Mathematics Stage 5 (Year 9) – unit of learning

Making decisions

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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 Core focus area of Data analysis A. The lessons and sequences in this program of learning are designed to allow students to explore standard deviation, the 5-number summary and box plots to help make informed decisions about the data.

**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. Learning episodes 7 and 8 focus on applying the skills of analysing data using box plots in different contexts. Teachers can opt to use one or both of these learning episodes.

**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**
* compares and analyses datasets using summary statistics and graphical representations **MA5-DAT-C-01**

The identified Life Skills outcome that relates to this unit is **MALS-DAT-02 –** interprets information from data displays.

[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 – revisiting the mean

### Teaching and learning activity

Students solve problems involving the mean and finding unknown values.

### Syllabus content

* Compare and contrast the centres, spreads and shapes of 2 or more numerical datasets, using box plots and numerical statistics, including the 5-number summary

Table 1 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| [Revisiting the mean (DOCX 352.2 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l01-revisiting-the-mean.docx)  Duration**:** 1 lesson  Learning intention   * To be able to solve problems using the mean.   Success criteria   * I can calculate the mean of a dataset. * I can use the mean to determine unknown values in a dataset. | * Appendix A, B, printed (one per pair) * Appendix C, printed on A3 paper, (one per group of 3 and one A4 copy per student) * Appendix D printed (one per group of 3 students) * Appendix E, printed (one per student) |  |

## Learning episode 2 – average from the average

### Teaching and learning activity

Students define standard deviation as the average difference from the mean. Students explore visual and concrete representations of standard deviation to understand standard deviation as a measure of spread.

### Syllabus content

* Compare and contrast the centres, spreads and shapes of 2 or more numerical datasets, using box plots and numerical statistics, including the 5-number summary
* Identify standard deviation as a measure of spread
* Calculate the standard deviation of a small dataset using digital tools

Table 2 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| [Average from the average (DOCX 401.3 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l02-average-from-the-average.docx)  Duration**:** 1 lesson  Learning intention   * To understand standard deviation as a measure of spread.   Success criteria   * I can define standard deviation. * I can calculate the difference from the mean for individual data. * I can find the average difference from the mean. * I can describe the effect that changing data values has on the standard deviation of a set of data. | * PowerPoint [*Average from the average* (PPTX 2.2 MB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l02-average-from-the-average-slideshow.pptx) * Appendix A, printed (one per group of 3 students) * Appendix B, printed on A3 paper (one per group of 3 students) * Appendix B, printed A4 or A5 size (one per student) |  |

## Learning episode 3 – Who gets to drive?

### Teaching and learning activity

Three datasets are presented to students in the form of lap times of F1 drivers and students are asked to determine the best driver. Students use technology to calculate standard deviation and interpret standard deviation as a measure of spread.

### Syllabus content

* Compare and contrast the centres, spreads and shapes of 2 or more numerical datasets, using box plots and numerical statistics, including the 5-number summary
* Identify standard deviation as a measure of spread
* Calculate the standard deviation of a small dataset using digital tools
* Compare small datasets using standard deviation

Table 3 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| [Who gets to drive? (DOCX 515.3 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l03-who-gets-to-drive.docx)  Duration**:** 1 lesson  Learning intention   * To understand the relationship between standard deviation and consistency.   Success criteria   * I can describe the spread of data in a dataset. * I can calculate standard deviation using technology. * I can compare datasets using standard deviation. * I can explain how standard deviation relates to consistency. | * PowerPoint [*Who gets to drive* (PPTX 1.3 MB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l03-who-gets-to-drive-slideshow.pptx) * Appendix A (one per group of 3) printed and cut out * Appendix B, printed (one copy per pair) * Appendix C, printed (one per group of 3) * Digital device per pair of students (optional) |  |

## Learning episode 4 – four equal groups

### Teaching and learning activity

In this lesson, students explore finding quartiles and generating the 5-number summary.

### Syllabus content

* Compare and contrast the centres, spreads and shapes of 2 or more numerical datasets, using box plots and numerical statistics, including the 5-number summary
* Determine the 5-number summary for sets of numerical data

Table 4 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| [Four equal groups (DOCX 550.9 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l04-four-equal-groups.docx)  Duration**:** 1 lesson  Learning intention   * To know how to generate a 5-number summary for a set of data.   Success criteria   * I can demonstrate that quartiles divide a set of data into approximately 4 equal groups. * I can find the lower and upper quartiles of a dataset. * I can explain what the values mean in a 5-number summary. | * PowerPoint [*Four equal groups* (PPTX 1.3 MB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l04-four-equal-groups-slideshow.pptx) * Appendix A and Appendix B, printed on A3 paper (one per group of 3) * Appendix A, printed A4 or A5 sized version (one per student) * Digital device per pair of students (optional) * Playing cards   Required if not using technology:   * One pull-back toy car per group * Tape measure (one per group) * Chalk (one per group) |  |

## Learning episode 5 – IQR and box plots

### Teaching and learning activity

Students use Amplify’s Polypad to construct box plots, comparing 5-number summaries and interquartile range.

### Syllabus content

* Compare and contrast the centres, spreads and shapes of 2 or more numerical datasets, using box plots and numerical statistics, including the 5-number summary
* Determine the 5-number summary for sets of numerical data
* Determine the interquartile range (IQR) for datasets
* Compare and explain the relative merits of range and IQR as measures of spread
* Represent numerical datasets using a box plot to display the median, upper and lower quartiles, and maximum and minimum values

Table 5 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| [IQR and box plots (DOCX 694 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l05-iqr-and-boxplots.docx)  Duration**:** 1 lesson  Learning intentions   * To be able to represent numerical data as a box plot. * To be able to calculate and interpret the interquartile range.   Success criteria   * I can find interquartile range of a dataset. * I can use the 5-number summary to draw box plots. * I can interpret box plots. | * PowerPoint [*IQR and box plots* (PPTX 1.4 MB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l05-iqr-and-boxplots-slideshow.pptx) * Appendix A, printed (one per pair) * Appendix B, printed (one per student) * Appendix C and D (one per pair) printed or provided digitally * Appendix E, printed and cut into cards (one per pair) * Digital device per pair of students (optional) * Deck of cards (one per pair) |  |

## Learning episode 6 – balls and boxes

### Teaching and learning activity

During this lesson, students collect the bounce height of various balls and use the data to produce parallel box plots. They make a claim about the data and support their claim using evidence.

### Syllabus content

* Compare and contrast the centres, spreads and shapes of 2 or more numerical datasets, using box plots and numerical statistics, including the 5-number summary
* Represent numerical datasets using a box plot to display the median, upper and lower quartiles, and maximum and minimum values
* Compare 2 or more numerical datasets using parallel box plots drawn on the same scale
* Compare and contrast the centres, spreads and shapes of 2 or more numerical datasets, using box plots and numerical statistics, including the 5-number summary

Table 6 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| [Balls and boxes (DOCX 330.8 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l06-balls-and-boxes.docx)  Duration**:** 1 lesson  Learning intention   * To be able to compare box plots to make informed decisions.   Success criteria   * I can compare box plots by referencing the median. * I can compare box plots by referencing the interquartile range. * I can compare box plots by referencing the shape of the data. | * PowerPoint [*Balls and boxes* (PPTX 1.4 MB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l06-balls-and-boxes-slideshow.pptx) * Appendix A, printed, cut into cards (one per pair) * Different types of balls (such as golf, basketball, netball, tennis, ping pong balls) * Appendix B, printed (one per group of 3) * Tape measure (one per group of 3) * Chalk (one per group of 3) |  |

## Learning episode 7 – distracted drivers

### Teaching and learning activity

Students collect data from 2 applets related to distractions whilst driving. They use spreadsheets to analyse and present the data and decide, based on the data, whether the fines issued by police are justifiable.

### Syllabus content

* Compare and contrast the centres, spreads and shapes of 2 or more numerical datasets, using box plots and numerical statistics, including the 5-number summary
* Represent numerical datasets using a box plot to display the median, upper and lower quartiles, and maximum and minimum values
* Compare 2 or more numerical datasets using parallel box plots drawn on the same scale
* Compare and contrast the centres, spreads and shapes of 2 or more numerical datasets, using box plots and numerical statistics, including the 5-number summary

Table 7 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| [Distracted drivers (DOCX 549.7 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l07-distracted-drivers.docx)  Duration**:** 1 lesson  Learning intention   * To compare box plots of similar data to inform decision making.   Success criteria   * I can describe the distribution of datasets. * I can use technology to assist in analysing data. * I can use technology to present data in a box plot. | * Appendix A (one per pair) printed or in digital form * Spreadsheets [*Distracted drivers – Part 1* (XLSX 97.7 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l07-distracted-drivers-part-1-spreadsheet.xlsx) and [*Distracted drivers – Part 2* (XLSX 96.9 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l07-distracted-drivers-part-2-spreadsheet.xlsx) * Appendix B, printed (one per pair) * At least one digital device per pair |  |

## Learning episode 8 – temperature’s rising

### Teaching and learning activity

Students explore the daily maximum temperature in their local area over a 30-year period. Students compare their local data with data from an intrastate area with a contrasting geographical climate.

### Syllabus content

* Represent numerical datasets using a box plot to display the median, upper and lower quartiles, and maximum and minimum values
* Compare 2 or more numerical datasets using parallel box plots drawn on the same scale
* Compare and contrast the centres, spreads and shapes of 2 or more numerical datasets, using box plots and numerical statistics, including the 5-number summary

Table 8 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| [Temperature’s rising (DOCX 340.6 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l08-temperatures-rising.docx)  Duration**:** 1 lesson  Learning intention   * To be able to compare box plots.   Success criteria   * I can use technology to construct box plots. * I can make inferences from comparing box plots. | * Video: [Temperature’s rising.mp4 (3:13)](https://players.brightcove.net/6197335233001/default_default/index.html?videoId=6350537215112) * Appendix A (one per student) (optional) * Digital device per pair of students |  |

## Learning episode 9 – What is the data telling us?

### Teaching and learning activity

Students look at the data presented by the Australian Bureau of Statistics and extract the 5-number summary from histograms to create box plots.

### Syllabus content

* Determine quartiles from datasets displayed in histograms and dot plots, and represent these as a box plot
* Identify and describe skewness or symmetry of datasets displayed in histograms, dot plots and box plots

Table 9 – lesson sequence and details

|  |  |  |
| --- | --- | --- |
| Teaching and learning activities | Required resources | Registration, adjustments and evaluation notes |
| [What is the data telling us? (DOCX 565.6 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l09-what-is-the-data-telling-us.docx)  Duration**:** 1 lesson  Learning intention   * To compare the benefits of representing data in histograms with the benefits of representing data in box plots.   Success criteria   * I can interpret visual data to find the median. * I can determine quartiles from datasets displayed as histograms. * I can find the 5-number summary from a histogram. * I can represent data presented as a histogram in a box plot. | * PowerPoint [*What is the data telling us?* (PPTX 1.7 MB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s5-unit-08-l09-what-is-the-data-telling-us-slideshow.pptx) * Appendix A, printed (one per group of 3 students) * Appendix B, printed (one per student) |  |

## 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 4 April 2024.

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