Mathematics Stage 4 (Year 8) – unit of learning

Constructing cylinders

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# Rationale

The NSW Department of Education publishes a range of curriculum support materials, including samples of lesson sequences, scope and sequences, assessment tasks, examinations, student and teacher resource booklets, and curriculum planning and curriculum evaluation templates. The samples are not exhaustive and do not represent the only way to complete or engage in each of these processes. Curriculum design and implementation is a dynamic and contextually-specific process. While the mandatory components of syllabus implementation must be met by all schools, it is important that the approach taken by teachers is reflective of their needs, and faculty or school processes.

The NSW Education Standards Authority (NESA) defines [programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming) as ‘the process of selecting and sequencing learning experiences which enable students to engage with syllabus outcomes and develop subject specific skills and knowledge’ (NESA 2024b). A program is developed collaboratively within a faculty. It differs from a unit in important ways, as outlined by NESA on their [Advice on units](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming/advice-on-units) page. A unit is a contextually-specific plan for the intended teaching and learning for a particular class for a particular period. The organisation of the content in a unit is flexible and it may vary according to the school, the teacher, the class and the learning space. They should be working documents that reflect the thoughtful planning and reflection that takes place during the teaching and learning cycle. There are mandatory components of programming and unit development, and this template provides one option for the delivery of these requirements. The NESA and department guidelines that have influenced this template are elaborated upon at the end of the document.

This resource has been developed to assist teachers in NSW Department of Education schools to create learning that is contextualised to their classroom. It can be used as a basis for the teacher’s own program, assessment, or scope and sequence, or be used as an example of how the new curriculum could be implemented. The resource has suggested timeframes that may need to be adjusted by the teacher to meet the needs of their students.

# Overview

**Description**: this program of learning addresses content from the focus areas of Volume and Equations. The lessons and sequences in this program of learning are designed to allow students to explore finding the volume and capacity of cylinders, and finding other measures from the volume or capacity of a cylinder.

**Duration**: this program of learning is designed to be completed over a period of approximately 5 weeks but can be adapted to suit the school context.

**Explicit teaching**: suggested learning intentions and success criteria are available for some lessons provided. Learning intentions and success criteria are most effective when they are contextualised to meet the needs of students in the class. The examples provided in this document are generalised to demonstrate how learning intentions and success criteria could be created.

**Accessing the resources**: this program of learning includes a range of student-facing and teacher resources. All resources can be accessed from the [Stage 4 Unit 16 – constructing cylinders](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-7-10-resources/mathematics-s4-unit-16-constructing-cylinders) catalogue page.

# Outcomes

## Core

A student:

* **solves linear equations of up to 2 steps and quadratic equations of the form MA4-EQU-C-01**
* **applies knowledge of volume and capacity to solve problems involving right prisms and cylinders MA4-VOL-C-01**

The identified Life Skills outcomes that relate to this unit are **MALS-VOL-01** – measures and uses volume, capacity and mass in everyday contexts and **MALS-ADS-01** –uses strategies for addition and subtraction.

[Mathematics K**–**10 Syllabus](https://curriculum.nsw.edu.au/learning-areas/mathematics/mathematics-k-10-2022/overview) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2022.

**Prior to planning for teaching and learning, please consider the following**:

**Engagement**

* How will I provide authentic, relevant learning opportunities for students to personally connect with lesson content?
* How will I support every student to grow in independence, confidence, and self-regulation?
* How will I facilitate every student to have high expectations for themselves?
* How will I identify and provide the support each student needs to sustain their learning efforts?

**Representation**

* What are some different ways I can present content to enable every student to access and understand it?
* How will I identify and address language and/or cultural considerations that may limit access to content for students?
* How will I make lesson content and learning materials more accessible?
* How will I plan learning experiences that are relevant and challenging for the full range of students in the classroom?

**Expression**

* How will I provide multiple ways for students to respond and express what they know?
* What tools and resources can students use to demonstrate their understanding?
* How will I know every student has understood the concepts and language presented in each lesson?
* How will I monitor if every student has achieved the learning outcomes and learning growth?

# Lesson sequence and details

## Learning episode 1 – prisms and cylinders

### Teaching and learning activity

By estimating the number of beans in a tin, students develop the formula for a cylinder's volume and explore how its uniform cross-section can help them understand its volume.

### Syllabus content

* Determine if a particular solid has a uniform cross-section
* Develop and apply the formula to solve problems involving the volume of cylinders: , where  is the length of the radius of the base and ℎ is the perpendicular height

Table 1 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Prisms and cylinders**  **Duration:** 1 lesson  **Learning intention**   * To be able to describe a cylinder and its volume.   **Success criteria**   * I can define a prism. * I can define a cylinder. * I can draw the net of a cylinder. * I can explain where the formula for the volume of a cylinder comes from. | * *Prisms and cylinders* PowerPoint * Appendix A, printed, cut into cards (per group of 3) * Class copy of Appendix B, printed * Adhesive putty |  |

## Learning episode 2 – volume of a cylinder

### Teaching and learning activity

Students explore milk trucks to deepen their understanding of the volume of a cylinder formula, followed by calculating the volume of various water tanks and silos across New South Wales.

### Syllabus content

* Develop and apply the formula to solve problems involving the volume of cylinders: , where  is the length of the radius of the base and ℎ is the perpendicular height
* Solve practical problems involving the volume and capacity of right prisms and cylinders

Table 2 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Volume of a cylinder**  **Duration:** 1 lesson  **Learning intention**   * To be able to apply the formula to calculate the volume of a cylinder.   **Success criteria**   * I can write and explain what the variables represent in the formula for the volume of a cylinder. * I can substitute values into the volume formula. * I can correctly calculate the volume of a cylinder. | * *Volume of a cylinder* PowerPoint * Appendix A, printed (one copy) * Class copy of Appendix B and C * Appendix C, printed A3 (per group of 3) * Appendix D, printed (3 copies) * A3 plastic pockets * Adhesive putty |  |

## Learning episode 3 – cylinders and equations

### Teaching and learning activity

## Students will use geometric shapes to estimate volume and calculate the stuffing needed for plush toys.

### Syllabus content

* Solve problems involving linear equations, including those arising from substituting given values into formulas
* Solve quadratic equations arising from substitution into a formula
* Solve practical problems involving the volume and capacity of right prisms and cylinders

Table 3 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Cylinders and equations**  **Duration:** 1 lesson  **Learning intention**   * To be able to use a formula to find unknown values.   **Success criteria**   * I can substitute numbers into a formula. * I can use the circumference formula to find the radius. * I can use the volume of a cylinder formula to find the height. * I can use the volume of a cylinder formula to find the radius. | * *Cylinders and equations* PowerPoint * A class copy of Appendix A and B, printed * Tape measure (per pair) * Plush toy (per pair) |  |

## Learning episode 4 – volume versus capacity

### Teaching and learning activity

### Students investigate the difference between volume and capacity.

### Syllabus content

* Recognise that 1000 L is equal to 1 kilolitre (kL) and use the abbreviation
* Recognise that 1000 kL is equal to 1 megalitre (ML) and use the abbreviation
* Solve practical problems involving the volume and capacity of right prisms and cylinders

Table 4 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Volume versus capacity**  **Duration:** 1 lesson  **Learning intention**   * To understand the difference between volume and capacity.   **Success criteria**   * I can explain the difference between volume and capacity. * I can calculate the volume of water in a cylinder. * I can convert between units of volume and capacity. | * *Volume versus capacity* PowerPoint * A class copy of Appendix A and B, printed * Appendix C and D, printed (per group of 3) |  |

## Learning episode 5 – percentages and cylinders

### Teaching and learning activity

Students investigate cylindrical food in cylindrical jars to consolidate calculating the volume of a cylinder and revisit percentages.

### Syllabus content

* Solve practical problems involving the volume and capacity of right prisms and cylinders

Table 5 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Percentages and cylinders**  **Duration:** 1 lesson  **Learning intention**   * To be able to solve problems involving cylinders.   **Success criteria**   * I can calculate the volume of a cylinder. * I can calculate the percentage of a volume. | * Appendix A, printed, cut into cards (per group of 3) * *Percentages and cylinders* PowerPoint * Mini whiteboards |  |

## Learning episode 6 – cylinders and water

### Teaching and learning activity

Students investigate different problems involving cylinders and water including pools, tanks and sprinklers.

### Syllabus content

* Solve practical problems involving the volume and capacity of right prisms and cylinders

Table 6 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Cylinders and water**  **Duration:** 1 lesson  **Learning intention**   * To be able to solve problems involving the volume and capacity of cylinders.   **Success criteria**   * I can use rates to solve problems with volume and capacity. * I can convert between measurements in cubic metres and litres. * I can use different units of measurement to calculate the volume of cylinders. | * Cylinders and water PowerPoint * A class copy of Appendix A, printed * Appendix B, printed (per group of 3) |  |

## Learning episode 7 – volume of trees

### Teaching and learning activity

Students will explore the volume of wood necessary to make various timber products. They will explore a variety of formulas used in the forestry industry, including the volume of a cylinder.

### Syllabus content

* Verify solutions to equations by substitution
* Solve problems involving linear equations, including those arising from substituting given values into formulas
* Solve practical problems involving the volume and capacity of right prisms and cylinders

Table 7 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Volumes of trees**  **Duration:** 1 lesson  **Learning intentions**   * To be able to solve equations. * To be able to find the volume of objects.   **Success criteria**   * I can substitute values into a formula. * I can verify solutions to an equation by substitution. * I can find the volume of a prism and cylinder. | * *Volume of trees* PowerPoint * Appendix A and B, printed (per group of 3) * Tape measure (per group of 3) * 5 metre string (per group of 3) |  |

# References

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NESA holds the only official and up-to-date versions of the NSW Curriculum and syllabus documents. Please visit the NSW Education Standards Authority (NESA) website <https://educationstandards.nsw.edu.au/> and the NSW Curriculum website [https://curriculum.nsw.edu.au](https://curriculum.nsw.edu.au/).

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NESA (NSW Education Standards Authority) (2024a) ‘[Advice on units](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming/advice-on-units)’, Programming, NESA website, accessed 18 December 2024.

NESA (NSW Education Standards Authority) (2022b) ‘[Programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming/advice-on-units)’, Understanding the curriculum, NESA website, accessed 18 December 2024.

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