Mathematics Stage 4 (Year 8) – unit of learning

Analysing patterns

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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 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 area of Analysing patterns. The lessons and sequences in this program of learning are designed to allow students to explore plotting and identifying points on the Cartesian plane, graphing linear relationships on the Cartesian plane and solving linear equations using graphical techniques.

**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 14 – analysing patterns](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-7-10-resources/year-8-unit-14-analysing-patterns) catalogue page.

# 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**
* creates and displays number patterns and finds graphical solutions to problems involving linear relationships **MA4-LIN-C-01**

The identified Life Skills outcomes that relate to this unit is **MALS-PAT-01** – recognises and applies patterns in everyday contexts.

[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 – plotting points

### Teaching and learning activity

Students create their own chess pieces to move along the Cartesian plane, as a way of reading and plotting points.

### Syllabus content

* Plot and label points on the Cartesian plane of given coordinates, including those with coordinates that are not whole numbers
* Identify and record the coordinates of given points on the Cartesian plane, including those with coordinates that are not whole numbers

Table 1 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Plotting points** **Duration:** 1 lesson**Learning intentions*** To be able to identify and record the coordinates of points on the Cartesian plane.
* To be able to plot points on the Cartesian plane.

**Success criteria*** I can identify and record the coordinates of points on the Cartesian plane.
* I can plot points with integer coordinates on the Cartesian plane.
* I can plot points with non-integer coordinates on the Cartesian plane.
* I can explain why axes are useful for describing location.
 | * *Plotting points* PowerPoint
* A3 plastic pockets (per group of 3)
* Adhesive putty
* Appendix A and Appendix B, printed A3 (per group of 3)
* Appendix C, printed (per pair)
* Digital device (per student)
 |  |

## Learning episode 2 – describing geometrical patterns

### Teaching and learning activity

Students explore geometric patterns using matchsticks. The focus is on being able to informally describe the relationship between the number of the term and the number of matchsticks.

### Syllabus content

* Construct a geometric pattern and record the results in a table of values
* Represent a given number pattern (including decreasing patterns) using a table of values
* Describe a number pattern in words and generate an equation using algebraic symbols
* Apply an equation generated from a pattern to calculate the corresponding value for a smaller or larger number

Table 2 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Describing geometrical patterns** **Duration:** 1 lesson**Learning intention*** To be able to describe a geometric pattern using words.

**Success criteria*** I can identify a geometric pattern.
* I can describe a geometric pattern in words.
* I can represent geometric patterns using a table of values.
* I can find further terms in a geometric pattern.
 | * Describing geometrical patterns PowerPoint
* Appendix A, printed on A3 (per group of 3)
* A3 plastic sleeves
* Adhesive putty
* 0–25 coordinate grid, printed A3 (per group of 3)
 |  |

## Learning episode 3 – describing linear relationships

### Teaching and learning activity

Students explore number patterns using tables of values and the Cartesian plane. They identify patterns as increasing, decreasing, linear, or non-linear.

### Syllabus content

* Represent a given number pattern (including decreasing patterns) using a table of values
* Recognise that a linear relationship can be represented by a number pattern, an equation (or a rule using algebraic symbols), a table of values, a set of pairs of coordinates and a line graphed on a Cartesian plane, and move flexibly between these representations

Table 3 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Describing linear relationships** **Duration:** 1 lesson**Learning intention*** To be able to describe linear relationships.

**Success criteria*** I can use a table of values to plot points on the Cartesian plane.
* I can correctly use the words increasing, decreasing, linear and non-linear to describe a number pattern.
* I can explain the relationship between a table of values and the Cartesian plane.
 | * Describing linear relationships PowerPoint
* Appendix A, printed (per student)
* Digital device (per pair)
* 0–10 blank coordinate grid, printed A3 (per group of 3)
* A3 plastic sleeves
* Adhesive putty
 |  |

## Learning episode 4 – linear equations

### Teaching and learning activity

Students explore linear relationships through a problem of stacking cups. They use their understanding to develop an equation that models the height of the stack of cups, given the number of cups stacked.

### Syllabus content

* Plot linear relationships on the Cartesian plane
* Describe a number pattern in words and generate an equation using algebraic symbols
* Apply an equation generated from a pattern to calculate the corresponding value for a smaller or larger number
* Recognise that a linear relationship can be represented by a number pattern, an equation (or a rule using algebraic symbols), a table of values, a set of pairs of coordinates and a line graphed on a Cartesian plane, and move flexibly between these representations
* Describe linear relationships in real-life contexts and solve related problems

Table 4 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Linear equations** **Duration:** 1 lesson**Learning intention*** To recognise that a linear relationship can be represented by an equation.

**Success criteria*** I can represent a linear pattern using an equation.
* I can plot linear relationships on the Cartesian plane.
* I can justify a prediction using my understanding of linear relationships.
 | * *Linear equations* PowerPoint
* Appendix A, printed (per group of 3). **Note**: optional, if not using disposable cups
* Appendix B, printed (per pair)
* Disposable cups with a lip (3 per group of 3)
* Ruler (3 per group of 3)
 |  |

## Learning episode 5 – solving equations

### Teaching and learning activity

Students will explore linear equations and their graphs, recognising that that there are an infinite number of ordered pairs that satisfy a linear relationship and that each point on the graph of a linear relationship satisfies the equation of the line.

### Syllabus content

* Explain that there are an infinite number of ordered pairs that satisfy a given linear relationship by extending a line joining a set of points on the Cartesian plane
* Describe linear relationships in real-life contexts and solve related problems
* Recognise that each point on the graph of a linear relationship satisfies the equation of a line
* Apply graphs of linear relationships to solve a corresponding linear equation using graphing applications

Table 5 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Solving equations** **Duration:** 1 lesson**Learning intention*** To understand the relationship between a straight-line graph and its equation.

**Success criteria*** I can substitute values into an equation.
* I can explain why there are an infinite number of ordered pairs that make up a linear graph.
* I can solve an equation algebraically.
* I can solve an equation graphically.
 | * *Solving equations* PowerPoint
* Digital device (per pair)
* Appendix A, printed (per pair)
* Appendix B, non-digital alternative, printed (per pair)
 |  |

## Learning episode 6 – comparing straight-line graphs

### Teaching and learning activity

Students explore the slope of mountain bike trails when represented as a straight-line graph. They explore the similarities and differences of line graphs and consider which trail would suit different riders.

### Syllabus content

* Compare similarities and differences of multiple straight-line graphs on the same set of axes using graphing applications
* Describe linear relationships in real-life contexts and solve related problems

Table 6 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Comparing linear graphs** **Duration:** 1 lesson**Learning intention*** To be able to compare straight-line graphs.

**Success criteria*** I can identify parallel lines using a graph.
* I can identify similarities and differences between graphs of straight lines.
* I can describe the graph of a straight-line using mathematical language.
 | * *Comparing linear graphs* PowerPoint
* Appendix A, printed (per pair)
* Appendix B, printed (per student)
 |  |

## Learning episode 7 – point of intersection

### Teaching and learning activity

Students explore intersecting lines and their point of intersection through the context of distance-time graphs.

### Syllabus content

* Graph 2 intersecting lines on the same set of axes and identify the point of intersection using either graphing applications or a table of values
* Verify that the point of intersection satisfies the equations of both lines
* Describe linear relationships in real-life contexts and solve related problems

Table 7 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| **Point of intersection****Duration:** 1 lesson**Learning intention*** I can find the point of intersection of 2 intersecting lines.

**Success criteria*** I can identify the point of intersection of 2 graphs.
* I can verify a point of intersection.
* I can explain what the point of intersection tells us about 2 graphs.
 | * *Point of intersection* PowerPoint
* Digital device (per pair)
* Mini-whiteboards (one per student)
 |  |

# 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/>.

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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 25 November 2024.

NESA (NSW Education Standards Authority) (n.d.) ‘[Advice on units](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming/advice-on-units)’, Programming, NESA website, accessed 25 November 2024.

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