Numeracy across Visual Arts,
Levels 7–10

Linking the Numeracy Learning Progressions
and the Victorian Curriculum

Numeracy underpins learning across the Victorian Curriculum F–10. While much of the explicit teaching of numeracy occurs in the Mathematics learning area, it is strengthened, made specific and extended in other learning areas as students engage in a range of learning activities with significant numeracy demands. The Numeracy Learning Progressions are designed to assist schools and teachers in all learning areas to support their students to successfully engage with the numeracy demands of the Victorian Curriculum F–10.

**The Numeracy Learning Progressions are provided as advisory material only and are not mandated as part of the Victorian Curriculum F–10. To view the Visual Arts curriculum, visit the** [**Victorian Curriculum F–10 website**](https://victoriancurriculum.vcaa.vic.edu.au/the-arts/visual-arts/curriculum/f-10)**.**

In the Victorian Curriculum, the Visual Arts learning area includes the fields of art, craft and design. Students make and respond to artworks using visual arts knowledge, understanding and skills. They engage in a journey of discovery and problem solving relevant to visual perception and visual language, utilising visual techniques, technologies, practices and processes. Visual Arts supports students to view the world through different lenses and contexts. They recognise the significance of visual arts histories, theories and practices, exploring and responding to artists, craftspeople and designers and their artworks.

The most relevant Numeracy Learning Progressions for Visual Arts are Quantifying numbers, Number patterns and algebraic thinking, Comparing units, Positioning and locating, Understanding units of measurement, Understanding geometric properties and Interpreting and representing data.

In **Quantifying numbers** place value is taken to mean more than being able to read, write and state the positional value of a digit. Place value relies on understanding the relationship between digits in a numeral, which then enables the numeral to be renamed in multiple ways.

**Number patterns and algebraic thinking** describes how a student becomes increasingly able to identify a pattern as something that is a discernible regularity in a group of numbers or shapes. Figuring out how a pattern works brings predictability and allows the making of generalisations. As students become increasingly able to connect patterns with the structure of numbers, they create a foundation for algebraic thinking (that is, thinking about generalised quantities). Algebra enables the ‘generalisation’ of patterns from one situation to another, such as identifying and generalising patterns and using repetition in artwork.

**Comparing units** addresses comparing units in ratios, rates and proportions. A ratio describes a situation in comparative terms and a proportion is taken to mean when this comparison is used to describe a related situation in the same comparative terms. For example, changing the ratio of white paint to blue paint results in different shades; the comparison is the amount of white to the amount of blue. Proportionally, the amount of white might be 2 parts and the amount of blue might be 5 parts.

**Positioning and locating** describes how a student becomes increasingly able to recognise the attributes of position and location and to use positional language to describe themselves and/or objects in various locations. A student learns to reason with representations of shapes and objects regarding position and location and to visualise and orientate objects to solve problems in spatial contexts, such as when manipulating proportion to communicate a particular meaning.

**Understanding geometric properties** describes how a student becomes increasingly able to identify the attributes of shapes and objects and how they can be combined or transformed. Being able to use spatial reasoning and geometric properties to solve problems is important for a range of tasks. For example, in Visual Arts students use their understanding of geometric properties when they use and manipulate shapes to communicate expressive qualities, such as by inverting triangles to create a sense of imbalance or using implied lines (converging/orthogonal lines) to create an imaginary vanishing point.

**Understanding units of measurement** describes how a student becomes increasingly able to recognise attributes that can be measured and how units of measure are used and calculated. In making the transition from informal to formal units, a student attends to the structure of units used to measure how they are assembled end to end, side by side or in layers without gaps or overlapping. The structure of the units gives rise to ways of calculating length, area and volume. In dealing with mass and capacity, experience helps develop estimates associated with commonly available reference objects (a cupful in cooking or the mass of an egg). Developing standard and agreed units of measurement is critically vital in areas as diverse as medicine and trade. The relationship between units of measurement is applied in ratios, rates and proportions as well as decimals and percentages.

**Interpreting and representing data** describes how a student becomes increasingly able to recognise and use visual and numerical displays to describe data associated with statistical investigations, and to critically evaluate investigations by others. A student understands how these concepts and tools make meaning of data in context, and develops the ability to think critically about any claims, either questioning or confirming them.

Numeracy in the context of Visual Arts

The tables in this document make explicit the links between the Numeracy Learning Progressions and content descriptions in all four strands of the Visual Arts curriculum. Relevant extracts of the achievement standards for Visual Arts are also included.

In addition to these Numeracy Learning Progression links, the approximate relation to the Victorian Curriculum F–10 Mathematics levels has been included. For further information on the alignment of the Numeracy Learning Progressions and the Victorian Curriculum F–10 Mathematics, please refer to the [Numeracy Learning Progressions map on the VCAA website](https://www.vcaa.vic.edu.au/curriculum/foundation-10/crosscurriculumresources/Pages/Numeracy.aspx).

The ‘Numeracy in context’ section of the table provides examples of learning that connect to the Numeracy Learning Progressions, allowing for a deeper understanding of numeracy demands.

Links to Explore and Express Ideas

In Visual Arts students explore, imagine, experiment and express ideas, concepts, themes, values, beliefs, observations and experiences in artworks that they view and make.

|  |  |  |
| --- | --- | --- |
| **Relevant Victorian Curriculum achievement standard extracts** | **Relevant Victorian Curriculum content descriptions** | **Numeracy Learning Progression links (plus approximate relation to Victorian Curriculum F–10 Mathematics levels)** |
| **Visual Arts Levels 7 and 8** |
| * … students identify, analyse and evaluate how other artists use materials, techniques, technologies, processes and visual conventions to express ideas and convey meaning.
* Students plan and make their art works in response to exploration of techniques, technologies and processes used in the work of other artists.
 | Explore visual arts practices as inspiration to explore and develop themes, concepts or ideas in artworks [(VCAVAE033)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAE033)Explore how artists use materials, techniques, technologies and processes to realise their intentions in artworks [(VCAVAE034)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAE034) | **Number patterns and algebraic thinking*** Generalising patterns (4–5)

**Understanding geometric properties** * Features of shapes and objects (1–2)
* Properties of shapes and objects (3–4)

**Positioning and locating*** Using formal maps and plans (3)

**Interpreting and representing data*** Collecting and displaying data (4–5)
 |
| **Visual Arts Levels 9 and 10** |  |
| * Students identify the influences of other artists and analyse connections between techniques, processes and visual conventions in artworks to develop their own art practice.
* … students analyse and evaluate how artists communicate ideas and convey meaning in artworks.
 | Explore the visual arts practices and styles as inspiration to develop a personal style, explore, express ideas, concepts and themes in art works [(VCAVAE040)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAE040)Explore how artists manipulate materials, techniques, technologies and processes to develop and express their intentions in art works [(VCAVAE041)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAE041) | **Number patterns and algebraic thinking*** Generalising patterns (4–5)
* Algebraic expressions (8)

**Understanding geometric properties** * Properties of shapes and objects (3–4)
* Symmetry (4)
* Angles and lines (5–7)
* Geometric properties (7–8)

**Interpreting and representing data*** Collecting and displaying data (4–5)
 |
| **Numeracy in context – Visual Arts, Levels 7–10** |
| **Visual Arts Levels 7 and 8** |
| **Number and algebraic thinking**Students recognise simple patterns in everyday contexts, including recognising random, linear, radial or abstract patterns when analysing artworks. Students copy simple patterns they find in objects to create similar random, linear, radial or abstract patterns in their own artworks.**Understanding geometric properties**Students discuss why artists manipulate images to convey ideas and meaning and analyse how artists use mathematics in their practice by combining, adapting and manipulating images when copying, enlarging and transforming them (rotating, reflecting, dilating and translating) to create their own artworks. Students may use a series of photographs that they take and enlarge them, or they might use an image in a repeat pattern for an abstract artwork. **Positioning and locating**Students explore the use of and the importance of symbolism in Aboriginal and Torres Strait Islander art. Students research a map showing locations of Aboriginal and Torres Strait Islander language and dialect groups. Koori and other Aboriginal and Torres Strait Islander artists use a range of materials and techniques that are unique and represent an artist’s connection to Country or Place. Different artworks and art forms are unique to different peoples and Countries. Artworks include rock paintings and engravings, Western Desert dot paintings, bark paintings, carvings, sculptures and weaving. Students investigate the use of materials in different art forms and the use of proportion, space and scale in artworks. A range of Aboriginal and Torres Strait Islander artists and their work can be found in the collections on the [National Gallery of Australia](https://nga.gov.au/first-nations/) and the [National Gallery of Victoria](https://www.ngv.vic.gov.au/explore/collection/first-nations-art/) websites.**Interpreting and representing data** Students collect and compare information about the variety of materials, techniques, technologies, processes and visual conventions artists use to express ideas and convey meaning. They select the most suitable representation of the information and justify data collection methods in the given context. |
| **Visual Arts Levels 9 and 10** |
| **Number patterns and algebraic thinking**Students identify, explore and evaluate visual arts practices and styles to develop a personal style. They investigate artworks of the many artists and photographers who include repetitive patterns, such as the Fibonacci sequence, as the compositional structure of their work. Students analyse artists’ use of the golden ratio in their application of space, proportion, scale, tone and form in their artworks.**Understanding geometric properties**Students use everyday language to describe and compare shapes and objects. They find objects in the environment with similar two-dimensional shapes or three-dimensional forms and use their collection of objects as subject matter in an artwork. Students document the similarities and differences between the objects and discuss how they have inspired their artwork. They identify and describe the features of shapes and objects and describe what the object may look like from a different perspective. Students explore symmetrical and tessellating patterns as artwork and manipulate familiar two-dimensional shapes and three-dimensional forms in a visual artwork by, for example, elongating (dilating), inverting (reflecting), repeating (translating) and rotating them. These techniques can be explored in artworks developed by MC Escher. **Interpreting and representing data** Students collect information about the materials, techniques, technologies or processes that an artist uses in an artwork. They explore how to represent the information and use evidence from the artwork. Their representation of the data may be written, oral or visual. |

Links to Visual Arts Practices

In Visual Arts, students develop understanding and skills by exploring, selecting, applying and manipulating techniques, technologies and processes. They conceptualise, plan and design artworks.

|  |  |  |
| --- | --- | --- |
| **Relevant Victorian Curriculum achievement standard extract** | **Relevant Victorian Curriculum content descriptions** | **Numeracy Learning Progression links (plus approximate relation to Victorian Curriculum F–10 Mathematics levels)** |
| **Visual Arts Levels 7 and 8** |
| * They demonstrate the use of materials, techniques, processes, visual conventions and technologies to express ideas and convey meaning in their artworks.
 | Experiment with materials, techniques, technologies and processes in a range of art forms to express ideas, concepts and themes in artworks [(VCAVAV035)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAV035)Develop skills in planning and designing art works and documenting artistic practice [(VCAVAV036)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAV036) | **Number patterns and algebraic thinking*** Generalising patterns (4–5)

**Comparing units*** Ratios (8)

**Positioning and locating*** Interpreting maps and plans (4–5)

**Understanding units of measurement*** Using formal units (3–5)
 |
| **Visual Arts Levels 9 and 10** |  |
| * They select, and manipulate materials, techniques, processes, visual conventions and technologies to express ideas and viewpoints in their artworks.
 | Select and manipulate materials, techniques, and technologies and processes in a range of art forms to express ideas, concepts and themes [(VCAVAV042)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAV042)Conceptualise, plan and design art works that express ideas, concepts and artistic intentions [(VCAVAV043)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAV043) | **Operating with percentages*** Understanding percentage and relative size (6)
* Find percentage as part of a whole (7–8)

**Number patterns and algebraic thinking*** Generalising patterns (4–5)
* Algebraic expressions (8)

**Comparing units*** Ratios (8)
* Rates (8)
* Applying proportion (9)

**Understanding geometric properties*** Properties of shape and objects (3–4)
 |
| **Numeracy in context – Visual Arts, Levels 7–10** |
| **Visual Arts Levels 7 and 8** |
| **Number patterns and algebraic thinking**Students recognise simple patterns in everyday contexts, including recognising random, linear, radial or abstract patterns when analysing artworks. They copy simple patterns that they view in the artworks. Students can use these patterns to create random, linear, radial or abstract patterns in their own artworks.**Comparing units**Students experiment, in a range of art forms, with materials, techniques, technologies and processes that require an understanding of ratios, including calculating quantities of paint required based on area, paint colour combinations, and water-to-clay combinations. Students consider the use of scale in drawings – the use of gridlines; the calculation of area of rectangles, triangles, parallelograms and circles; and the effect of scale changes on area. Artists focusing on abstract art and geometry include Henri Matisse, Josef Albers, Piet Mondrian, Joan Miró and Cubist artists such as Georges Braque. Students select an image for their work and map the scale and size of the image using shapes and lines. Students examine the aspect ratio of rectangles used by [Piet Mondrian](https://www.tate.org.uk/kids/explore/who-is/who-piet-mondrian) and investigate why he used the ratios in his work. They examine to what extent his work was dependent on the use of the golden ratio.**Positioning and locating**Students review techniques used by artists locally and around the world, and they are able to interpret formal maps to determine locations. **Understanding units of measurement**Students use multiple informal units to measure length, mass or capacity in art; for example, they use the principles of scale and proportion when measuring the proportions of a face for an artwork or design work. They choose and use a selection of the same size and type of units to make indirect comparisons of mass and capacity when comparing the sizes of artworks or calculating the amount of clay required to make a ceramic vessel.Students explore concepts of change over time in society and culture and the influences these changes had on artists’ practices.  |
| **Visual Arts Levels 9 and 10** |
| **Operating with percentages**Students take photographs and apply the rule of photographic composition that states 60% of the scene should involve the main subject. They apply the ‘rule of thirds’, which divides a photograph into nine equal areas. **Number patterns and algebraic thinking**The golden ratio φ (*phi*) is a solution of the algebraic equation φ2 – φ – 1 = 0. Students set up an Excel workbook and by trial and error obtain an estimate of φ. It can be shown that $φ=\frac{1+\sqrt{5}}{2}$. They use an image they have found and superimpose the golden ratio on top of the image as a basis for an artwork. When exploring colour composition students consider primary colour composition. **Comparing units**The golden ratio is regarded as the most pleasing aspect ratio for a rectangular shape. Students compare the formula for the golden ratio with the formulas for different aspect ratios for different image sizes when developing prints. Students can use this process when printing their digital images and designs on paper. They can compare the ratios on the screen to different sizes of paper. Students use enlargement to identify pixels in images using technology and develop pixelated artworks. In digital photography students apply ISO settings to achieve the correct exposure when taking photographs. Students can explore how, on a digital SLR camera, the opening of the lens (aperture) is specified by ‘f-stops’. A typical f-stop sequence is f/1.4, f/2, f/2.8, f/4, f/5.6, f/8 … $$f-stop=\frac{lens focal length}{aperture diameter}$$Students explore camera shutter speeds, which are typically given by the sequence $1 s, \frac{1}{2}s, \frac{1}{4}s, \frac{1}{8}s$ with each point on the scale being approximately half of the previous one. On a camera the fraction notation is not used and the speeds are listed as 1, 2, 4, 8, 15, 30, 60, 125, 500 …**Understanding geometric properties**A common material in Visual Arts is rectangular paper. Students can define the aspect ratio of a rectangle (the proportional relationship between its width and its height). They can investigate how the numerical value of the golden ratio is expressed as an aspect ratio of a rectangle, the limit of a ratio of sequential terms in any Fibonacci sequence (12, 17, 29, 46, 75, …) and as an infinite fraction.When investigating techniques, students compare their own process to examples of lithographic work, such as [Pablo Picasso’s *The Bull*](https://www.artyfactory.com/art_appreciation/animals_in_art/pablo_picasso.htm). When reviewing, selecting and comparing materials, students describe the mathematical elements in the Cubist works of Pablo Picasso and Georges Braque. They use the same mathematical elements to create a portrait or a still life work.Students photograph a subject from multiple viewpoints. They create a collage of the images and trace over the shapes and lines to form the composition of the artwork.  |

Links to Present and Perform

In Visual Arts, students develop understanding and skills by exploring, selecting, applying and manipulating techniques, technologies and processes. They conceptualise, plan and design artworks.

|  |  |  |
| --- | --- | --- |
| **Relevant Victorian Curriculum achievement standard extract** | **Relevant Victorian Curriculum content descriptions** | **Numeracy Learning Progression links (plus approximate relation to Victorian Curriculum F–10 Mathematics levels)** |
| **Visual Arts Levels 7 and 8** |
| * Students identify and describe artworks and exhibitions from different cultures, times and places …
 | Create and display artworks, describing how ideas are expressed to an audience [(VCAVAP037)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAP037) | **Interpreting fractions*** Fractions as numbers (5)
* Using fractions (6)
 |
| **Visual Arts Levels 9 and 10** |
| * Students identify the influences of other artists and analyse connections between techniques, processes and visual conventions in artworks to develop their own art practice. They select, and manipulate materials, techniques, processes, visual conventions and technologies to express ideas and viewpoints in their artworks.
 | Create, present, analyse and evaluate displays of artwork considering how ideas can be conveyed to an audience [(VCAVAP044)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAP044) | **Positioning and locating*** Using formal maps and plans (3)
* Interpreting maps and plans (4–5)

**Understanding units of measurement*** Using formal units (3–5)
 |
| **Numeracy in context – Visual Arts, Levels 7–10** |
| **Visual Arts Levels 7 and 8** |
| **Interpreting fractions**Students understand the relationship between a fraction, decimal and percentage, as different representations of the same quantity (for example, ½ = 0.5 = 50%). They can interchangeably write or speak about the way space is partitioned in a visual artwork or describe a small square as being 1/4, 25% or 0.25 of another square. Students can research the works of artists who used mathematical formulas as a basis for their artworks, such as [op artists](https://www.tate.org.uk/kids/explore/what-is/op-art) [Victor Varsarely](http://www.artnet.com/artists/victor-vasarely/) and [Bridget Riley](https://www.artsy.net/artist/bridget-riley) and the pop artist [Roy Lichtenstein](https://www.tate.org.uk/art/artists/roy-lichtenstein-1508).Students can use strategies to find a fraction of a quantity, for example when using a whole shape and fractional parts of the same shape in the composition of visual and design works. Students can consider the relationships between the use of space and the compositional arrangements of these artworks. They could plan an online presentation of these works using mathematical formulas to present the artworks.  |
| **Visual Arts Levels 9 and 10** |
| **Positioning and locating**Students explore artwork from cultures around the world, such as from a range of galleries and art museums on [Google Arts and Culture](https://artsandculture.google.com/). Students can also preview a list of principal art galleries in and around Melbourne through the [Visit Victoria website](https://www.visitvictoria.com/Regions/Melbourne/Things-to-do/Art-theatre-and-culture/Art-galleries). Students can transpose a two-dimensional view into a three-dimensional planometric drawing or a one- or two-point perspective drawing of the view. They can import their designs into a digital software application and render their plans and drawings using digital tools to create an online route or printed information brochure. **Understanding units of measurement**Students use multiple informal units to measure length, mass or capacity when measuring the proportions of a face for a portrait drawing or painting. Students use a selection of the same size and type of units (centimetres, millimetres, litres, millilitres) to make indirect comparisons of mass and capacity; for example, students compare the sizes of artworks when analysing the presentation of artworks. Students could view a range of ceramic works and document the size and dimensions of the work. From their analysis students plan their own artworks. They draw their work, calculate the dimensions and then research the amount of clay required to make a ceramic vessel. |

Links to Respond and Interpret

In Visual Arts, students develop understanding and skills by exploring, selecting, applying and manipulating techniques, technologies and processes. They conceptualise, plan and design artworks.

|  |  |  |
| --- | --- | --- |
| **Relevant Victorian Curriculum achievement standard extract** | **Relevant Victorian Curriculum content descriptions** | **Numeracy Learning Progression links (plus approximate relation to Victorian Curriculum F–10 Mathematics levels)** |
| **Visual Arts Levels 7 and 8** |
| * Students identify and describe artworks and exhibitions from different cultures, times and places and how ideas are interpreted by audiences.
 | Analyse how ideas and viewpoints are expressed in artworks and how they are viewed by audiences [(VCAVAR038)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAR038)Identify and connect specific features of visual artworks from different cultures, historical and contemporary times, including artworks by Aboriginal and Torres Strait Islander peoples [(VCAVAR039)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAR039) | **Understanding geometric properties*** Symmetry (4)

**Positioning and locating*** Using formal maps and plan (3)

**Interpreting and representing data*** Collecting and displaying data (4–5)
 |
| **Visual Arts Levels 9 and 10** |  |
| * Students analyse and evaluate artworks and exhibitions from different cultures, times and places, and discuss how ideas and beliefs are interpreted by audiences.
 | Analyse and interpret artworks to explore the different forms of expression, intentions and viewpoints of artists and how they are viewed by audiences [(VCAVAR045)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAR045)Analyse, interpret and evaluate a range of visual artworks from different cultures, historical and contemporary contexts, including artworks by Aboriginal and Torres Strait Islander Peoples to explore differing viewpoints [(VCAVAR046)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAR046) | **Comparing units** * Building ratios (7)
* Ratios (8)
* Rates (8)
* Applying proportion (9)
 |
| **Numeracy in context – Visual Arts, Levels 7–10** |
| **Visual Arts Levels 7 and 8** |
| **Understanding geometric properties**Students explore a range of cultural art found in the collections on the [National Gallery of Australia](https://nga.gov.au/first-nations/) and the [National Gallery of Victoria](https://www.ngv.vic.gov.au/explore/collection/first-nations-art/) websites. They explore the artworks on these sites and select examples that use symmetry. Students analyse the extent to which point and line symmetry is used as a principle in the artworks. They identify that the artist’s use of symmetry is visual language and identify how this symmetry differs from the pure mathematical form.**Positioning and locating**Students locate positions and are able to read and interpret a range of maps locating artworks from different cultures around the world. They are able to apply their knowledge of scale and proportion to draw and interpret maps. **Interpreting and representing data**Students analyse how ideas and viewpoints are expressed in artworks and how they are viewed by audiences. They describe the artist’s use of techniques, processes, materials and visual conventions in artworks from different periods of time. They consider how the presentation, location and context of the artwork can influence the interpretation of the artwork.  |
| **Visual Arts Levels 9 and 10** |
| **Comparing units** Students use knowledge of fractions as part­–whole relationships to divide and compare quantities when analysing the use of circles and segments or the division of thirds as a compositional tool in artwork or visual design. They interpret ratios as a comparison between the same units of measurement if calculating the aspect ratio of an image or a 1:5 scale model for a three-dimensional work. Students explore how artists from different times and cultures have used the Fibonacci sequence to create patterns for artworks and design works. They research examples of patterns in nature that demonstrate the golden ratio as a basis for an artwork or visual design. Students demonstrate how increasing one quantity in a ratio will affect the total proportion. They calculate proportion as the equality of two ratios or rates. They determine proportions in nature and the human form as represented in artworks, for example determining ‘the length of the outspread arms is equal to the height of a man’ as seen in [*Vitruvian Man* by Leonardo da Vinci](https://www.leonardodavinci.net/the-vitruvian-man.jsp).  |