Stage 6 Mathematics Life Skills

## MLS – M2 Measuring Two-Dimensional and Three-Dimensional Shapes

### Overview

| MLS-M2 Measuring Two-Dimensional and Three-Dimensional Shapes | Unit Duration |
| --- | --- |
| Measurement is an important skill for life and in this topic students focus on measurement skills, terminology and strategies, and apply these to meaningful contexts. |  |

| Subtopic focus | Outcomes |
| --- | --- |
| In this subtopic students explore the properties of two-dimensional (2D) shapes and three-dimensional (3D) shapes and measure perimeters, areas, volumes and capacities. Where appropriate, the skills developed should be applied to relevant real-life situations. The knowledge, skills and understanding in this subtopic builds on Life Skills Years 7–10 outcomes and content for Measurement and Geometry. | A student:* explores mathematical concepts, reasoning and language to solve problems MALS6-1
* engages with mathematical symbols, diagrams, graphs and tables to represent information accurately MALS6-2
* explores contexts of everyday measurement MALS6-4
* engages with mathematical skills and techniques, including technology, to investigate, explain and organise information MALS6-13
* communicates mathematical ideas and relationships using a variety of strategies MALS6-14
 |
| Related Mathematics Standard outcomes | ****Related Numeracy CEC outcomes**** |
| MS11-1, MS11-2, MS11-4, MS11-9, MS11-10, MS1-12-1, MS1-12-2, MS1-12-4, MS1-12-9, MS1-12-10, MS2-12-1, MS2-12-2, MS2-12-4, MS2-12-9, MS2-12-10 | N6-1.1, N6-1.2, N6-1.3, N6-2.2, N6-2.5, N6-3.1, N6-3.2 |

All outcomes referred to in this unit come from the [Stage 6 Mathematics Life Skills Syllabus](https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/stage-6-learning-areas/stage-6-mathematics/mathematics-life-skills-2017)© NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2017

### Adjustments

Examples of adjustments can be found on the NESA website under [Adjustments](https://www.educationstandards.nsw.edu.au/wps/portal/nesa/11-12/Diversity-in-learning/stage-6-special-education/adjustments).

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| Student’s name | Adjustments |
| e.g. John Smith | Requires learning material to be printed on blue paper. |
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### Unit of learning

| ContentStudents learn to: | Suggested teaching strategies and resources | Differentiation and modifications | Date and initial |
| --- | --- | --- | --- |
| M2.1: 2D and 3D shapesStudents:* recognise, identify, match and sort shapes in the environment, for example:
* in nature
* in the home
* in the classroom
* in the workplace
* in pictures
* online Work and enterprise icon Work and enterprise icon
* recognise attributes, similarities and differences of shapes in the environment and in a range of contexts, for example:
* putting a round tablecloth on a square table
* identify or describe attributes, similarities and differences of shapes in the environment and in a range of contexts using everyday language, for example:
* stacked rolls of toilet paper in the cupboard Literacy icon Literacy icon
 | Investigating 2D shapes* Teacher to brainstorm with students the names of as many different shapes as possible. Students could then sort these into 2D and 3D shapes
* Students could use [Geoboard](https://apps.mathlearningcenter.org/geoboard/) to create and name a variety of 2D shapes
* Students could collect photos of road signs and investigate their names and features such as the number of sides, parallel sides, symmetry

**Resource:** investigating-road-signs.DOCX* Students could repeat the activity above using objects in their home/workplace/school Eg tiles, mats, place-mats, pictures, mirrors, cookie cutters
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| * make representations of 2D shapes using technology as appropriate, for example:
* a bedroom plan
* a transport map
* a garden  Information and communication technology capability icon  Information and communication technology capability icon
* recognise tessellations, identifying the shapes involved
* continue or create tessellations using different methods, for example:
* grids, technology or concrete materials
 | Investigating tessellations* Students complete this scaffolded investigation into patterns used in tiling and paving.Resource: investigating-tiling-patterns.DOCX
* Students can either use the scaffolded investigation or the interactive [Tessellation creator](https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Tessellation-Creator/) from NCTM, to investigate which shapes tessellate and which don’t **Resource:** do-quadrilaterals-tessellate.DOCX
* Teacher to introduce students to the work of [MCEscher](https://mcescher.com/gallery/). Liberation is a great piece to show the basic starting shape and how it has been altered. Teacher to lead a discussion of the features of his artwork
* This [Tessellating tiles](https://blog.doublehelix.csiro.au/tessellating-tiles/) resource from CSIRO, contains a scaffolded lesson plan where students create their own tessellating tile pattern using irregular shapes**:**
* In this [Decorate a room](https://fuse.education.vic.gov.au/Resource/LandingPage?ObjectId=4e95960a-1df2-4423-887e-e8564c8f3146&SearchScope=All) interactive computer activity, students decorate a room using a tessellation of trapeziums
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| * explore the number of faces, edges and corners, whether the faces are flat or not, whether the shape can be stacked, packed or rolled Critical and creative thinking icon Critical and creative thinking icon
* make representations of 3D shapes using technology as appropriate, for example:
* using nets to construct a model of a dog kennel  Information and communication technology capability icon  Information and communication technology capability icon
* solve problems involving 2D and 3D shapes, for example:
* packing a suitcase
* stacking objects in the pantry
* keeping storage containers in the garage/wardrobe Critical and creative thinking icon Critical and creative thinking icon Literacy icon Literacy icon Personal and social capability icon Personal and social capability icon
 | Recognising and naming 3D shapes* Students watch the video [Shapes glorious shapes](https://education.abc.net.au/home#!/media/1566372/) to learn the names of 3D shapes and some places they are used in our world. Teacher to summarise the shapes and places shown in the video.
* In this [Skeleton shapes](https://nrich.maths.org/1156) activity from nrich, students build different 3D shapes using toothpicks and blu-tak
* In this interactive [Shape maker: stacker](https://fusecontent.education.vic.gov.au/2cd385b9-19d5-4c70-b044-49732ffbeb71/p/index.html) computer activity, students make 3D shapes by spinning or extruding 2D shapes

Feature of 3D shapes* In this [Odd one out](https://nzmaths.co.nz/resource/odd-solids) problem-solving activity from nzmaths, students must decide which 3D object is the odd one out by looking at their features. Students must explain their reasoning.
* Teacher to show students the [Solids](https://revisionmaths.com/gcse-maths/geometry-and-measures/3d-shapes) video to introduce the terminology of faces, edges and vertices. Teacher to summarise the words used in the video and students could add these to a glossary.
* In these interactive computer activities, students practise counting how many faces, different shapes have, including composite shapes**Resources:**
* [Finding faces 1](https://fuse.education.vic.gov.au/Resource/LandingPage?ObjectId=9c06574c-a5bc-44c7-a597-b0bec5603d04&SearchScope=All)
* [Finding faces 2](https://fuse.education.vic.gov.au/Resource/LandingPage?ObjectId=54749591-043d-4897-8234-570ba024a073&SearchScope=All)
* [Predicting faces](https://fuse.education.vic.gov.au/Resource/LandingPage?ObjectId=1027307e-3388-4b60-85b1-35e73884bc1d&SearchScope=All)
* In this scaffolded [Shape shadows](https://www.resolve.edu.au/shape-shadows) ReSolve investigation, students explore the shapes of shadows cast by different 3D objects
* Teacher to discuss with students how plans are used by builders to build houses, sheds and other buildings. Teacher to show students plans of houses from different viewpoints.
* Students complete this [Plans, elevations and isometric drawing](https://www.tes.com/teaching-resource/plans-elevations-and-isometric-drawing-11043897) worksheet to practise drawing 3D objects from their front, side and top views

Investigating 3D shapes* In this scaffolded [Shapes at work](http://sciencenetlinks.com/lessons/shapes-at-work/) lesson from sciencenetlinks, students look at shapes in nature vs man-made shapes
* Teacher to show students a variety of photos of bridges. Students should identify what shapes are used in each bridge. Which shapes are common?
* Students watch the video [What is the strongest shape?](https://education.abc.net.au/home#!/media/2929331/how-strong-are-triangles-) to learn why triangles have been used in engineering and architecture design through the ages
* Students to use the interactive [Maths is fun](https://www.mathsisfun.com/definitions/net.html) website to see what 3D shapes look like as nets.
* In this investigation students collect samples of different packaging and explore the different shapes and number of sides, faces, edges, and vertices in each. They then look at how each of these packages can be stacked together and what their net looks like.**Resource**: investigating-packaging.DOCX
* In this [Building tall](https://www.fi.edu/science-recipes/building-tall) lesson from the Franklin Institute, students build a skyscraper by choosing the best material to create the tallest structure they can
* Students watch the [How to build a skyscraper](https://education.abc.net.au/home#!/media/30429/) video about how the shape of an object can affect its strength. Students to reflect if they used any of these features when building their tower in the previous activity.
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| M2.2: PerimeterStudents:* recognise language and comparative language that relates to perimeter, for example:
* longer than
* shorter than
* distance
* ruler
* tape measure
* centimetre
* metre Literacy icon Literacy icon
* recognise the perimeter of 2D shapes
* recognise metric units of perimeter, their abbreviations and conversions between them
* recognise appropriate units and devices to measure perimeter Critical and creative thinking icon Critical and creative thinking icon
* identify or describe the perimeter of 2D shapes using everyday language Literacy icon Literacy icon
* estimate and compare perimeter, for example:
* how much tinsel is needed to decorate and hang around the window frame and the doorway?
* estimate and measure perimeter using a variety of strategies, for example:
* using a tape measure
* using string and measuring the string Critical and creative thinking icon Critical and creative thinking icon
* calculate perimeters by measuring sides and adding them together
* calculate perimeters by adding given side lengths from diagrammatic representations of shapes
* solve problems involving perimeter, for example:
* calculate the length of edging needed for a garden bed Critical and creative thinking icon Critical and creative thinking icon Literacy icon Literacy icon Personal and social capability icon Personal and social capability icon
 | * Before starting perimeter, students could practise estimating and measuring distances around their school.
* In this scaffolded outdoor activity, students practise estimating and measuring distances required when driving a car Eg 10m before an intersection, 200m from a vehicle to dip your high beams**Resource:** driving-distances.DOCX

Introducing perimeter* Teacher to revise the concept of perimeter with students.
* Students use the interactive, online [geoboard](https://apps.mathlearningcenter.org/geoboard/) to make as many shapes as they can with a perimeter of 10 units.
* In this scaffolded activity, students use Google Maps to measure the perimeter of different AFL grounds around Australia. They then order the grounds from largest to smallest.**Resource:** afl-grounds.DOCX
* Students should use measuring tapes and trundle wheels to measure the perimeter of the school, basketball court etc They should compare their results with other students and the teacher can then lead a discussion about accuracy.

Investigating perimeter* In this scaffolded investigation, students can either independently or working in pairs, investigate the perimeter of different tiling patterns for a given number of tiles. They are encouraged to investigate how the perimeter changes for different arrangements of the same number of tiles.**Resource:** tiling-patterns.DOCX
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| M2.3: Area and surface areaStudents:* recognise language and comparative language that relates to area, for example:
* space
* more
* less
* square metre Literacy icon Literacy icon
* recognise metric units of area, their abbreviations and conversions between them
* recognise the area of 2D shapes and surface area of 3D shapes
* describe the area of 2D shapes and surface area of 3D shapes using everyday language Literacy icon Literacy icon
* estimate and compare areas of shapes, for example:
* bread plates and dinner plates Critical and creative thinking icon Critical and creative thinking icon
* identify or make different shapes with the same area Critical and creative thinking icon Critical and creative thinking icon
* recognise the relationship between length and width and the number of grid squares in the rows and columns of a square or rectangle
* use the rule 'area = length x width' to calculate areas of squares and rectangles and apply this to real situations
* investigate the concept of surface area through practical activities, for example:
* wrapping a box in paper to determine the surface area of the box Critical and creative thinking icon Critical and creative thinking icon Personal and social capability icon Personal and social capability icon
* calculate the surface area of a 3D shape by adding the areas of the faces
* solve problems involving area and surface area, for example:
* putting protective covering on a book
* having enough wrapping paper to wrap a gift
* buying a large enough can of paint to cover the area Critical and creative thinking icon Critical and creative thinking icon Literacy icon Literacy icon Personal and social capability icon Personal and social capability icon
 | Introducing area* Students use the [geoboard](https://apps.mathlearningcenter.org/geoboard/) to make different shapes that have an area of 10 units. Challenge them to find as many shapes as possible.
* Students are to research or to measure and find the area of different sporting fields Eg Hockey, soccer, NRL, AFL, tennis, netball, basketball.
* Which is largest?
* Find the amount of space per player
* In this scaffolded investigation, students work independently to compare the size of different states in Australia by either counting squares or cutting out one state and comparing it to others**Resource:** estimating-areas.DOCX
* In this [Build](https://phet.colorado.edu/sims/html/area-builder/latest/area-builder_en.html) it! interactive website from Phet, students can practise building shapes that have a given area or perimeter
* In this [Parking cars](https://nzmaths.co.nz/resource/parking-cars) problem solving activity from nzmaths, students design a car park that meets certain criteria

Area of squares and rectangles* Students use the [geoboard](https://apps.mathlearningcenter.org/geoboard/) to calculate the area for as many squares and rectangles as possible by counting squares. The teacher should lead the students into discovering that it is simpler to multiply the length x width. They could then watch the [Area demonstration](https://www.youtube.com/watch?v=41ADSvcoRKo) video

Introducing Surface area* Teacher to show students photos on the internet of “aluminium foil prank”. Discuss with students how many rolls of foil they think it would take to carry out the prank.
* Student to investigate the concept of surface area by covering objects with aluminium foil or wrapping paper.
* Students can use [Google sketch](https://www.sketchup.com/) up to find the surface area of 3D shapes. Teachers can refer to this [Use google sketchup to visualise 3d](http://www.harnwell.org/2011/06/use-google-sketchup-to-visualise-3d.html) tutorial if necessary
* Students can calculate the surface area of familiar 3D shapes, such as Weetbix boxes by measuring side lengths and performing the necessary calculations.
* Students can investigate the volume of shapes that have the same surface area by either completing the scaffolded investigation or by watching the video [Volume and surface areas](https://education.abc.net.au/home#!/media/2951668/volumes-and-surface-areas)**Resources:**
* surface-area-vs-volume.DOCX
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| M2.4: VolumeStudents: * recognise language and comparative language that relates to volume, for example:
* size
* space
* cubic units Literacy icon Literacy icon
* recognise appropriate units and devices to measure volume Critical and creative thinking icon Critical and creative thinking icon
* recognise metric units of volume, their abbreviations and conversions between them
* identify or describe the volume of 3D shapes using everyday language Literacy icon Literacy icon
* construct 3D shapes of a given volume using concrete materials, for example:
* centicubes
* blocks
* estimate and compare volume
* estimate and measure volume by counting cubes
* recognise the relationship between length, width and height and the number of centicubes in a cube, square prism or rectangular prism
* use the rule 'volume = length x width x height' for a cube, square prism or rectangular prism and apply this to real situations
* calculate the volume of a range of shapes
* construct 3D shapes of a given volume using concrete materials
* solve problems involving volume, for example:
* how much soil is needed to fill a garden bed when designing a vegetable garden Critical and creative thinking icon Critical and creative thinking icon Literacy icon Literacy icon Personal and social capability icon Personal and social capability icon
 | Introducing volume* In this [Noah's mystery parcel](https://nzmaths.co.nz/resource/noah-s-mystery-parcel) problem solving activity by nzmaths, students guess what could be in a parcel based on its dimensions
* In this interactive [Cubes](https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Cubes/) computer activity by NCTM, students fill boxes with cubes to find the volume of the box
* Students can use centi-cubes to create objects of a given volume. i.e. how many shapes can they make with a volume of 10cm3
* Students could collect glasses/cups of different shapes and sizes and compare their volume.
* Do they all hold the same amount?
* Which holds the most?
* Students could investigate the standard volumes for wine, beer and spirit glasses used in the hospitality industry. Do these differ in different countries?
* In this interactive [Inside a cubic metre](https://fuse.education.vic.gov.au/Resource/LandingPage?ObjectId=1027307e-3388-4b60-85b1-35e73884bc1d&SearchScope=All), computer activity, students investigate how large a cubic metre is and compare it to a cubic centimetre
* In this interactive [Working it out!](https://fuse.education.vic.gov.au/Resource/LandingPage?ObjectId=923302d3-1a87-4784-9837-dc32d19f5497&SearchScope=All), computer activity, students practise calculating the volume of rectangular prisms
* In this ReSolve [Parcel post](https://www.resolve.edu.au/measurement-parcel-post) investigation, students have to work out the cheapest method of posting different size and weight packages
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| M2.5: Measuring capacityStudents:* recognise language and comparative language that relates to capacity, for example:
* fullest
* empty Literacy icon Literacy icon
* recognise metric units of capacity, their abbreviations and conversions between them Literacy icon Literacy icon
* recognise appropriate units and devices to measure capacity Critical and creative thinking icon Critical and creative thinking icon
* recognise the concept of capacity and how it relates to volume Literacy icon Literacy icon
* estimate and compare capacities, for example:
* decide if food in one container will fit into another container with a different shape
* choose which of a set of 3D shapes would have the greatest capacity Critical and creative thinking icon Critical and creative thinking icon
* estimate and measure capacity using a range of devices including measuring jugs, medicine droppers, cups and spoons as appropriate, for example:
* measure 1½ cups of milk for a pancake recipe and 1 teaspoon of vanilla essence Critical and creative thinking icon Critical and creative thinking icon
* measure capacity with a requested degree of accuracy, for example:
* measuring cough syrup to the nearest millilitre
* convert between metric units of capacity
* investigate the relationship between volume, mass and capacity, for example: Critical and creative thinking icon Critical and creative thinking icon
* experiment with volume, mass and capacity of 3D containers
* discover and use the fact that 1 L of water weighs 1 kg Critical and creative thinking icon Critical and creative thinking icon
* discover and use the fact that 1 mL of water is equivalent to 1 cm3Critical and creative thinking icon Critical and creative thinking icon
* large objects can be very light, while smaller objects can be heavy Critical and creative thinking icon Critical and creative thinking icon
* solve problems involving capacity, for example:
* using 200 mL of orange juice for an orange muffin recipe and only having a 50 mL measuring cup Critical and creative thinking icon Critical and creative thinking icon Literacy icon Literacy icon Personal and social capability icon Personal and social capability icon
 | Measuring capacity* Teacher to lead a brainstorm about situations where we need to measure the capacity of an object. Teacher should revise the difference between volume and capacity.
* Students should investigate the capacity of common measuring devices used in cooking.
* How many teaspoons are in a tablespoon
* How many quarter cups to fill a cup
* How many cups in a litre?
* Students look at the sizes of fridges and their capacity in terms of litres. Teacher could then lead a discussion as to how many litres of milk would fit in a particular fridge
* Students could compare the number of litres of water used when:
* Having a bath compared to a shower?
* Washing up vs using a dishwasher
* Students could collect images (or physical containers) of different shaped containers with the same capacity e.g. 1 litre
* Students cook various recipes that require them to measure a variety of ingredients
* Students look at the dosages for common medicines such as Panadol, and practise measuring the amounts using syringes and medicine cups
* Students could practise measuring chemicals for scientific experiments using beakers and measuring cylinders
* Students to compare the weight of a cup of flour vs water vs rice etc
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### Evaluation

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###  Glossary

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| Term | Description |
| area | area is a measure of how many units are required to cover a surface.  |
| capacity | capacity is a term used to describe how much a container will hold. it is often used in relation to the volume of fluids. units of capacity, for volume of fluids or gases, include litres and millilitres. |
| edge | for a polygon, a line segment on the boundary joining one vertex to another |
| face | any of the individual flat surfaces of a solid object |
| mass | mass is the measure of how much matter is in a person, object or substance.in this course, the terms ‘mass’ and ‘weight’ are used interchangeably. |
| net | a pattern that you can fold to make a model of a solid shape |
| perimeter | the perimeter of a plane figure is the length of its boundary. the perimeter of a figure can be calculated by adding the lengths of all its sides. |
| surface area | the total area of the surface of a three-dimensional object |
| tessellation | a pattern made of one or more shapes. the shapes must fit together with no gaps and no overlap. |
| three-dimensional | an object is three-dimensional when it possesses the dimensions of height, width and depth. two-dimensional objects have only two dimensions: length and width. a solid is any geometrical object with three-dimensions. |
| transformation | the transformations included in this glossary are reflections (flips), rotations (spins) and translations (slides). |
| two-dimensional | a shape is two-dimensional when it only possesses the dimensions of length and width. |
| volume | the volume of a solid region is a measure of the size of a region. |
| weight | weight, refers to the amount of gravitational force acting on matter. if you travelled to mars, your mass would be the same as it was on earth, but your weight would be less due to the weaker gravitational force on mars.in this course, the terms ‘mass’ and ‘weight’ are used interchangeably. |

### Supplementary resources