](#)
- Mathematics [ACMNA081](#)
- Science [ACSSU019](#)
- History [ACHHS047](#)
- Mathematics [ACMNA133](#)
- Science [ACSSU019](#)
- History [ACHHS047](#)
- Mathematics [ACMNA208](#)
- Science [ACSS169](#)
- History [ACHHS117](#)

**English**

- recognising patterns in games, music, artwork
  - describing patterns using different colours or repeating a pattern in music
  - creating a pattern based on the petal structure of a flower
  - creating a pattern that could be used to produce a mosaic

**Examples**

- Mathematics [ACMNA005](#)
- Science [ACSSU004](#)
- History [ACHHK001](#)
- Mathematics [ACMNA081](#)
- Science [ACSSU019](#)
- History [ACHHS047](#)
- Mathematics [ACMNA133](#)
- Science [ACSSU019](#)
- History [ACHHS047](#)
- Mathematics [ACMNA208](#)
- Science [ACSS169](#)
- History [ACHHS117](#)

**Science**

- recognising patterns in games, music, artwork
  - describing patterns using different colours or repeating a pattern in music
  - creating a pattern based on the petal structure of a flower
  - creating a pattern that could be used to produce a mosaic

**Examples**

- Mathematics [ACMNA005](#)
- Science [ACSSU004](#)
- History [ACHHK001](#)
- Mathematics [ACMNA081](#)
- Science [ACSSU019](#)
- History [ACHHS047](#)
## Using fractions, decimals, percentages, ratios and rates

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### Interpret proportional reasoning
- recognise a ‘whole’ and ‘parts of a whole’ within everyday contexts
- recognise that a whole object can be divided into equal parts
- visualise and describe halves and quarters
- visualise, describe and order tenths, hundredths, 1-place and 2-place decimals
- visualise, describe and order equivalent fractions, decimals and simple percentages
- visualise and describe the proportions of percentages, ratios and rates
- illustrate and order relationships for fractions, decimals, percentages, ratios and rates

**Example**
- separating objects or dividing materials into non-equal parts
- fold or cut a shape into equal parts
- putting the amounts of money raised by different classes in a school fundraiser into order
- explaining how to make a drink using 20% fruit, 30% lemonade and 50% fruit juice
- explaining the sizes of different cultural groups as proportions of the population of the local community
- calculating and plotting the savings made on a variable interest rate mortgage for the past 5 years

### Apply proportional reasoning
- identify quantities such as more, less and the same in everyday comparisons
- solve problems using halves and quarters
- solve problems using equivalent fractions for tenths, hundredths, 1-place and 2-place decimals
- solve problems using equivalent fractions, decimals and simple percentages
- solve problems using simple percentages, ratios and rates
- solve problems involving fractions, decimals, percentages, ratios and rates

**Example**
- pouring a liquid equally into two containers or identifying that one storage container is larger than another
- using kitchen measuring equipment to show 2 half cup measures can be used instead of a 1 cup measure
- finding the time difference between the fastest and slowest times for a class Beep test
- using migration statistics to show which 50-year period in Australia’s history had the largest percentage of growth
- comparing and contrasting trends in migration from Asian countries to Australia since World War II
- using proportional reasoning to assess the impact of changes in society and significant events, for example population loss from the 1919
## Using spatial reasoning

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<td>Mathematics ACMNA208</td>
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### Visualise 2D shapes and 3D objects

- **1a** Typically by the end of Foundation Year, students
- **1b** Typically by the end of Year 2, students

**Example**
- sorting objects by features of shape, size, colour and function
- grouping 2D shapes and 3D objects by their features, colour and materials
- creating a structure using a variety of shapes
- recording the angles of the shots hit by a batsman in a cricket match
- identifying and explaining key features of architecture in Qing China
- explaining how the design of buildings in the local community reflect their use

**Mathematics**
- ACMNA005
- ACMNA016
- ACMNA077
- ACMNA103
- ACMNA187
- ACMNA208

**Science**
- ACSSU003
- ACSSU038
- ACSSU048
- ACSSU078
- ACSSU048
- ACSSU078

**English**
- ACERA1483

**Mathematics**
- ACMGM111
- ACMGM161
- ACMGM216
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### Interpret maps and diagrams

- **Typically by the end of Foundation Year**, students
  - Demonstrate awareness of position of self and objects in relation to everyday contexts

- **Typically by the end of Year 2**, students
  - Follow directions to demonstrate understanding of common position words and movements

- **Typically by the end of Year 4**, students
  - Give and follow directions on maps and diagrams of familiar locations

- **Typically by the end of Year 6**, students
  - Interpret information, locate positions and describe routes on maps and diagrams using simple scales, legends and directional language

- **Typically by the end of Year 8**, students
  - Identify and describe routes and locations, using grid reference systems and directional language such as north or north east

- **Typically by the end of Year 10**, students
  - Create and interpret 2D and 3D maps, models and diagrams

#### Examples

- **Mathematics**
  - ACMG03010

- **Science**
  - ACSSU033
  - ACHHK045

- **History**
  - ACDSEH078

- **English**
  - ACELA1524
  - ACMG113
  - ACSSU096
  - ACHHK094

- **Create and interpret maps, models and diagrams using a range of mapping tools**

- **Examples**
  - Following actions to a song or dance
  - Using a diagram or picture as a guide to building a model
  - Using the language of position and movement to direct a friend to a new location
  - Creating and labelling a diagram showing the location of historical features in the local community
  - Using a street map to describe how to locate a friend’s house
  - Creating a map showing the expansion of the Mongol Empire across Europe and Asia
  - Creating a map showing the movement of people in the transatlantic slave trade or convict transportation to Australia

- **Science**
  - ACSSU190

- **History**
  - ACDSEH018

- **Mathematics**
  - ACMG090

- **History**
  - ACDSEH018

- **Science**
  - ACSSU190

- **History**
  - ACDSEH018
## Interpreting statistical information

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### Interpret data displays

- **display information using real objects or photographs and respond to questions about the information displayed**
  - **Example**
    - displaying the most popular activity in the class using photographs

- **recognise how to ask and answer simple data questions and interpret data in drawings or picture graphs**
  - **Examples**
    - asking class members which football team they support and recording this information using the team logos

- **collect and describe data on a relevant issue based on one variable and display as lists, tables or picture graphs**
  - **Examples**
    - constructing column graphs and picture graphs to represent the amount of water wasted by a dripping tap over a week

- **collect record and display data as tables, diagrams, picture graphs and column graphs**
  - **Examples**
    - presenting evidence about the foods eaten by animals in a column graph

- **collect, compare, describe and interpret data as 2-way tables, double column graphs and sector graphs, including from digital media**
  - **Examples**
    - comparing and discussing line graphs about pulse rates when at rest and after activity

- **compare, interpret and assess the effectiveness of different data displays of the same information**
  - **Examples**
    - choosing the most effective data display to compare mean and median rainfalls and water consumption in different locations

- **evaluate media statistics and trends by linking claims to data displays, statistics and representative data**
  - **Examples**
    - using bar graphs to compare food rations from World War II with their own food consumption

### Mathematics
- ACMSP011
- ACMSP048
- ACMSP096
- ACMSP147
- ACMSP170
- ACMSP253

### Science
- ACSIS014
- ACSIS040
- ACSIS068
- ACSIS107
- ACSIS146
- ACSIS206

### History
- ACHHK001
- ACHHS036
- ACHHS087
- ACHHS125
- ACHHS153
- ACHHS189
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**Interpret chance events**

Level 1b is the starting point for this sub-element

- recognise that some events might or might not happen

**Examples**
- recognising that it might or might not rain tomorrow

**Examples**
- discussing and using the language of chance to describe the likelihood of events such as ‘will’, ‘won’t’ and ‘might’

Mathematics
ACMSP024

Science
ACISIS212

**Examples**
- understanding and using terms denoting the likelihood of events, including colloquial terms such as ‘no way’, ‘for sure’

Mathematics
ACMSP067

Science
ACISIS216

**Examples**
- comparing and discussing the difference between predicted data and evidence when explaining the outcomes of an investigation

Mathematics
ACMSP146

Science
ACSHE098

**Examples**
- predicting and comparing the outcomes of plant-cloning techniques in agriculture

Mathematics
ACMSP205

Science
ACISIS141

**Examples**
- explaining the likelihood of multiple events occurring together by giving examples of situations when they might happen

Mathematics
ACMSP225
### Using measurement

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#### Estimate and measure with metric units

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<tr>
<td>use informal language and/or actions to describe characteristics of length, temperature, mass, volume, capacity and area in familiar environments</td>
<td>measure by comparing objects and indicate if these measurements are the same or different</td>
<td>estimate, measure and order using direct and indirect comparisons and informal units to collect and record information about shapes and objects</td>
<td>estimate, measure and compare the length, temperature, volume, capacity and mass of everyday objects using metric units and scaled instruments</td>
<td>choose and use appropriate metric units for length, area, volume, capacity and mass to solve everyday problems</td>
<td>convert between common metric units for volume and capacity and use perimeter, area and volume formulas to solve authentic problems</td>
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</table>

**Example**
- using hand gestures to describe the length of an object

**Examples**
- comparing the length of two objects and indicating which one is longer
- using informal measures to record observations, compare masses of objects using a balance scale, measure the heights of plants in hand spans
- using a thermometer to measure heating and cooling and recording results to the nearest half unit
- using measurements from maps, plans and other sources to describe historical buildings and the layout of settlements
- estimating and working out the area of a vegetable garden in square metres and calculating how much sugarcane mulch to buy to cover it
- working out how much space is taken up by kitchen cupboards in a kitchen design and the area of remaining walls that will need to be painted
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### Operate with clocks, calendars and timetables

- **Sequence familiar actions and events in a variety of ways**
- **Sequence familiar actions and events using the everyday language of time**
- **Read digital and analogue clocks to the half and quarter hour, sequence events by months and seasons and identify a date on a calendar**
- **Read digital and analogue clocks to the minute, convert between hours and minutes, use ‘am’ and ‘pm’, and use calendars to locate and compare time events**
- **Convert between 12- and 24-hour systems to solve time problems, interpret and use timetables from print and digital sources**
- **Use 12- and 24-hour systems within a single time zone to solve time problems, and place personal and family events on an extended time scale**
- **Use 12- and 24-hour systems within a multiple time zone to solve time problems, use large and small timescales in complex contexts and place historical and scientific events on an extended time scale**

#### Example
- **English**
  - associating familiar activities with times of the day or days of the week using pictorial, written or technology formats

#### Examples
- **English**
  - retelling a familiar story or sorting pictures from a familiar event into time order
  - developing a list for celebrating class birthdays

- **Mathematics**
  - calculating how many hours are spent at school in the month of July
  - working out how long it would take to get from home to the airport by bus or train
  - recording the correct time when creating a new event in a social media website
  - calculating the correct time differences before phoning an overseas friend
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