Mathematics Stage 4 (Year 7) – unit of learning

Triangles and quadrilaterals

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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/school processes.

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 2022). 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 Angle relationships and Properties of geometrical figures. The lessons and sequences in this program of learning are designed to allow students to explore triangles and quadrilaterals, developing the language, knowledge and understanding to be able to classify these 2-dimensional shapes according to their geometrical properties and apply this to meaningfully make connections across topics and concepts. Students will explore these aspects of quadrilaterals and triangles through a range of pedagogical practices, building connections across the big ideas in mathematics to consolidate their learning.

**Duration:** this program of learning is designed to be completed over a period of approximately 3 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.

# Outcomes

## Core

A student:

* develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly   
  **MAO-WM-01**
* **applies angle relationships to solve problems, including those related to transversals on sets of parallel lines MA4-ANG-C-01**
* identifies and applies the properties of triangles and quadrilaterals to solve problems **MA4-GEO-C-01**

The identified Life Skills outcome that relates to this unit is **MALS-GEO-01** – explores 2-dimensional shapes and 3-dimensional objects.

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**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 – strike a pose

### Teaching and learning activity

In this lesson students will locate angles in everyday life, estimate the size of angles, name the types of angles and use naming conventions for angles.

### Syllabus content

* Identify and label the vertex and arms of an angle with capital letters
* Use appropriate conventions to label and name angles

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required Resources | Registration, adjustments and evaluation notes |
| [Strike a pose [DOCX 10.3 MB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-01-strike-a-pose.docx)  Duration: 1–2 lessons  Learning intentions   * To be able to classify angles. * To be able to apply the language, notation and conventions of geometry.   Success criteria   * I can estimate the size of angles. * I can identify types of angles. * I can use geometric conventions to name angles. | * [*Strike a pose* [PPTX 4.3 MB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-01-strike-a-pose.pptx) PowerPoint * Appendix A printed in colour * A single set of Appendix B printed, cut into cards (enough need only be printed for one card per student) |  |

## Learning episode 2 – Is that a triangle?

### Teaching and learning activity

Students will explore triangles, classify them based on their properties and use appropriate conventions to draw them.

### Syllabus content

* Use common conventions to indicate right angles, equal angles and intervals on diagrams
* Label triangles using appropriate text and symbols
* Classify and describe types of triangles based on their properties, including acute-angled, right-angled, obtuse-angled, equilateral, isosceles and scalene triangles

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required Resources | Registration, adjustments and evaluation notes |
| [Is that a triangle? [DOCX 504 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-02-is-that-a-triangle.docx)  Duration: 1–2 lessons  Learning intention   * To be able to classify triangles.   Success criteria   * I can identify types of triangles based on angle size. * I can identify types of triangles based on the lengths of the sides. * I can apply reasoning skills to identify shapes that are triangles. | * One digital device per pair to interact with Desmos during this lesson (optional) * [*Is that a triangle?* [PPTX 1MB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-02-is-that-a-triangle.pptx)PowerPoint * One blank piece of A4 paper for each student * Scissors * One ruler per student * One pencil per student * One set of Appendix B per pair * Class set of Appendix A (if not using technology) |  |

## Learning episode 3 – I see triangles

### Teaching and learning activity

Students will use their knowledge of angle sizes to investigate the angle sum of a triangle. They will build on this result to investigate the angle sum of a quadrilateral.

### Syllabus content

* Prove that the interior angle sum of a triangle is 180° with or without digital tools
* Apply the angle sum of a triangle to prove that the angle sum of a quadrilateral is 360°
* Apply the properties of triangles and quadrilaterals to determine unknown sides and angles to solve problems, giving reasons

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required Resources | Registration, adjustments and evaluation notes |
| [I see triangles [DOCX 761 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-03-i-see-triangles.docx)  Duration: 1–2 lessons  Learning intention   * To know the angle sum of a triangle and quadrilateral.   Success criteria   * I can explain why the angle sum of a triangle is 180°. * I can explain why the angle sum of a quadrilateral is 360°. * I can use angle sums of shapes to calculate unknown values. | * [*I see triangles* [PPTX 956 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-03-i-see-triangles.pptx) PowerPoint * One digital device per pair to interact with Desmos or Polypad during this lesson * One pencil per student * 3 blank pieces of A4 paper per student * One ruler per student * Scissors * Glue (enough for class to use) * One copy of Appendix A per student * One copy of Appendix B per student |  |

## Learning episode 4 – throwing light on the exteriors

### Teaching and learning activity

Students investigate the relationship between interior and exterior angles of a triangle and use it to solve problems.

### Syllabus content

* Prove that any exterior angle of a triangle equals the sum of the 2 interior opposite angles

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required Resources | Registration, adjustments and evaluation notes |
| [Throwing light on the exteriors [DOCX 543 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-04-throwing-light-on-the-exteriors.docx)  Duration: 1 lesson  Learning intention   * To understand the relationship between the interior angles and exterior angles of a triangle.   Success criteria   * I can explain the relationship between the interior and exterior angles of a triangle. * I can prove the relationship between the interior and exterior angles of a triangle. * I can calculate unknown angles in a triangle. | * [*Throwing light on the exteriors* [PPTX1.1 MB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-04-throwing-light-on-the-exteriors.pptx)PowerPoint * Appendix A, printed for each student * Blank pieces of A4 paper for each student * Scissors * One ruler per student * One pencil per student * One protractor per student |  |

## Learning episode 5 – unravelling tessellations

### Teaching and learning activity

Students identify quadrilaterals by exploring and designing tessellations. Students distinguish between convex and non-convex quadrilaterals within this process.

### Syllabus content

* Identify quadrilaterals using naming conventions
* Distinguish between convex and non-convex quadrilaterals

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required Resources | Registration, adjustments and evaluation notes |
| [Unravelling tessellations [DOCX 1 MB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-05-unravelling-tessellations.docx)  Duration: 2–3 lessons  Learning intentions   * To be able to identify special quadrilaterals. * To be able to distinguish between convex and non-convex quadrilaterals.   Success criteria   * I can recognise special quadrilaterals using basic properties. * I can draw convex and non-convex quadrilaterals. * I can explain the difference between convex and non-convex quadrilaterals. | * [*Unravelling tessellations* [PPTX 1.1 MB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-05-unravelling-tessellations.pptx) PowerPoint * Sets of Appendix A printed and cut up, enough for one per pair of students * Class set of Appendix B and D * Copies of Appendix C printed, enough for one quadrilateral per student * Coloured card or paper for each student * Protractors, scissors, coloured pencils * Device with internet access per pair of students (optional) |  |

## Learning episode 6 – sides and angles united

### Teaching and learning activity

Students explore the properties of a square by relating them to equilateral and isosceles triangles.

### Syllabus content

* Verify and describe the properties of the special quadrilaterals which include parallelograms, rectangles, rhombuses, squares, trapeziums and kites
* Identify and label the properties of the special quadrilaterals using appropriate conventions

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required Resources | Registration, adjustments and evaluation notes |
| [Sides and angles united [DOCX 603 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-06-sides-and-angles-united.docx)  Duration: 1–2 lessons  Learning intention   * To know the properties of a square.   Success criteria   * I can compare the properties of a triangle to a square. * I can describe the properties of a square. * I can justify why a quadrilateral can be classified as square. | * [*Sides and angles united* [PPTX 660 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-06-sides-and-angles-united.pptx) PowerPoint * Class set of Appendix A and B * One copy of Appendix C printed, per pair * Multiple copies of Appendix D printed per student * Rulers and protractors for student use |  |

## Learning episode 7 – diamonds of geometry

### Teaching and learning activity

Students explore the properties of a rhombus by joining 2 equilateral triangles and then 2 isosceles triangles.

### Syllabus content

* Verify and describe the properties of the special quadrilaterals which include parallelograms, rectangles, rhombuses, squares, trapeziums and kites
* Identify and label the properties of the special quadrilaterals using appropriate conventions
* Justify why some quadrilaterals may be classified as more than one type of quadrilateral

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required Resources | Registration, adjustments and evaluation notes |
| [Diamonds of geometry [DOCX 980 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-07-diamonds-of-geometry.docx)  Duration: 1–2 lessons  Learning intention   * To know the properties of a rhombus.   Success criteria   * I can compare the properties of 2 quadrilaterals. * I can describe the properties of a rhombus. * I can justify why a quadrilateral can be classified as rhombus. | * [*Diamonds of geometry* [PPTX 962 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-07-diamonds-of-geometry.pptx) PowerPoint * Class set of Appendix A, printed * Enough sets of Appendix B printed on A3 paper, for one per group of 3 students * One A4 sheet of paper per student |  |

## Learning episode 8 – two of a kind

### Teaching and learning activity

Students explore the properties of a rectangle by comparing it to a square and a parallelogram by comparing it to a rhombus. Students will use their prior knowledge of triangles, squares, and rhombuses in this lesson.

### Syllabus content

* Verify and describe the properties of the special quadrilaterals which include parallelograms, rectangles, rhombuses, squares, trapeziums and kites
* Identify and label the properties of the special quadrilaterals using appropriate conventions
* Justify why some quadrilaterals may be classified as more than one type of quadrilateral

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required Resources | Registration, adjustments and evaluation notes |
| [Two of a kind [DOCX 486 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-08-two-of-a-kind.docx)  Duration: 1–2 lessons  Learning intentions   * To know the properties of a rectangle. * To know the properties of a parallelogram.   Success criteria   * I can identify properties of a rectangle and parallelogram. * I can compare the properties of a rectangle and parallelogram. * I can justify why a quadrilateral can be classified as a rectangle or a parallelogram. | * Two long and 2 short ‘sticks’ for each group of 3 students (examples include actual sticks, strips of paper, popsicle sticks) * Class set of Appendix A and D, printed * Three copies of Parallelogram A or Parallelogram B from Appendix B printed and cut per group of 3 students * Enough copies of Appendix C printed on A3 paper for each group of 3 students * Three sheets of paper (A4 or A5) per group of 3 students |  |

## Learning episode 9 – tackling trapeziums

### Teaching and learning activity

Students explore the properties of a trapezium by examining its relationship to the properties of other quadrilaterals. Students will be able to verify and describe the properties of trapeziums.

### Syllabus content

* Verify and describe the properties of the special quadrilaterals which include parallelograms, rectangles, rhombuses, squares, trapeziums and kites
* Identify and label the properties of the special quadrilaterals using appropriate conventions
* Justify why some quadrilaterals may be classified as more than one type of quadrilateral

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required Resources | Registration, adjustments and evaluation notes |
| [Tackling trapeziums [DOCX 670 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-09-tackling-trapeziums.docx)  Duration: 1–2 lessons  Learning intention   * To know the properties of a trapezium.   Success criteria   * I can identify the properties of a trapezium. * I can compare the properties of a trapezium and a parallelogram. * I can justify why a quadrilateral can be classified as a trapezium. | * [*Tackling Trapeziums* [PPTX 721 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-09-tackling-trapeziums.pptx) PowerPoint * Digital devices with internet access per pair of students * Enough sets of Appendix A, B and C printed on A3 paper per group of 3 students * Class set of Appendix C printed on A4 paper |  |

## Learning episode 10 – let’s go fly a kite

### Teaching and learning activity

Students explore the properties of a kite by comparing the shape to previously explored special quadrilaterals. The lesson finishes in a kite flying experiment.

### Syllabus content

* Verify and describe the properties of the special quadrilaterals which include parallelograms, rectangles, rhombuses, squares, trapeziums and kites
* Identify and label the properties of the special quadrilaterals using appropriate conventions
* Justify why some quadrilaterals may be classified as more than one type of quadrilateral

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required Resources | Registration, adjustments and evaluation notes |
| [Let’s go fly a kite [DOCX 737 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-10-lets-go-fly-a-kite.docx)  Duration: 1–2 lessons  Learning intention   * To know the properties of a kite.   Success criteria   * I can identify the properties of a kite. * I can compare the properties of a kite, rhombus and parallelogram. * I can justify why a quadrilateral can be classified as a kite. | * [*Let’s go fly a kite* [PPTX 533 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-10-lets-go-fly-a-kite.pptx)PowerPoint * Appendix A printed on A3 paper, one per pair of students * Appendix B, C and D printed on A3 paper, one per group of 3 students * Whiteboard marker per pair of students * Paper towel or whiteboard eraser per group * Protractor per group * Ruler per group * Several packets of wooden skewers or similar (enough for several skewers per student) * Various sized sheets of paper (enough for multiple pieces per student) * Stopwatches, sticky tape, and scissors per group of 3 students |  |

## Learning episode 11 – quadrilateral quest

### Teaching and learning activity

Students review the properties of the 6 special quadrilaterals: square, rectangle, parallelogram, trapezium, kite and rhombus through a variety of activities. The lesson concludes with a visual overview of the hierarchy of different types of quadrilaterals.

### Syllabus content

* Classify quadrilaterals based on their properties
* Justify why some quadrilaterals may be classified as more than one type of quadrilateral

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required Resources | Registration, adjustments and evaluation notes |
| [Quadrilateral quest [DOCX 768 KB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-11-quadrilateral-quest.docx)  Duration: 1–2 lessons  Learning intention   * To be able to compare quadrilaterals using their properties.   Success criteria   * I can identify different types of quadrilaterals. * I can compare quadrilaterals using their properties. * I can justify why a shape is a particular quadrilateral. | * [*Quadrilateral quest* [PPTX 4.2 MB]](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s4-unit-06-lesson-11-quadrilateral-quest.pptx) PowerPoint * Class set of mini whiteboards and whiteboard markers (or a suitable alternative) * Copies of Appendix A, B, D and E printed on A3 paper enough for one per group of 3 students * Class set of Appendix C, printed |  |

# References

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NESA (NSW Education Standards Authority) (2022) ‘[Programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming/advice-on-units)’, Understanding the curriculum, NESA website, accessed [20 October 2023].

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