Mathematics Stage 2 – Unit 18

Questions can be asked and answered by interpreting data

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# Unit description and duration

This unit develops the big idea that questions can be asked and answered by interpreting data.

In this 2-week unit students are provided opportunities to:

* use data in a spreadsheet to create column graphs
* investigate how data can be interpreted and used to make decisions
* conduct chance experiments and compare the predicted and actual results where the outcomes are equally likely.

## Syllabus outcomes

* **MAO-WM-01** 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
* **MA2-RN-01** applies an understanding of place value and the role of zero to represent numbers to at least tens of thousands
* **MA2-AR-01** selects and uses mental and written strategies for addition and subtraction involving 2- and 3-digit numbers
* **MA2-AR-02** completes number sentences involving addition and subtraction by finding missing values
* **MA2-DATA-01** collects discrete data and constructs graphs using a given scale
* **MA2-DATA-02** interprets data in tables, dot plots and column graphs
* **MA2-CHAN-01** records and compares the results of chance experiments

## Working mathematically

In the Mathematics K–10 Syllabus, there is one overarching Working mathematically outcome (**MAO-WM-01**). The Working mathematically processes should be embedded within the concepts being taught. The Working mathematically processes present in the Mathematics K–10 Syllabus are:

* communicating
* understanding and fluency
* reasoning
* problem solving.

[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.

## Student prior learning

Before engaging in these teaching and learning activities, students would benefit from prior experience with:

* displaying and interpreting data using lists, tables, dot plots and column graphs
* posing questions and collecting discrete data
* predicting and describing possible outcomes from chance experiments.

In NSW classrooms there is a diverse range of students, including Aboriginal and/or Torres Strait Islander students, students learning English as an additional language or dialect, high potential and gifted students and students with disability. Some students may identify with more than one of these groups or possibly all of them. Refer to [Curriculum planning for every student – advice](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/advice-on-curriculum-planning-for-every-student-k-12) for further information.

Teachers can support student learning and reasoning in this unit by connecting language, representations and visualisation for chance (see Figure 1). This model of support is adapted from content provided by Adjunct Professor Marj Horne in [Big Ideas to Start Strong across K–6 – Module 3](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/professional-learning-mathematics-k-12/mathematics-k-6-professional-learning-catalogue/big-ideas-to-start-strong-across-k6) (NSW DoE 2023).

Figure 1 – pedagogical support – Stage 2 Chance

A poster titled ‘Stage 2 Chance – Everyone is a mathematician’.

Around a central triangle are 3 headings: Visualisation, Language and Representation.

For Visualisation, there are 4 statements:

'Seeing in your mind', both statically and dynamically; Manipulating objects in your mind; Imagine from someone else's perspective; Imagining what you can not see.

For Language, there are 3 points:

Symbolic and non-verbal language (gestures); Topic-specific language (formal/informal); Language of reasoning.
For Representation, there are 2 points:

We can move between a range of representations to support understanding; Examples/non-examples.

There are 4 additional statements on the poster:

By using graphs and diagrams, students can visualise possible outcomes and describe the discrepancies between expected and observed outcomes.

By exploring language and representation using a variety of manipulatives, students are able to visualise what likely, unlikely and equally likely truly means.

By visualising chance on a linear scale, students can describe and represent what more or less likely looks like in a variety of situations.

By using language such as 'for every 4 parts, 2 are red', students can visualise chance as part of a whole and represent this in many ways.

For each lesson on chance in this unit, students can enhance their understanding by using various representations or tools (see Figure 2). These can be constructed with students or provided as a resource. This resource can also be found in [Stage 2 Year A Unit 8](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/planning-programming-and-assessing-mathematics-k-6/mathematics-3-6-units#tabs_7270186521:~:text=Unit%208%20%E2%80%93%20Visual%20representations%20help%20to%20understand%20aspects%20of%20the%20world%20(chance%20and%20position)) and [Stage 2 Year B Unit 28](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/planning-programming-and-assessing-mathematics-k-6/mathematics-3-6-units#tabs_727018652_copy1:~:text=Unit%2028%20%E2%80%93%20Visual%20representations%20help%20understand%20aspects%20of%20our%20world%20(chance%20and%20position)) and [Unit 38](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/planning-programming-and-assessing-mathematics-k-6/mathematics-3-6-units#tabs_727018652_copy2:~:text=DOCX%205.9%20KB)-,Stage%202%20%E2%80%93%20Year%20B,-NSW%20students%20in).

Figure 2 – chance representations

Eight representations to enhance student understanding of chance. The first 6 representations are relevant to Stage 2 students:

Linear scale – What does a scale remind us of? How does a scale support us in thinking about the likelihood of chance? How can they support our language?

List outcomes – Where do we use lists in real life? How can lists help us to remember and think about options? Is the order in a list important?

Manipulatives – How can manipulatives help us to visualise a situation? Why are they useful in representing how situations can change? How can they support our language?

Random generators – How do different generators represent different possible outcomes? How can they support our reasoning about chance? How can they support our language?

Diagrams – How can diagrams represent a situation or our thinking? How can they help us to think sequentially? How can they support our language?

Graphs – How can graphs be used to represent the outcome of a chance experiment? Are they more useful than words? How can they support our language?

The last 2 representations are relevant to Stage 3 students:

Fraction Strips/wall – How do fraction strips help me to think about chance as a part of the total possibilities? How can they help me to understand that the same chance can look different?
Numerical representation – How does expressing chance as a fraction, decimal or percentage help us to build a shared understanding? How does it change the language we use when describing chance?

For each lesson on data in this unit and for [Stage 2 Year B Unit 38](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/planning-programming-and-assessing-mathematics-k-6/mathematics-3-6-units#tabs_727018652_copy3:~:text=DOCX%201.6%20MB)-,Stage%202%20%E2%80%93%20Year%20B,-NSW%20students%20in), the following definitions in Figure 3 build teacher understanding of the data types students are taught in Stage 3. The Stage 2 teaching advice states that students are not expected to classify the type of data they are collecting.

Figure 3 – data types

A multi-part resource that includes a flow diagram and a series of representations and descriptions of different data types. 

The flow diagram begins with a tile that says ‘Collect Data’. The diagram then splits into 2.

On the left-hand side is a tile for continuous data, followed by a tile for numerical data and an image of a line graph. This element has a note to say that it is for Stage 3.

The right-hand side of the flow chart begins with a tile that says ‘Discrete’. ‘Discrete’ is then separated into 2 more tiles called ‘Numerical’ and ‘Categorical’. Both of these are annotated to say that they are for Stage 2 and Stage 3. The numerical tile is linked to an image of a column graph.

The ‘Categorical’ tile is further split into tiles labelled ordinal and nominal. Both of these data types are annotated to say that they are for Stage 3. ‘Ordinal’ is linked to an image of a Likert scale. ‘Nominal’ is linked to an image of 3 eyes of different colour.

There are 7 additional elements to represent and describe different terms used in the syllabus. There are 3 types of data classifications: data, discrete and continuous. 

The Data classification contains the Variable and Numerical variable elements.

Variable – Something measurable or observable that is expected to change either over time or between observations, such as hair colour.

Numerical variable – Variables that are numbers. Adding, subtracting or calculating an average makes sense, such as the number of children in a family.

The Discrete classification contains the Discrete numerical data, Categorical data, Ordinal categorical data and Nominal data elements.

Discrete numerical data – Describes items or events that can only be counted in whole number values, where number where values in between the whole numbers cannot be found or labelled in the data display, such as the number of children in a family.

Categorical data – Describes a quality or characteristic of something. Values belong to exactly one category, such as blood type. 

Ordinal categorical data – Categories can be ranked or ordered. The order is clear but not the distance between each position, such as a feedback scale. 

Nominal data – No meaningful order between the categories, such as eye colour. 

The Continuous classification contains the Continuous numerical data element.

Continuous numerical data – Values between the whole numbers are meaningful and are labelled in the data display, such as temperature 19.8° or fuel prices $1.78.

The resource has the following note:

Stage 2 teaching advice states that students are not expected to classify the type of data they are collecting.

# Lesson overview and resources

The table below outlines the sequence and approximate timing of lessons, learning intentions and resources.

|  |  |  |
| --- | --- | --- |
| Lesson | Content | Duration and resources |
| [**Lesson 1**](#_Lesson_1_1)  **Daily number sense learning intention:**   * recognise and explain the connection between addition and subtraction | **Lesson core concept**: there are many ways to collect and record data.  **Core concept learning intention**:   * organise and display data using tables and graphs | **Lesson duration**: 65 minutes   * [Resource 1 – additive strategies](#_Resource_1_–) * [Resource 2 – word problem](#_Resource_2_–) * [Resource 3 – bar models](#_Resource_3_–) * [Resource 4 – Stage 2 house groups](#_Resource_4_–) * Digital devices * Individual whiteboards * Microsoft Excel or Google Sheets * Writing materials |
| [**Lesson 2**](#_Lesson_2)  **Daily number sense learning intention:**   * recognise and explain the connection between addition and subtraction | **Lesson core concept**: data from chance experiments can be collected, organised and recorded.  **Core concept learning intentions**:   * identify possible outcomes from chance experiments * identify when events are affected by previous events * organise and display data using tables and graphs | **Lesson duration**: 70 minutes   * [Resource 5 – house group allocations](#_Resource_5_–) * [Resource 6 – column graph](#_Resource_6_–) (enlarged to A3) * [Digital spinner](https://wheelofnames.com/) * Digital devices * Whiteboards * Writing materials |
| [**Lesson 3**](#_Lesson_3_1)  **Daily number sense learning intention:**   * recognise and explain the connection between addition and subtraction | **Lesson core concept**: the chance of an event occurring is sometimes affected by previous events.  **Core concept learning intentions**:   * identify possible outcomes from chance experiments * identify when events are affected by previous events * interpret and compare data | **Lesson duration**: 60 minutes   * [Resource 7 – chance scale](#_Resource_7_–) * [Resource 8 – mystery lunch](#_Resource_8_–) * [Resource 9 – lunch combinations](#_Resource_9_–) * [Resource 10 – 3B’s lunch selections](#_Resource_10_–) * Bag to place counters in * Green and red counters * Whiteboards * Writing materials |
| [**Lesson 4**](#_Lesson_4_1)  **Daily number sense learning intention:**   * teacher-identified task based on student needs | **Lesson core concept**: chance experiment outcomes can be predicted, recorded and compared.  **Core concept learning intentions**:   * describe the likelihood of outcomes of chance events * identify when events are affected by previous events * organise and display data using tables and graphs | **Lesson duration**: 60 minutes   * [Resource 11 – dice sums](#_Resource_11_–) * [Resource 12 – true or false](#_Resource_12_–) * [Resource 13 – race to win](#_Resource_13_–) * Website: [Polypad](https://polypad.amplify.com/p#random) or 2 large 6-sided dice * 6-sided dice * Coloured markers * Round stickers * Writing materials |
| [**Lesson 5**](#_Lesson_5)  **Daily number sense learning intention:**   * recognise and represent numbers that are 10, 100 or 1000 times as large | **Lesson core concept**: data can be interpreted to help make decisions.  **Core concept learning intention:**   * interpret and compare data | **Lesson duration**: 60 minutes   * [Resource 14 – place value cards](#_Resource_14_–) * [Resource 15 – council research](#_Resource_15_–) * [Resource 16 – interpreting data 1](#_Resource_16_–) * [Resource 17 – interpreting data 2](#_Resource_17_–) * [Resource 18 – interpreting data 3](#_Resource_18_–) * [Resource 19 – climbing equipment options](#_Resource_19_–) * 9-sided dice * Writing materials |
| [**Lesson 6**](#_Lesson_6_1)  **Daily number sense learning intention:**   * recognise and represent numbers that are 10, 100 or 1000 times as large | **Lesson core concept**: interpreting data helps us solve problems and ask new questions.  **Core concept learning intentions**:   * interpret and compare data * select and trial methods for data collection | **Lesson duration**: 60 minutes   * [Resource 20 – 10 times larger](#_Resource_20_–) * [Resource 21 – councillor’s email](#_Resource_21_–) * [Resource 22 – trial survey question](#_Resource_22_–) * 9-sided dice * Blue counters (one per student) * Digital device or camera * Masking tape * Red counters (one per student) * Sticky notes * Writing materials |
| [**Lesson 7**](#_Lesson_7_1)  **Daily number sense learning intention:**   * recognise and represent numbers that are 10, 100 or 1000 times as large | **Lesson core concept**: data can be interpreted to make decisions.  **Core concept learning intention**:   * construct and interpret data displays with many-to-one scales | **Lesson duration**: 60 minutes   * [Resource 23 – truth detective](#_Resource_23_–) * [Resource 24 – Rivenoak School’s results](#_Resource_24_–) * [Resource 25 – many-to-one displays](#_Resource_25_–) * Digital devices * Microsoft Excel or Google Sheets * Photograph of dot plot created in [Lesson 6](#_Lesson_6_1) |
| [**Lesson 8**](#_Lesson_8_1)  **Daily number sense learning intention:**   * teacher-identified task based on student needs | **Lesson core concept**: mathematicians interpret and evaluate the effectiveness of real-world data.  **Core concept learning intentions**:   * interpret and compare data * describe the likelihood of outcomes of chance events * identify when events are affected by previous events | **Lesson duration**: 60 minutes   * [Resource 26 – chance examples](#_Resource_26_–) * [Digital spinner](https://wheelofnames.com/) * Digital devices |

# Lesson 1

**Core concept: there are many ways to collect and record data.**

## Daily number sense – missing value – 15 minutes

Daily number sense activities for Lessons 1 to 3 ‘activate’ prior number knowledge and support the learning of new content in the unit. These activities can also assist teachers to identify the starting points for learning by revealing the extent of students’ existing knowledge.

The table below contains a suggested learning intention and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Daily number sense learning intention | Daily number sense success criteria |
| Students are learning to:   * recognise and explain the connection between addition and subtraction. | Students can:   * use number relation principles to solve related problems * demonstrate how addition and subtraction are inverse operations. |

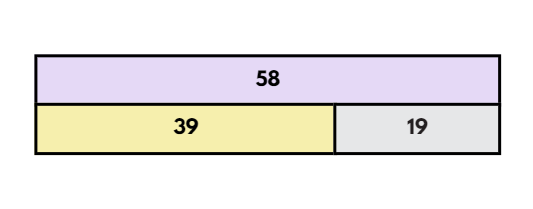
**Note:** [Resource 1 – additive strategies](#_Resource_1_–) is from [Stage 2 Year A Unit 15](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/planning-programming-and-assessing-mathematics-k-6/mathematics-3-6-units#tabs_7270186522:~:text=Unit%2015%20%E2%80%93%20Addition%20and%20subtraction%20problems%20can%20be%20solved%20using%20a%20variety%20of%20strategies) and may already be printed and displayed as a class resource. This resource will be referred to in Daily number sense lessons 1 to 3.

1. Display [Resource 2 – word problem](#_Resource_2_–).
2. Students [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645) the strategies that could be used to find the missing value. Students may wish to refer to [Resource 1 – additive strategies](#_Resource_1_–).
3. Explain that a bar model can be an effective representation to find missing values and to check solutions using inverse operations.

**Inverse operation:** the operation that reverses the effect of another operation. Addition and subtraction are inverse operations. When you add 3 to 7 you get 10. If you then subtract 3, you get back to 7.

1. Demonstrate drawing a bar model on the board to represent the solution to [Resource 2 – word problem](#_Resource_2_–) (see Figure 4).

Figure 4 – bar model matching word problem



1. Identify the related addition and subtraction number sentences that the bar model represents. Model thinking aloud, ‘If I know 39 + 19 = 58, then I know 58 − 19 = 39.’
2. Display [Resource 3 – bar models](#_Resource_3_–). In pairs, students solve the problems and record the related addition and subtraction number sentences on individual whiteboards.
3. Regroup and select students to share responses.

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students use number relation principles to solve related problems? **[MAO-WM-01, MA2-AR-01, MA2-AR-02]** * Can students demonstrate how addition and subtraction are inverse operations? **[MAO-WM-01, MA2-AR-01, MA2-AR-02]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * AdS7.   Links to suggested [Interview for Student Reasoning](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/assessment-resources/ifsr) (IfSR) tasks:   * IfSR-AT: 3A.1, 3A.3. |

## Core lesson – house group data collection – 45 minutes

The table below contains a suggested learning intention and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Core concept learning intention | Core concept success criteria |
| Students are learning to:   * organise and display data using tables and graphs. | Students can:   * create a list or table to organise the data * construct column graphs (with scale intervals of 1) and dot plots using relevant software where appropriate. |

1. Display the word ‘data.’ Ask the following questions:

* What is data?
* How can data be collected?
* How can data be organised and displayed?
* Why might data be collected?

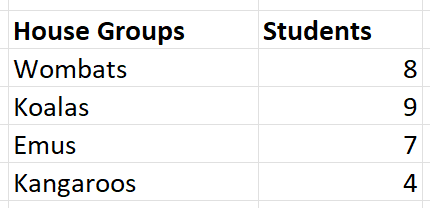
**Data:** facts or units of information collected.

1. Explain that Banksia Crescent Public School will have a sports carnival in 2 weeks. Mr Goodfellow is organizing the carnival. He needs to find how many Stage 2 students are in each house group. He asked the Stage 2 teachers to provide him with their class data.
2. Display [Resource 4 – Stage 2 house groups](#_Resource_4_–) and ask the following questions:

* How has each teacher displayed their data?
* What are some advantages and disadvantages of each data display?
* How else could Mr Goodfellow collect the house group information for all Stage 2 students?
* How could the Stage 2 data be displayed more efficiently?

1. Draw students’ attention to 3B’s class list on [Resource 4 – Stage 2 house groups](#_Resource_4_–). Explain that the data recorded on the class list is useful, however it could be organised and displayed more efficiently.
2. Model creating a tally table on the board, using 3B’s class list data.
3. Explain that spreadsheets, using digital programs such as Microsoft Excel and Google Sheets, can be used to record information in tables and column graphs. Refer to class 4C’s data in [Resource 4 – Stage 2 house groups](#_Resource_4_–).
4. Demonstrate how to enter 3B’s class data into a simple table in a Microsoft Excel spreadsheet. For example, see Figure 5.

Figure 5 – house group and student numbers table

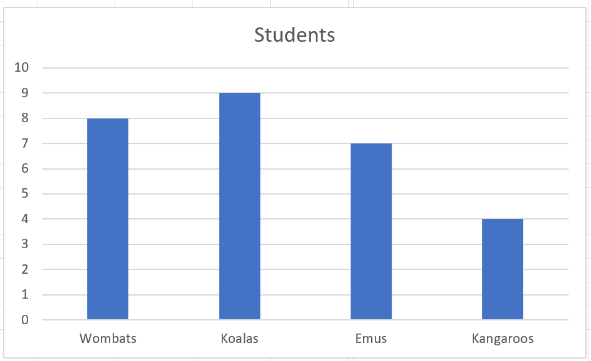


1. Provide students with digital devices. Students enter the 2 data sets, house groups and number of students, into a table in a Microsoft Excel spreadsheet.
2. Demonstrate how to create a column graph from the data recorded in the table.

**Note:** to create a column graph in Microsoft Excel, highlight the data in the table. Select the **Insert** tab in the ribbon. Click on the **Insert column or bar chart** icon. Select **Clustered Column** icon under the **2D-Column** heading.

1. Guide students through each step to create a column graph on individual devices (see Figure 6).

Figure 6 – student house groups column graph



1. Examine the features of the graph created, for example:

* equal spaces (intervals) on axes
* rectangular bars of equal width, with spaces (intervals) between them
* rectangular column heights that match the frequency of the category.

**Note:** when entering data into the Microsoft Excel spreadsheet, the graph will change to a many-to-one display (going up by increments of 2) if more than 10 students are in one house group. If this occurs, ask students why a many-to-one scale has been used and explain how to interpret the graph.

1. Ask students to consider if the automatically populated title accurately describes the data being presented.
2. Ask students to suggest an appropriate title for the class column graph, for example ‘3B’s House Groups’.
3. Demonstrate changing the title by double clicking on the text and renaming the title.
4. Ask if there are any features missing from the graph, for example, named and labelled axes.
5. Demonstrate how to add axes labels by right-clicking on the graph and selecting the **Chart Elements** icon and selecting **Axis Titles** (see Figure 7).

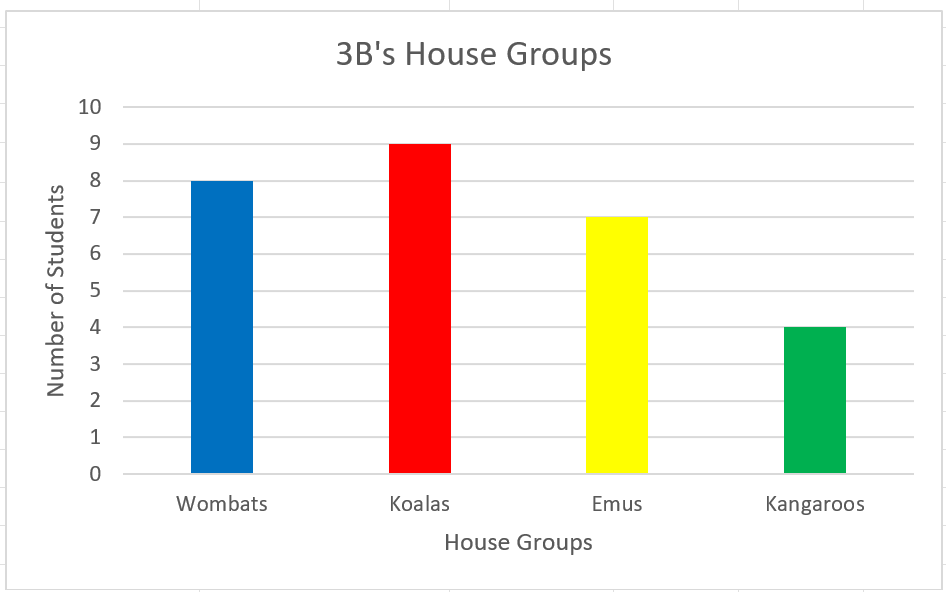
Figure 7 – student house groups column graph with chart elements icon

A column graph with the heading ‘students’. On the x-axis there are 4 categories: wombats, koalas, emus and kangaroos. On the y-axis the numbers from zero to 10 go up in equal increments by ones. The columns are coloured blue. Wombats column has 8, koalas column has 9, emus column has 7 and kangaroos column has 4. 

On the right hand side the 'chart elements' icon has been selected. In the menu, Axes, Axis title, Chart title and gridlines are selected. Data labels, Data table, Error bars, Legend and Trendline are unselected.

1. Demonstrate labelling the axes by double clicking on the text and renaming the titles. For example, labelling the x-axis ‘House Groups’ and labelling the y-axis ‘Number of Students.’
2. Model changing the column colour for each house group by double-clicking on the individual columns. Right-click and select the **Fill** option to change the column to the corresponding house group colour (see Figure 8). Repeat for all columns.

Figure 8 – 3B’s house groups column graph



**Note**: student spreadsheets can be saved for formative assessment purposes.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot construct column graphs (with scale intervals of 1) and dot plots using relevant software where appropriate.   * Provide students with a Microsoft Excel spreadsheet with the table pre-populated. | Students can construct column graphs (with scale intervals of 1) and dot plots using relevant software where appropriate.   * Provide students with stage or whole-school data to input into a table and create a many-to-one column graph. * Investigate ways to make other graph representations in Microsoft Excel. For example, 2D bar graph, 3D column graph or 3D bar graph. |

## Discuss and connect the mathematics – 5 minutes

1. Regroup and ask the following questions:

* How does using software help to organise and display data?
* Why is it important to label the axes and choose appropriate titles for column graphs?
* How might using software assist Mr Goodfellow when collecting Stage 2 or whole-school house group information?
* How does our school record student house group allocations? (Refer to a database, for example ERN or Sentral.)

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students create a list or table to organise the data?  **[MAO-WM-01, MA2-DATA-01]** * Can students construct column graphs (with scale intervals of 1) and dot plots using relevant software where appropriate?  **[MAO-WM-01, MA2-DATA-01]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * IRD3. |

# Lesson 2

**Core concept**: data from chance experiments can be collected, organised and recorded.

## Daily number sense – number sentences – 10 minutes

The table below contains a suggested learning intention and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Daily number sense learning intention | Daily number sense success criteria |
| Students are learning to:   * recognise and explain the connection between addition and subtraction. | Students can:   * use number relation principles to solve related problems * demonstrate how addition and subtraction are inverse operations. |

1. Record the numbers 28, 35, 14, 42, 21 on the board.
2. Explain that students will use these numbers to identify as many related number sentences as possible.
3. Ask how the number sentence 28 + 14 = 42 could be used to identify other related number sentences. For example, ‘Because I know 28 + 14 = 42, then I know 42 − 14 = 28.’
4. Using only the numbers recorded on the board, students create as many number sentences as possible, recording their thinking on individual whiteboards.
5. Regroup and ask the following questions:

* Which of your number sentences show that addition and subtraction are inverse operations?
* Which of your number sentences show the commutative property?

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students use number relation principles to solve related problems? **[MAO-WM-01, MA2-AR-01, MA2-AR-02]** * Can students demonstrate how addition and subtraction are inverse operations? **[MAO-WM-01, MA2-AR-01, MA2-AR-02]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * AdS7.   Links to suggested [Interview for Student Reasoning](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/assessment-resources/ifsr) (IfSR) tasks:   * IfSR-AT: 3A.1, 3A.3. |

## Core lesson 1 – house group allocations – 30 minutes

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Core concept learning intentions | Core concept success criteria |
| Students are learning to:   * identify possible outcomes from chance experiments * identify when events are affected by previous events * organise and display data using tables and graphs. | Students can:   * predict the number of times each outcome might occur in a chance experiment involving a set number of trials * conduct experiments and compare the predicted and actual results where the outcomes are equally likely * identify and discuss events where the chance of one event occurring will not be affected by the occurrence of the other * mark equal spaces (intervals) on axes, name and label axes and choose appropriate titles for column graphs. |

**Note**: throughout the unit a digital spinner will be used for various chance experiments as a random generator. Use a website such as [wheelofnames.com](https://wheelofnames.com/) to create the spinners required for each lesson or activity.

1. Explain that Mr Goodfellow has been told 12 new students will arrive at the school in time for the sports carnival. The students must be placed into one of the 4 house groups. The office staff use a spinner to randomly assign the 12 new students a house group.
2. Display the [spinner](https://wheelofnames.com/).
3. Enter the 4 outcomes (house groups) into the text box to the right of the spinner.

* Wombats (blue)
* Koalas (red)
* Emus (yellow)
* Kangaroos (green)

1. Write the term equally likely on the board. Students [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645) and create a shared definition.

**Equally likely**: an event for which all outcomes have the same probability of occurring. For example, in tossing a fair coin, the outcome ‘head’ and the outcome ‘tail’ are equally likely (NESA 2022).

**Note:** students may have the misconception that equally likely means 50/50 or a 1 in 2 chance of occurring. This is not the case when there are more than 2 outcomes. For example, on a die each outcome is equally likely, however each outcome only has a 1 in 6 chance of being rolled.

1. Regroup and create a class definition for the term equally likely.
2. Ask the following questions:

* What features of the spinner make the chance of each outcome equally likely?
* If I spin Kangaroos on my first spin, is it still equally likely that I could spin Kangaroos on my second spin? (Yes, when using this spinner, the chance of a certain outcome occurring resets after each spin. Each spin is independent of the next.)

1. Ask students to [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645) and predict how many students will be placed in each house group. Students record their predicted results in the ‘class results’ table on [Resource 5 – house group allocations](#_Resource_5_–).
2. Select students to share their predictions and justify their choices.

**Note:** the Stage 2 [Teaching advice for Chance B](https://curriculum.nsw.edu.au/learning-areas/mathematics/mathematics-k-10-2022/content/stage-2/face5c0f2c?show=advice#:~:text=Teaching%20advice%20for%20Chance%20B) states that randomness can lead to unexpected outcomes. The ‘law of averages’ is a term sometimes used to describe the common mistaken belief that an outcome must occur as many times as its numerical probability suggests. This belief suggests that what has happened in the past will be balanced by what occurs next. The ‘law of averages’ misconception in this task may see students predict that 3 students will be placed in each house group. Students need many opportunities to compare their expectations (what might happen) with actual outcomes (what does happen) to appreciate the variation that is experienced with random generators, including spinners (NESA 2022b).

1. Spin the spinner 4 times, selecting the **close** button after each spin to ensure the outcome remains on the spinner for subsequent spins.
2. Students record tally marks for each spin in the ‘class results’ table on [Resource 5 – house group allocations](#_Resource_5_–).
3. Discuss how the chance of one outcome (house group) being selected is not affected by previous spins. As the house groups are not removed after being selected, there is still an equal chance of each house group being spun and selected again. For example, if child one lands on the blue house group, there is still an equal chance of child 2 and child 3 also being placed in the blue house group.
4. Spin the spinner another 8 times and record tally marks to allocate a house group to all 12 students.
5. Students analyse the ‘class results’ table on [Resource 5 – house group allocations](#_Resource_5_–) to compare the predicted and actual results. Discuss as a class.

The table below outlines stimulus prompts to generate conversation about the topic, along with anticipated responses from students.

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * Did your predicted results match the actual results? | * No. I predicted there would be 3 students in each house group, but the actual results were different. * No. My predictions were different but as the chance experiment was random, it would be hard to predict exact results. * Yes! My predictions matched the actual results, but I know this won’t happen every time. |
| * What are some potential issues that could arise if this random method of assigning students to house groups was always used? | * Numbers of students in each house could be very unbalanced. For example, the blue house group could have double the number of students that the yellow house group has. If a team has more students, they will more likely be the winning house. * Siblings may be placed in separate houses if the random spinner was used. |
| * Is it possible for all 12 students to be placed in Wombats using this spinner. Why or why not? | * It is unlikely that all 12 students would be placed in the same house group using this spinner, but it is not impossible. * There is an equal chance of each house group being selected on each spin, so it is possible that all 12 students will be placed in Wombats. I do not think it is likely. |

1. Explain that in pairs, students will conduct the experiment for a second time. Ask students to consider the class results and complete the prediction column in the ‘our results’ table on [Resource 5 – house group allocations](#_Resource_5_–).
2. Provide pairs with digital devices and model setting up the [spinner](https://wheelofnames.com/) with the house groups.

**Note:** to ensure correct colour allocation, students need to enter the 4 house group names into the text box in the following order: Wombats, Koalas, Emus, Kangaroos.

1. Pairs spin the spinner 12 times and record tally marks for each spin in the ‘our results’ table on [Resource 5 – house group allocations](#_Resource_5_–).

## Core lesson 2 – house group column graph – 15 minutes

1. Explain that results collected from a chance experiment can be organised and displayed into a column graph.
2. Display [Resource 6 – column graph](#_Resource_6_–) and [Resource 5 – house group allocations](#_Resource_5_–).
3. Ask students to [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645) and determine where the following titles would be added to the column graph for the class chance experiment:

* Number of students
* House groups
* House group allocations.

1. Record the titles onto the blank lines on [Resource 6 – column graph](#_Resource_6_–).
2. Ask students to identify the labels that are missing from the axes.
3. Model adding the house group names to the x-axis.

**Note**: when creating column graphs, the columns should not be joined as they represent discrete numerical data. When adding the house group names to the x-axis, ensure the labels are written within the width of 2 squares with a one square gap between each. [Resource 6 – column graph](#_Resource_6_–) can be enlarged to A3 if required.

1. Using the grid as a guide, mark equal intervals on the y-axis and record the numbers 1–12.
2. Refer to the class results on [Resource 5 – house group allocations](#_Resource_5_–) and model using this data to draw rectangular columns to represent the number of students assigned to each house group. Colour the column with the corresponding house group colour (see Figure 9).

Figure 9 – house group allocations column graph example

A column graph with the heading ‘House Group Allocations’. 

On the x-axis, titled 'House Groups', there are 4 categories: Wombats, Koalas, Emus and Kangaroos. 

On the y-axis, titled 'Number of Students', the numbers from zero to 12 go up in equal increments by ones. 

A grid is in the background to guide the columns. Wombats' blue column has 5, Koalas' red column has 3, Emus' yellow column has one and Kangaroos' green column has 3.

1. Highlight the attributes of a column graph, including:

* an appropriate title
* equal spaces (intervals) on axes
* named and labelled axes
* rectangular bars of equal width, with spaces between them
* rectangular column heights that match the frequency of the category.

**Note:** opportunities to discuss how your school allocates students to sporting houses could be explored during this lesson.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot conduct experiments and compare the predicted and actual results where the outcomes are equally likely.   * Reduce the number of possible outcomes to 2 and ask students to predict the results if the chance experiment was conducted 10 times. Support students to conduct the experiment and compare the predicted and actual results. | Students can conduct experiments and compare the predicted and actual results where the outcomes are equally likely.   * Students predict the frequency of each number being rolled on a 6-sided die if rolled 20 times. Students conduct the experiment, record the actual results and compare these to their predictions. |

## Consolidation and meaningful practice – 15 minutes

1. Distribute [Resource 6 – column graph](#_Resource_6_–).
2. Students create their own column graph using data from the ‘our results’ table on [Resource 5 – house group allocations](#_Resource_5_–).

**Note:** there are opportunities to extend this lesson further by having students compare their data with other pairs. Additionally, all results could be combined to create a larger set of data for analysis.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot mark equal spaces (intervals) on axes, name and label axes and choose appropriate titles for column graphs.   * Provide a copy of [Resource 6 – column graph](#_Resource_6_–) with some intervals, labels and titles pre-recorded on the graph. | Students can mark equal spaces (intervals) on axes, name and label axes and choose appropriate titles for column graphs.   * Students combine the class data and their own data from the random spinner to create a many-to-one column graph representing the house groups for 24 students. |

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students predict the number of times each outcome might occur in a chance experiment involving a set number of trials? **[MAO-WM-01, MA2-CHAN-01]** * Can students conduct experiments and compare the predicted and actual results where the outcomes are equally likely?  **[MAO-WM-01, MA2-CHAN-01]** * Can students identify and discuss events where the chance of one event occurring will not be affected by the occurrence of the other? **[MAO-WM-01, MA2-CHAN-01]** * Can students mark equal spaces (intervals) on axes, name and label axes and choose appropriate titles for column graphs? **[MAO-WM-01, MA2-DATA-01]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * UnC2, UnC3 * IRD3. |

# Lesson 3

**Core concept**: the chance of an event occurring is sometimes affected by previous events.

## Daily number sense – missing values – 10 minutes

The table below contains a suggested learning intention and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Daily number sense learning intention | Daily number sense success criteria |
| Students are learning to:   * recognise and explain the connection between addition and subtraction. | Students can:   * demonstrate how addition and subtraction are inverse operations * explain and check solutions to problems, including by using the inverse operation. |

1. Record the following number sentences on the board and provide students with writing materials.

* \_ + 26 = 58
* 19 + \_ = 35
* 84 − \_ = 33
* 194 = \_ + 177
* 168 − \_ = 45.

1. Students select 2 of the number sentences to solve and calculate the missing value by using a number line or bar model. Encourage students to check their solution by using the inverse operation.
2. Students swap whiteboards with a partner to check solutions and give feedback.
3. Regroup and select students to share their recorded representations. Refer to [Resource 1 – additive strategies](#_Resource_1_–) to connect student recordings to strategies used. For example, for the number sentence 19 + \_ = 35, a solution could use the strategies of inverse operation (knowing that 35 −19 = \_ is the same as 19 + \_ = 35) and constant difference (add one to both numbers = 36 − 20 = 16).
4. Reflect on which strategies and representations were most effective for number sentences with missing values.

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students demonstrate how addition and subtraction are inverse operations? **[MAO-WM-01, MA2-AR-01, MA2-AR-02]** * Can students explain and check solutions to problems, including by using the inverse operation?  **[MAO-WM-01, MA2-AR-01, MA2-AR-02]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * AdS7.   Links to suggested [Interview for Student Reasoning](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/assessment-resources/ifsr) (IfSR) tasks:   * IfSR-AT: 3A.1, 3A.3. |

## Core lesson – mystery lunch – 40 minutes

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Core concept learning intentions | Core concept success criteria |
| Students are learning to:   * interpret and compare data * identify possible outcomes from chance experiments * identify when events are affected by previous events. | Students can:   * describe and interpret information presented in tally tables and column graphs * record all possible combinations in a chance situation where the outcomes are equally likely * identify and discuss events where the chance of one event occurring will not be affected by the occurrence of the other * compare events where the chance of one event occurring is affected by the occurrence of the other. |

**Note:** the chance scale was explored in [Stage 2 Year A Unit 8](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/planning-programming-and-assessing-mathematics-k-6/mathematics-3-6-units#tabs_7270186521:~:text=Unit%208%20%E2%80%93%20Visual%20representations%20help%20to%20understand%20aspects%20of%20the%20world%20(chance%20and%20position)) Lesson 5. This lesson provides an opportunity for students to develop confidence using some additional vocabulary terms listed in the Stage 2 [Teaching advice for Chance B](https://curriculum.nsw.edu.au/learning-areas/mathematics/mathematics-k-10-2022/content/stage-2/face5c0f2c?show=advice).

1. Display [Resource 7 – chance scale](#_Resource_7_–). Ask students to [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) and identify a scenario for each of the terms:

* impossible
* unlikely
* equally likely
* likely
* certain.

1. Students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) and determine where the word ‘possible’ would be placed on the scale.

**Note:** ‘certain’ is the opposite of ‘impossible’. Anything that is not impossible, is possible. Therefore, ‘possible’ includes a scale of things that are more and less likely, equally likely and certain. ‘Impossible’ means that the outcome can never occur. ‘Certain’ means that it will definitely occur.

1. Explain that anything that is not impossible, is possible. Demonstrate drawing a line to show that the word possible would be placed anywhere on the scale after impossible (see the purple line in Figure 10).

Figure 10 – chance scale

A line representing a chance scale with ‘impossible’, ‘unlikely’, ‘equally likely’, ‘likely’ and ‘certain’ marked and labelled at equal points on the scale. 

There are 5 additional vocabulary cards in text boxes below: less likely, possible, least likely, most likely and more likely. 

A green line connects 'less likely' to the space in between ‘impossible’ and ‘unlikely’. 

A blue line connects 'least likely' to the space close to ‘impossible’. 

A red line connects 'most likely' to the space close to ‘certain’. 

A yellow line connects 'more likely’ in between 'likely' and 'most likely'. 

A purple line connects a bracket that extends from just after ‘impossible’ up to 'likely'.


1. Students [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645) to determine where the other chance vocabulary cards should be placed on the scale.
2. Students share their decisions and justify their reasoning. Highlight the differences between less likely and least likely, and more likely and most likely.
3. Select students to draw lines on the class model from the grey vocabulary boxes to where the terms would sit on the chance scale (see Figure 10).
4. Explain that at the Banksia Crescent Public School sporting carnival, the canteen is providing students with a mystery lunch.
5. Display [Resource 8 – mystery lunch](#_Resource_8_–). Explain to students that on the day of the sporting carnival, the canteen is offering 4 different food items and 2 different drink items. The students will visit the canteen and spin 2 random spinners to decide which food and drink item they will receive. Ask questions using the prompts in the table below.

This table outlines stimulus prompts to generate conversation about the topic, along with anticipated responses from students.

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * Which chance terms could be used to describe the likelihood of spinning a chicken burger for food? | * Equally likely * Possible |
| * What is the chance of spinning water as the drink? | * Equally likely. There are 2 possible outcomes for drinks. Each child must receive one of the 2, water or apple juice. |
| * What is the chance of a student spinning avocado sushi? | * Equally likely, as there are 4 possible outcomes for food. |
| * Is it less likely to spin the vegetarian lasagne than the chicken burger? | * No, there is an equal chance of receiving each food item. |
| * If Amal is vegetarian, is there an equal chance of spinning a food she can eat? | * Yes, 2 out of the 4 outcomes are vegetarian: avocado sushi and vegetarian lasagne. There is an equal chance of spinning a vegetarian option or a non-vegetarian option. |
| * What could a spinner look like if the chance of Amal spinning a vegetarian option was certain? | * Amal needs a different spinner with only 2 options, avocado sushi and vegetarian lasagne, so the chance of receiving a vegetarian food is certain. * Amal could have a spinner with 4 options: 2 avocado sushi and 2 vegetarian lasagnes. |
| * What is the likelihood of spinning orange juice? | * Impossible. There is no orange juice on the spinner, therefore it is not a possible outcome. |

1. Ask students to [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) and discuss why the term equally likely can be used to describe the chance of one out of 4 possible outcomes and the chance of one out of 2 possible outcomes.
2. Explain that when using this spinner, the chance of a certain outcome occurring resets after each spin. Each spin is independent of the next. For example, 3 students in a row may spin and land on ‘hotdog’. The chance of spinning a hotdog on each spin remains equally likely.
3. Pose the scenario: Archer visits the canteen and selects ‘spin’ on each of the random spinners. The outcomes of the spins were a chicken burger and an apple juice. This was one possible combination Archer could have received. What are some other possible combinations he could have received?
4. Students [Think-Pair-Share](http://Think-Pair-Share) and record all other possible lunch combinations using writing materials.
5. Regroup and select students to share their combinations.
6. Display [Resource 9 – lunch combinations](#_Resource_9_–). Explain that the table can be used to display the possible combinations of outcomes from the 2 spinners. The images in the grey row and column show the possible food and drink outcomes. The combination created is recorded in the white section of the table where the 2 outcomes meet.
7. Model how to use the table in [Resource 9 – lunch combinations](#_Resource_9_–) to determine and record the possible combinations of this experiment (see Figure 11).

Figure 11 – lunch combinations table

A table with 3 rows and 5 columns representing the lunch combinations made when a food and drink item are selected. 

The top row represents the food outcomes with images of a chicken burger, avocado sushi, a hotdog and a vegetarian lasagne, one in each column. 

The drink outcomes are represented in the first column, apple juice in row 1 and water in row 2.

The combination of food and drink options are recorded in the white squares of the table where the 2 outcomes meet. 

Blue text represents the initials of the food: CB = chicken burger, AS = avocado sushi, HD = hot dog and VL = vegetarian lasagne. 

Green text represents the initial of the drink: A = apple juice and W = water.

The white boxes in the second row read as follows:
CB and A, AS and A, HD and A, VL and A.

The white boxes in the third row read as follows:
CB and W, AS and W, HD and W, VL and W.

1. Explain that on the day of the sporting carnival, class 3B visited the canteen and participated in the chance experiment. They created a graph to show the results.
2. Distribute [Resource 10 – 3B’s lunch selections](#_Resource_10_–). Students interpret the data display to complete the questions.
3. Regroup to discuss answers.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot identify and discuss events where the chance of one event occurring will not be affected by the occurrence of the other.   * Students use the drink spinner only to conduct a chance experiment and record the results. Highlight that the chance of spinning water or apple juice is not affected by previous spins.   Students cannot describe and interpret information presented in tally tables and column graphs.   * Provide students with a tally table showing class 3B’s results. | Students can identify and discuss events where the chance of one event occurring will not be affected by the occurrence of the other.   * Students brainstorm a list of real-world examples where the chance of one event occurring will not be affected by the occurrence of the other. For example, a coin landing on heads 2 times in a row, or rolling a 4 on a die 3 times in a row.   Students can describe and interpret information presented in tally tables and column graphs.   * Students create questions about the graph for their partner to answer. |

## Discuss and connect the mathematics – 10 minutes

1. At the end of the sporting carnival, the canteen had 3 hotdogs and 3 avocado sushi rolls left over. The canteen manager placed each food item in a brown paper bag for 6 teachers to take home. The teachers will pick one brown paper bag at random.
2. Record the 6 possible outcomes on the whiteboard.
3. Explain that the first teacher has an equally likely chance of selecting a bag containing a hotdog or an avocado sushi roll.
4. Place 3 red and 3 green counters in a bag to represent the food items. Select one student to be the first teacher and choose a counter from the bag at random. Draw a line through the matching outcome listed on the board to show that the food item is no longer a possible outcome.
5. Ask the following questions:

* Is there still an equally likely chance that the second teacher will select a bag containing a hotdog or an avocado sushi roll? Why or why not?
* What will happen to the probability of a hotdog or avocado sushi roll as each teacher selects their bag?

1. Explain to students that sometimes in a chance experiment the chance of one event occurring is affected by the occurrence of the other. In this case, one of the food items is now less likely to occur than the other.
2. Invite a second student to choose a counter at random. Draw a line through the matching outcome listed.
3. Discuss the possible outcomes of the third and fourth teacher’s selections.

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students record all possible combinations in a chance situation where the outcomes are equally likely? **[MAO-WM-01, MA2-CHAN-01]** * Can students identify and discuss events where the chance of one event occurring will not be affected by the occurrence of the other? **[MAO-WM-01, MA2-CHAN-01]** * Can students compare events where the chance of one event occurring is affected by the occurrence of the other?  **[MAO-WM-01, MA2-CHAN-01]** * Can students describe and interpret information presented in tally tables and column graphs? **[MAO-WM-01, MA2-DATA-02]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * UnC3, UnC4, UnC5 * IRD3. |

# Lesson 4

**Core concept**: chance experiment outcomes can be predicted, recorded and compared.

## Daily number sense – 10 minutes

1. From a class need surfaced through formative assessment data, identify a short, focused activity that targets students’ knowledge, understanding and skills. Example activities may be drawn from the following resources:

* [Mathematics K–6 resources](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources)
* [Universal Resources Hub](https://resources.education.nsw.gov.au/home).

## Core lesson 1 – dicey sums – 25 minutes

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Core concept learning intentions | Core concept success criteria |
| Students are learning to:   * organise and display data using tables and graphs * describe the likelihood of outcomes of chance events * identify when events are affected by previous events. | Students can:   * construct column graphs (with scale intervals of 1) and dot plots using relevant software where appropriate * compare the likelihood of obtaining particular outcomes in a simple chance experiment by predicting, conducting the experiment and comparing the results with the prediction * identify and discuss events where the chance of one event occurring will not be affected by the occurrence of the other. |

1. Display 2 dice using [Polypad](https://polypad.amplify.com/p#random), an alternative digital program or large physical dice.
2. Ask students what the sum of the 2 dice could be.
3. Students [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645) and record possible outcomes using writing materials. For example, 1 + 2 = 3, 2 + 2 = 4, 2 + 3 = 5.
4. Regroup and discuss the possible outcomes students recorded. Ask questions using the prompt table below.

This table outlines stimulus prompts to generate conversation about the topic, along with anticipated responses from students.

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * What is the chance of the outcome being 13? | * Thirteen is an impossible outcome. There are no 2 numbers on a 6-sided die that add up to 13. |
| * Do the numbers on one die have an equally likely chance of being rolled? Why or why not? | * Yes, each number has an equal chance of being rolled. When rolling a die, the chance of a certain number occurring resets after each roll. Each roll is independent of the next. For example, the chance of rolling a number 6 will not be affected by previous rolls. |
| * Does each outcome (sum) have an equally likely chance of occurring? Why or why not? | * No, each outcome has a different likelihood of occurring. For example, 2 can only be an outcome if both dice land on one. This is less likely than an outcome of 4 where the dice could land on one and 3 or 2 and 2. |

1. Draw a horizontal line on the board to represent an x-axis. Make 12 equally-spaced marks along the line and label with the numbers 1–12 underneath.
2. Ask students to predict the outcome (sum) when 2 dice are rolled. Each student places a round sticker above the corresponding number to create a dot plot.
3. Select some students to justify their predictions.

**Note:** if round stickers are not available, a masking tape line on the classroom floor and counters can be used as an alternative. Ensure counters or stickers are a consistent shape and size.

1. Roll the 2 dice and find the sum. Refer to the prediction dot plot and determine how many students correctly predicted the outcome (sum).
2. Display [Resource 11 – dice sums](#_Resource_11_–). Explain that the table shows the sum of 2 numbers. The numbers in the grey row and column show the possible outcomes when one die is rolled. The sum of the numbers is recorded in the square where the 2 numbers meet.
3. Ask the following questions:

* What do you notice?
* What do you wonder?

1. Display [Resource 12 – true or false](#_Resource_12_–). Students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) to determine whether the statements are true or false.
2. Regroup and ask students to justify their decisions.

## Core lesson 2 – race to win – 15 minutes

This activity is an adaptation of ‘Derby roleplay in the classroom’ from Seriously Fun Maths: The complete guide to motivational mathematics by Tuohilampi.

1. Display [Resource 13 – race to win](#_Resource_13_–). Explain that the ‘Race to win’ track has 12 lanes. In the game, the winning lane is determined by creating a column graph with horizontal bars.
2. Explain the rules of the game:
3. Roll 2 dice and find the sum.
4. Colour one square in the numbered lane that matches the sum.
5. Repeat until one lane reaches the finish line (see Figure 12).

Figure 12 – ‘Race to win’ gameboard example

A gameboard organised in a grid. The first column has 12 boxes with the numbers 1 to 12 in each row. This axis is labelled 'Lane number (sum of dice)'.

The second column is a solid fill with the word 'start'. A grid of 6 by 12 squares is followed by a chequered finish line and 2 dice.
 
The grid has the numbers 1 to 6 under each column and the title 'Number of times rolled'.

In the grid, a coloured marker has been used to colour in the numbers rolled. 

Rows 1 and 12 have 6 blank squares. 

Rows 2 and 3 have one coloured square, followed by 5 blank squares. 

Rows 4, 5, 9 and 11 have 2 coloured squares, followed by 4 blank squares. 

Row 6 has 5 coloured squares, followed by a square that is being coloured with a marker. 

Row 7 has 4 coloured squares, followed by 2 blank squares. 

Row 8 has 5 coloured squares, followed by 1 blank square. 

Row 10 has 3 coloured squares, followed by 3 blank squares.


1. Ask students to predict the following:

* Which lane is most likely to win the race?
* Which lane is least likely to win the race?

1. Provide pairs with [Resource 13 – race to win](#_Resource_13_–), two 6-sided dice and coloured markers.
2. Pairs play ‘Race to win’ and determine the winning lane.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot compare the likelihood of obtaining particular outcomes in a simple chance experiment by predicting, conducting the experiment and comparing the results with the prediction.   * Support students to create a table to list all the possible outcomes when rolling one 6-sided die. * Students make a tally of how many times each outcome occurred in the table [Resource 11 – dice sums](#_Resource_11_–). Support students to record the frequency numerically and compare the likelihood of each outcome (sum) occurring. For example, the outcome of 2 occurs once and the outcome of 3 occurs twice, so 3 is more likely to occur as 3 is a larger number than 2. | Students can compare the likelihood of obtaining particular outcomes in a simple chance experiment by predicting, conducting the experiment and comparing the results with the prediction.   * Provide students with two 9-sided dice. Students create a version of [Resource 11 – dice sums](#_Resource_11_–) using these dice. * Students make statements using chance vocabulary to make predictions about the likelihood of particular outcomes (sums) when two 9-sided dice are rolled. |

## Discuss and connect the mathematics – 10 minutes

1. Students compare their ‘Race to win’ results with another pair. Ask the following questions:

* How did your predictions compare to the actual results?
* How are your results similar or different to the other pair’s results?
* Were there any surprises in how many times an outcome (sum) occurred?
* How many times did you need to roll the dice before a lane crossed the finish line?
* How is a column graph with horizontal bars similar to a column graph with vertical columns?

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students construct column graphs (with scale intervals of 1) and dot plots using relevant software where appropriate?  **[MAO-WM-01, MA2-DATA-01]** * Can students compare the likelihood of obtaining particular outcomes in a simple chance experiment by predicting, conducting the experiment and comparing the results with the prediction? **[MAO-WM-01, MA2-CHAN-01]** * Can students identify and discuss events where the chance of one event occurring will not be affected by the occurrence of the other? **[MAO-WM-01, MA2-CHAN-01]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * UnC2, UnC3 * IRD3. |

# Lesson 5

**Core concept**: data can be interpreted to help make decisions.

## Daily number sense – largest number wins – 10 minutes

Daily number sense activities for Lessons 5 to 7 ‘loop’ back to concepts and procedures covered in previous units to assist students to build an increasingly connected network of ideas. These concepts may differ from the core concepts being covered by the unit.

The table below contains a suggested learning intention and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Daily number sense learning intention | Daily number sense success criteria |
| Students are learning to:   * recognise and represent numbers that are 10, 100 or 1000 times as large. | Students can:   * describe how making a number 10, 100 or 1000 times as large changes the place value of digits. |

**Note:** prepare [Resource 14 – place value cards](#_Resource_14_–) prior to the lesson by printing and cutting one set per small group (3 to 4 students).

1. Explain the rules of the game:
2. The aim of the game is to make the largest number.
3. Randomly place cards from [Resource 14 – place value cards](#_Resource_14_–) face down in the centre of the small group of players.
4. Players take turns to roll a 9-sided die.
5. After each roll, the player flips over a card and makes the number rolled that many times as large. For example, if a 9 is rolled and the card flipped says ‘× 100’, it would become 900.
6. Repeat until each player has had a turn.
7. The player with the largest number receives a point if they can read the number correctly.
8. Shuffle cards after each round of play.
9. The player with the most points at the end of the game period, wins.
10. Provide small groups (3 to 4 students) with a pre-prepared set of [Resource 14 – place value cards](#_Resource_14_–) and a 9-sided die to play the game.
11. Regroup and share reflections on how making the number 10, 100 or 1000 times as large, changes the place value of the digits.

This table details an opportunity for assessment.

|  |  |
| --- | --- |
| Assessment opportunity | Links |
| What to look for:   * Can students describe how making a number 10, 100 or 1000 times as large changes the place value of digits?  **[MAO-WM-01, MA2-RN-01]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * NPV8, NPV9.   Links to suggested [Interview for Student Reasoning](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/assessment-resources/ifsr) (IfSR) tasks:   * IfSR-NP: 4B.6. |

## Core lesson – playground planning – 45 minutes

The table below contains a suggested learning intention and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Core concept learning intention | Core concept success criteria |
| Students are learning to:   * interpret and compare data. | Students can:   * describe and interpret information presented in tally tables and column graphs * investigate how data is interpreted to make decisions. |

**Note:** Lessons 5–8 may provide opportunities for cross-curricular links to HSIE, science and PDHPE.

1. Pose the following scenario: The local playground equipment was damaged and cannot be used by the community members. The council are looking to redevelop the park. They need to interpret a range of data to ensure the new playground equipment meets the community’s needs.
2. Display [Resource 15 – council research](#_Resource_15_–). Explain that the council did observations and collected survey data. They did this to plan for the park’s redevelopment.
3. Ask the following questions:

* What do you notice about the information the council collected?
* What do the data displays have in common?
* Which data display is easiest to interpret? Why?

1. Draw attention to the many-to-one scale used in the ‘Favourite Playground Equipment’ and ‘Facilities and Infrastructure Priorities’ data displays. Explain that when the equal spaces (intervals) represent more than one item or response, it is called a many-to-one scale.

**Many-to-one scale**: a scale of many-to-one uses one unit or interval to represent more than one item or response.

1. Ask:

* Why do the equal spaces (intervals) on these data displays increase in fives and tens?
* When should data be presented using a many-to-one scale?
* What are some positives and negatives about using a many-to-one scale?

1. Provide students with one of the following: [Resource 16 – interpreting data 1](#_Resource_16_–), [Resource 17 – interpreting data 2](#_Resource_17_–) or [Resource 18 – interpreting data 3](#_Resource_18_–).
2. Students find a partner that has the same data display. Pairs analyse and interpret the data display and discuss the questions.
3. Allocate students to a new group, consisting of one representative for each data display. Each student shares their data display and answers with the group.
4. Regroup and ask the following questions:

* What information can be interpreted from each data representation?
* How can this data help inform the council’s plan to redevelop the park?
* Does the council need to collect any further data to inform the park plan?

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot **describe and interpret information presented in tally tables and column graphs.**   * Provide students with [Resource 17 – interpreting data 2](#_Resource_17_–). Support students to count the tally marks and record the total numerically.   Students cannot investigate how data is interpreted to make decisions.   * Students reflect on their own playground equipment preferences as a 6–9-year-old child. Consider how a park designed for 6 to 9-year-olds would differ from a park designed for 0 to 4-year-olds. | Students can **describe and interpret information presented in tally tables and column graphs.**   * Students create their own questions for a peer to answer based on the data sets.   Students can investigate how data is interpreted to make decisions.   * Provide students with access to the local council website. They investigate whether there are any current community consultation projects. |

## Discuss and connect the mathematics – 5 minutes

1. Display [Resource 19 – climbing equipment options](#_Resource_19_–). Explain that the councillor has analysed the data and has shortlisted 9 pieces of climbing equipment for the park. Ask the following questions:

* Which piece(s) of equipment would you recommend for this park? Why?
* Which option would not be appropriate for this park? Justify your decision.

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students describe and interpret information presented in tally tables and column graphs? **[MAO-WM-01, MA2-DATA-02]** * Can students investigate how data is interpreted to make decisions? **[MAO-WM-01, MA2-DATA-02]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * IRD3, IRD4. |

# Lesson 6

**Core concept**: interpreting data helps us solve problems and ask new questions.

## Daily number sense – 10 times larger – 10 minutes

The table below contains a suggested learning intention and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Daily number sense learning intention | Daily number sense success criteria |
| Students are learning to:   * recognise and represent numbers that are 10, 100 or 1000 times as large. | Students can:   * recognise the number of tens, hundreds or thousands in a number * describe how making a number 10, 100 or 1000 times as large changes the place value of digits. |

1. Provide pairs with [Resource 20 –10 times larger](#_Resource_20_–) and two 9-sided dice.
2. Pairs roll the dice and record the number rolled as a 2-digit number. For example, if a 6 and a 2 are rolled, the number 62 would be recorded.
3. Students record the numbers that are 10, 100 and 1000 times larger than the number rolled.
4. Repeat the process to complete the table on [Resource 20 –10 times larger](#_Resource_20_–).
5. Students create a reflection in workbooks to answer the following question: How does the number of tens in a number change when it is made 10 times larger? Students compare the 10 × and 100 × columns for one of the rolls on the gameboard to support the explanation. For example, 620 has 62 tens but when it becomes 6200, it has 620 tens.

**Note:** some students may appreciate further investigation using 3-digit numbers.

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students recognise the number of tens, hundreds or thousands in a number? **[MAO-WM-01, MA2-RN-01]** * Can students describe how making a number 10, 100 or 1000 times as large changes the place value of digits? **[MAO-WM-01, MA2-RN-01]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * NPV7, NPV8, NPV9.   Links to suggested [Interview for Student Reasoning](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/assessment-resources/ifsr) (IfSR) tasks:   * IfSR-NP: 4B.6. |

## Core lesson – conducting a small trial – 45 minutes

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Core concept learning intentions | Core concept success criteria |
| Students are learning to:   * interpret and compare data * select and trial methods for data collection. | Students can:   * investigate how data is interpreted to make decisions * refine survey questions as necessary after a small trial * compare the effectiveness of different methods of collecting and recording data. |

1. Explain that the local councillor wants to contact local teachers to check if the data is accurate. She is worried that the data on favourite playground equipment was from a range of ages. She wants to ask Stage 2 students what equipment they would like included in the plan.
2. Display [Resource 21 – councillor’s email](#_Resource_21_–). Explain that the councillor has drafted an email and is deciding on the best question to use. She has narrowed it down to 3 possible survey questions. Ask the following questions using prompts from the table below.

This table outlines stimulus prompts to generate conversation about the topic, along with anticipated responses from students.

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * What are the benefits of each question and why? | * For the first question, new and interesting ideas could be shared. The number of responses is not limited. For example, someone could share 10 pieces of equipment and someone else could share 3 pieces of equipment. * For the second question, there are 10 pieces of equipment which everyone can choose from. This would make collecting the data and interpreting the results easier. * For the third question, new and interesting ideas could be shared. Asking for one response only means that a student would pick their absolute favourite. |
| * What are the limitations of each question and why? | * For the first question, the results could include over 50 different pieces of equipment. When the results are interpreted, there may only be one person who recorded a particular piece of equipment, even though many people might like it but did not think to record it. * For the second question, there is a limit to the pieces of equipment and there is no option for you to share any other ideas. * For the first and third questions, students could call a piece of equipment different names. For example, slide or slippery dip. * For the second and third questions, having one response may not show enough difference between pieces of equipment. |

1. Explain that the councillor has decided to use the second question. She has asked your class teacher to provide feedback on the question by conducting a small trial with your class. This will enable the councillor to refine the survey question before using it with other schools.
2. Display [Resource 22 – trial survey question](#_Resource_22_–). Students discuss and share personal experiences of the 10 pieces of playground equipment.

**Note:** develop a common understanding of the options council have provided, to ensure all students can make an informed decision. For example, if a student has no firsthand experience with a ninja course, another student’s experience may support their understanding of why it could be a good option for the park plan.

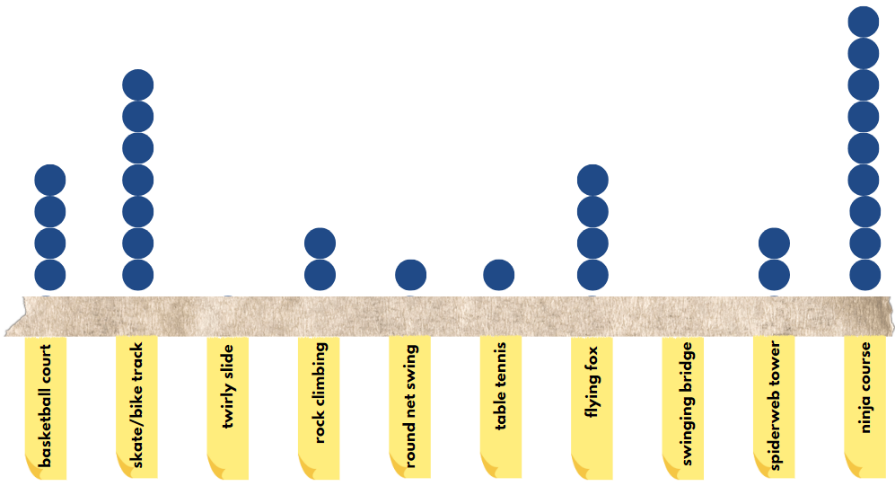
1. Make an x-axis with masking tape across the floor of the classroom. Label the axis by placing sticky notes with equipment names along the strip at equal intervals (see Figure 13).

Figure 13 – x-axis example



1. Provide each student with a blue counter. Explain that the counters will be used to create a dot plot of student responses.
2. Students place their counter above the playground equipment piece they would like included in the park plan (see Figure 14).

Figure 14 – equipment choices dot plot example



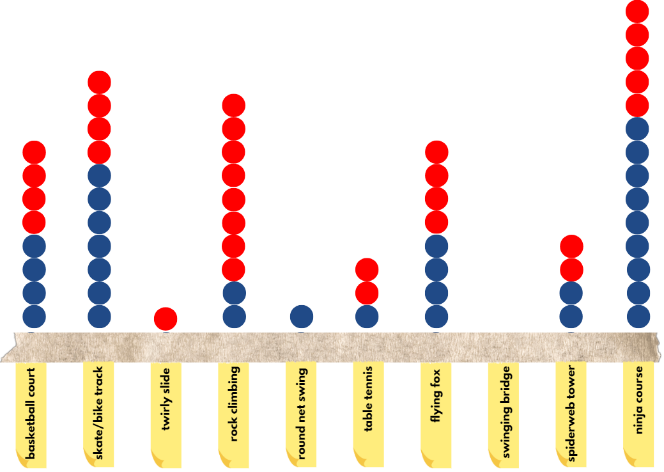
1. View the class dot plot and ask the following questions using the prompt boxes below.

This table outlines stimulus prompts to generate conversation about the topic, along with anticipated responses from students.

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * Is a dot plot an effective way to gather and display our class data? | * Using counters to create a dot plot was a very quick way of collecting data for our class. * The dot plot allows us to quickly see which playground equipment was the most popular. However, if we wanted to know how many students voted for each, it would require us to individually count each counter. A table or column graph would be easier to interpret. |
| * Would a dot plot be an effective way to gather and display data if 1000 people were surveyed? | * In a larger trial, this method of data collection would not be very effective or efficient. Counters could be knocked, not placed in a straight line or placed with inconsistent gaps between each one. * No, it would not be an effective data collection method. There could be hundreds of dots for each piece of equipment. It would be hard to create. It would also be difficult to interpret because it would take a long time to count the number of total votes for each piece of equipment. |
| * Which playground equipment piece was most popular and how does this compare with the data council presented in [Resource 18 – interpreting data 3](#_Resource_18_–)? | * Dependent on class results. |
| * Would our class data provide the council with enough information to inform the park plan? | * Our data only gives us information about what our class would like included in the plan. I think the council would need to ask more students in a larger trial to make the final decision. * No one wants to play in a park with only one piece of equipment. By only allowing students to vote once, the council will determine the most popular piece of equipment. If the council are planning to develop a whole park, they should ask students to select more than one option. |
| * Do you predict the data would change if everyone were able to vote for 2 pieces of equipment? Why or why not? | * I think the data could change if we were allowed to vote twice. It would give the council more information about the different pieces of equipment that should be included in the park. * The data might stay the same. For example, the same piece of equipment might still be the most popular. However, it would be more effective as it would better represent students’ preferences. This would help council to develop a plan that best suits the needs of the community. |

1. Provide each student with a red counter to add to the dot plot to indicate their second choice. Explain to students that they cannot vote for the same piece of equipment (see Figure 15).

Figure 15 – equipment choices dot plot example with 2 votes



1. Ask the following questions:

* Did the results change by giving students a second vote?
* If the dot plot used the same-coloured counters for both preferences, how would this affect the data's interpretation?

1. Take a photograph of the dot plot for use in [Lesson 7](#_Lesson_7_1).

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot compare the effectiveness of different methods of collecting and recording data.   * Support students to transfer the data from the dot plot into a tally table. Ask students to determine which method of recording data they find easier to interpret and justify their response. | Students can compare the effectiveness of different methods of collecting and recording data.   * Students use the data from the dot plot to create a table with 3 columns next to the equipment options, labelled ‘first choice’, ‘second choice’ and ‘total.’ Students analyse results to determine if separating the data by order of choice is more or less effective than grouping together in the total. |

## Discuss and connect the mathematics – 5 minutes

1. Discuss the effectiveness of the question the councillor posed. Ask the following questions:

* Should the councillor only allow students to make one choice when completing the survey?
* How could the question be refined to ensure the park meets community needs?
* Is there any other feedback our class could give to the councillor?

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students investigate how data is interpreted to make decisions? **[MAO-WM-01, MA2-DATA-02]** * Can students refine survey questions as necessary after a small trial? **[MAO-WM-01, MA2-DATA-02]** * Can students compare the effectiveness of different methods of collecting and recording data? **[MAO-WM-01, MA2-DATA-02]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * IRD3. |

# Lesson 7

**Core concept**: data can be interpreted to make decisions.

## Daily number sense – truth detective – 10 minutes

The table below contains a suggested learning intention and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Daily number sense learning intention | Daily number sense success criteria |
| Students are learning to:   * recognise and represent numbers that are 10, 100 or 1000 times as large. | Students can:   * describe how making a number 10, 100 or 1000 times as large changes the place value of digits. |

1. Display [Resource 23 – truth detective](#_Resource_23_–). Explain that Detective Solve-it needs help identifying the true statement.
2. Students [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645) to determine the true statement, providing justification for their choices.
3. Pairs create their own ‘truth detective’ scenarios involving numbers 10, 100 or 1000 times as large.

This table details an opportunity for assessment.

|  |  |
| --- | --- |
| Assessment opportunity | Links |
| What to look for:   * Can students describe how making a number 10, 100 or 1000 times as large changes the place value of digits?  **[MAO-WM-01, MA2-RN-01]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * NPV8, NPV9.   Links to suggested [Interview for Student Reasoning](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/assessment-resources/ifsr) (IfSR) tasks:   * IfSR-NP: 4B.6. |

## Core lesson – Rivenoak Public School – 45 minutes

The table below contains a suggested learning intention and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Core concept learning intention | Core concept success criteria |
| Students are learning to:   * construct and interpret data displays with many-to-one scales. | Students can:   * use a given many-to-one scale to represent discrete data in column graphs * use data in a spreadsheet to create column graphs with units on vertical axes that are in multiples * interpret and evaluate the effectiveness of various data displays found in media and in factual texts where displays represent data using a scale of many-to-one. |

1. Explain that after receiving feedback, the councillor refined the question and sent a survey to the Stage 2 classes at Rivenoak Public School (RPS). Students were allowed to vote for 2 pieces of playground equipment to be included in the council’s plan.
2. Display [Resource 24 – Rivenoak School’s results](#_Resource_24_–). Ask the following questions:

* In what ways are the RPS results similar or different to our class results? (refer to the photograph of the dot plot created in [Lesson 6](#_Lesson_6_1))
* 320 votes were submitted. How many students completed the survey? Justify your reasoning.
* How many more students voted for the ninja course than the basketball court?
* Based on our class data and Rivenoak’s data, which pieces of playground equipment do you think the council should include in the plan?

1. Explain that the councillor needs to present this information to the local community at the town meeting. She would like to present the information in a column graph. She has asked that the students in the class to create the graphs using software such as Microsoft Excel or Google Sheets.

**Note**: the instructions in step 10 revise how to create a graph in Microsoft Excel. Students entered a smaller data set in [Lesson 1](#_Lesson_1_1) and created a column graph, labelling the axes and changing the title. If students are confident using this software, step 7 can be completed independently rather than as a demonstration.

1. Demonstrate how to create a column graph in Microsoft Excel using RPS’s data.
2. Enter the data into a table (see Figure 16).
3. Highlight the data.
4. Select the **Insert tab** in the ribbon.
5. Click on the **Insert Column or Bar Chart** icon.
6. Select **Clustered Column** from the **2D Column** menu.
7. Change the title to ‘Rivenoak PS results’ by double-clicking on the text.
8. Right-click on the graph and select the **Chart Elements** icon.
9. Select **Axis Titles.**
10. Name the axes by double-clicking on the text.

Figure 16 – Rivenoak Public School’s results

A table with 2 columns and 10 rows.

In the first column, playground equipment pieces have been listed. In the second column, the number of votes received for each playground piece of equipment have been recorded. 

The results are: basketball court: 65, skate/bike track: 30, twirly slide: 23, rock climbing: 19, round net swing: 22, table tennis: 4, flying fox: 33, swinging bridge: 29, spider web tower: 16, ninja course: 79.

1. Provide pairs with digital devices. Students repeat the modelled steps to create a column graph, with a many-to-one scale, using Rivenoak Public School’s data.
2. Explain that the software automatically displays the information in a many-to-one scale with intervals of 10 on the y-axis. This can make comparing the data challenging.
3. In the **Chart Elements** icon, select **Data Labels** to add the numerical total for each category to the graph (see Figure 17).

Figure 17 – Rivenoak Public School Stage 2 results column graph

A column graph with the heading ‘Rivenoak PS Stage 2 and 3 results. 

On the x-axis, titled ‘Equipment’, there are 10 categories representing the playground equipment. 

On the y-axis, titled ‘Number of votes’, the equally spaced intervals are labelled with the numbers 0, 10, 20, 30, 40, 50, 60, 70, 80 and 90. 

The results are represented by red columns with the number of votes cast recorded in text at the top of the column. 

The results are: basketball court: 65, skate/bike track: 30, twirly slide: 23, rock climbing: 19, round net swing: 22, table tennis 4:, flying fox: 33, swinging bridge: 29, spider web tower: 16, ninja course: 79.

1. Ask the following questions:

* Why is labelling each category with a total useful when interpreting this graph?
* Would a many-to-one scale with intervals of 5 be more appropriate for this data set? Why or why not?

1. Students save their spreadsheet for future reference.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot use data in a spreadsheet to create column graphs with units on vertical axes that are in multiples.   * Students enter the class data from [Lesson 6](#_Lesson_6_1), into a table and column graph in Microsoft Excel or Google Sheets. Support students to create a column graph with scale intervals of one. | Students can use data in a spreadsheet to create column graphs with units on vertical axes that are in multiples.   * Students explore how to change the many-to-one scale of their graph in Microsoft Excel or Google Sheets. * Students create horizontal column graphs, with many-to-one scales, to represent Rivenoak Public School’s data. |

## Discuss and connect the mathematics – 5 minutes

1. Display [Resource 25 – many-to-one displays](#_Resource_25_–). Explain that both column graphs represent the same data, but the many-to-one scale is different.
2. Students [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645). Ask the following questions:

* Which many-to-one scale would be the best for this data set?
* Which many-to-one scale would be the best to display the combined data of all Stage 2 students from multiple local schools?
* Is the table useful to help interpret the many-to-one scale? Why or why not?

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students use a given many-to-one scale to represent discrete data in column graphs?  **[MAO-WM-01, MA2-DATA-01, MA2-DATA-02]** * Can students use data in a spreadsheet to create column graphs with units on vertical axes that are in multiples? **[MAO-WM-01, MA2-DATA-01, MA2-DATA-02]** * Can students interpret and evaluate the effectiveness of various data displays found in media and in factual texts where displays represent data using a scale of many-to-one? **[MAO-WM-01, MA2-DATA-02]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * IRD3, IRD4. |

# Lesson 8

**Core concept:** mathematicians interpret and evaluate the effectiveness of real-world data.

## Daily number sense – 10 minutes

1. From a class need surfaced through formative assessment data, identify a short, focused activity that targets students’ knowledge, understanding and skills. Example activities may be drawn from the following resources:

* [Mathematics K–6 resources](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources)
* [Universal Resources Hub](https://resources.education.nsw.gov.au/home).

## Core lesson – spin a playground – 35 minutes

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Core concept learning intentions | Core concept success criteria |
| Students are learning to:   * interpret and compare data * describe the likelihood of outcomes of chance events * identify when events are affected by previous events. | Students can:   * investigate how data is interpreted to make decisions * compare the likelihood of obtaining particular outcomes in a simple chance experiment by predicting, conducting the experiment and comparing the results with the prediction * compare events where the chance of one event occurring is affected by the occurrence of the other. |

**Note:** the spinner used in step 6 should be programmed prior to the lesson. To program the spinner, type the 10 equipment pieces: ninja course, spiderweb tower, swinging bridge, flying fox, table tennis, round net swing, rock climbing, twirly slide, bike/skate track and basketball court, into the text box. The ‘advanced mode’ option allows each outcome to be represented by a different colour, visually representing the equally likely probability of each category (see Figure 18).

Figure 18 – programmed spinner

The pre-programmed spinner with 10 options listed. 
The 10 equipment pieces are listed on a segment of the spinning wheel: ninja course , spiderweb tower, swinging bridge , flying fox, table tennis, round net swing, rock climbing, twirly slide, bike/skate track  and basketball court.


1. Explain that the councillor collected data from 3 local primary schools. They presented the findings to the community at the town meeting. The council’s budget allowed for 5 new pieces of playground equipment to be included in the new park. After analysing the data, the council decided to include a basketball court, ninja course, flying fox, rock climbing and bike/skate track.
2. Ask students to [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645) what the problems may have been if the council did not collect data to decide on the plan. These could include:

* the park would not meet community needs and wants
* community members may not use the park as often
* the community may be upset that there was no one surveyed.

1. Explain that in a different council, the councillor felt that surveying the local community would be too expensive and take too long. He decided to use a spinner to select the pieces of equipment to be included in the playground.
2. Display the pre-programmed [spinner](https://wheelofnames.com/). Explain that the councillor will spin the wheel 5 times to determine the playground equipment.
3. Students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) to discuss whether they agree or disagree with the following statements:

* Elijah says that it is impossible for the result to be 5 of the same equipment pieces.
* Ahmed says that it is equally likely that each item could be selected in the park plan.
* Jen states that if the spinner lands on rock climbing, it is unlikely it will be selected again.

1. Spin the spinner 5 times, selecting the **Close** button each time to ensure the outcome remains on the spinner for the following spins. Select the **Results** tab to view the results of the chance experiment.
2. Ask the following questions:

* What problems might occur if a random spinner is used to determine the playground equipment?
* How could the spinner be changed so that each piece of equipment is only selected once?

1. Explain that the spinner has the option to remove the selected playground equipment after each spin.

**Note:** this task allows students to conduct an experiment where the chance of one event occurring is affected by the occurrence of the other. When an outcome is not removed, the chance of each outcome occurring remains at one in 10. When an outcome is removed after each spin, although the remaining outcomes are equally likely, the likelihood increases to one in 9 for the second spin one in 8 for the third spin, and so on.

1. Explain that by removing the selected outcome after each spin, it is impossible for the same piece of equipment to be selected more than once.
2. Select **Clear the list** in the **Results** tab.
3. Return to the main screen by selecting the **Entries** tab.
4. Spin the spinner and select **Remove** to ensure the outcome is removed from the spinner prior to the next spin.
5. Repeat 4 times. Select the **Results** tab to view the results of the chance experiment.
6. Ask the following questions:

* How does removing an outcome after it has been randomly selected, impact the overall results?
* After each spin, should the councillor keep or remove the selected outcome? Why?

1. Ask students to turn and talk to determine which councillor’s strategy of developing the park plan was more effective (collecting and interpreting community data or using a spinner).
2. Revise the benefits of collecting and interpreting data to make decisions.
3. Explain that councils make decisions by collecting and interpreting data on:

* population: age, gender and number of people in the local area
* water usage: average consumption per local area
* microchipped pets: household pets registered with the council
* library circulation: number of items circulated by council libraries
* recycle rate: the amount of waste collected by council that does not go to landfill and is usually recycled.

1. Pairs select one of the above and provide reasons why it may be important for councils to collect data on these matters of interest.
2. Regroup and select students to share why it is important for the council to regularly collect data.

**Note:** if time permits, students may like to design an aerial view plan for the park based on the results of their chance experiment.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot compare events where the chance of one event occurring is affected by the occurrence of the other.   * Reduce the number of outcomes added to the spinner to 4. Spin the spinner 2 times (without removing outcomes after each spin) and record the results. Reset the spinner. Spin the spinner another 2 times, removing the selected outcome after each spin. Record the results. Explore how the possible outcomes changed in each experiment. | Students can compare events where the chance of one event occurring is affected by the occurrence of the other.   * Students brainstorm a list of events where the chance of one event occurring is affected by the other. For example, selecting a King from a deck of cards after 2 Kings have already been drawn. |

## Discuss and connect the mathematics – 15 minutes

1. Display [Resource 26 – chance examples](#_Resource_26_–). Explain that the chance images can be organised into 2 categories: events that are affected by previous events and events that are not affected by previous events.
2. In pairs, students select 2 chance images.
3. Pairs discuss and determine which category the chance event belongs in.

The table below outlines stimulus prompts to generate conversation about the topic, along with anticipated responses from students.

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * Flipping a coin | * The chance of the coin landing on heads is not affected by the previous flips. For example, if the coin lands on heads 3 times in a row, it still has an equal chance of landing on heads on the fourth flip. |
| * Selecting a card at random from a deck and keeping it | * Each card that is chosen at random affects the chance of another card being chosen. For example, if a Queen is drawn and removed from the deck, the chance of drawing another Queen is less likely. |
| * Rolling one die | * Rolling a 6 on the die does not affect the chance of rolling a 6 on the next roll. The chance of each number being rolled is not affected by previous events. |
| * Taking a lolly from the jar | * Removing a red lolly from the jar increases the chance of taking a yellow, green, pink or purple lolly next time. The chance of a lolly being chosen is affected by previous events. * If one red, one yellow and 2 green lollies are removed from the jar, this will affect the colour of the fifth lolly to be removed. A green lolly can no longer be chosen at random. |
| * Name drawn out of a hat | * Each class member’s name is placed in a hat. Names are drawn at random to allocate class jobs. If Ella’s name is drawn out of the hat and she is allocated the class job of ‘lunch order collector’, she no longer has a chance of being allocated the job of ‘office monitor’. The previous event (her name being drawn for a specific job) affects future events of job allocations. |
| * Game of bingo | * Each number that is chosen at random affects the chance of another number being chosen. For example, if 16 is drawn, the chance of drawing another 16 is impossible. |
| * Carnival prize wheel | * The spinning wheel has 18 prizes (represented by a number). Each prize is equally likely to be selected on each spin. It is possible to land on the same prize 2 times in a row if the prize is not removed from the wheel. The carnival organisers would need multiple prize items to make sure the winners can collect their prize. |
| * Craft stick student selector | * If a craft stick with a student name stays out of the jar until all other names in the class have been selected, then this would affect the chance of which names would be called. For example, if Emma’s name was drawn first and removed from the jar, the remaining students have an increased likelihood of being drawn on the next selection. It would be impossible for Emma’s name to be drawn on the next selection. * If a craft stick with a student name goes back in the jar after it has been drawn, the chance would not be affected. For example, if Harley’s name was drawn and put back in the jar, Harley has an equally likely chance of being drawn on the next selection. |

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students investigate how data is interpreted to make decisions? **[MAO-WM-01, MA2-DATA-02]** * Can students compare the likelihood of obtaining particular outcomes in a simple chance experiment by predicting, conducting the experiment and comparing the results with the prediction? **[MAO-WM-01, MA2-CHAN-01]** * Can students compare events where the chance of one event occurring is affected by the occurrence of the other? **[MAO-WM-01, MA2-CHAN-01]** | Links to [National Numeracy Learning Progressions](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (NNLP):   * IRD3 * UnC3. |

# Resource 1 – additive strategies

Explanations of 3 additive strategies. 

The first strategy is Landmark numbers. It has text that reads: “Friendly numbers” that are easy to work with fluently, flexibly and efficiently. For example, 5, 10, 100, 1000 and more.

The second strategy is Levelling. It has text that reads: Adjusting to landmark numbers to add efficiently. For example, Level 2 up, 2 down can be shown as 28 + 35 = 30 + 33 = 63.

The third strategy is Partitioning. It has text that reads: Splitting numbers into smaller parts to make calculations easier. For example:
45 + 33
= 40 + 5 + 30 + 3
= 70 + 8
= 78.

Explanations of 3 additive strategies.

The first strategy is Compensation. It has text that reads: Adjusting numbers to make a calculation more efficient. For example,
36 − 17
= 37 − 17 − 1
= 20 − 1
= 19.
There are arrows pointing to 37 with the words 'add 1' and to the number 17 with the words 'subtract 1' on the second line of the algorithm.

The second strategy is Commutative Property of Addition. It has text that reads: Two numbers can be added in any order and the sum is equivalent. For example, 28 + 35 = 35 + 28.

The third strategy is Inverse Operations. It has text that reads: Addition and subtraction are inverse operations. For example,
12 + 18 = 30
30 − 12 = 18
30 − 18 = 12.
The last 2 number sentences are complement principles. There is also a bar model with a rectangle at the top labelled 30 and 2 rectangles underneath it with the label 12 in one rectangle and the label 18 in the other.

Explanations of 3 additive strategies.

The first strategy is Constant Difference. It has text that reads: A common difference between pairs of numbers when completing subtraction. For example,
125 − 78 = 47
126 − 79 = 47
127 − 80 = 47.

The second strategy is Algorithms. It has text that reads: A set of written steps to calculate using partitioning and regrouping for the algorithm 364 minus 39.

The third strategy is Associative Property of Addition. It has text that reads: More than two numbers can be added in any order to make it more efficient. For example,
22 + 13 + 8
= 22 + 8 + 13
= 30 + 13
= 43.

An additive strategy called Equivalence. It has text that reads: Different equations can have the same value. For example, 28 + 50 = 58 + 20. The ‘=’ symbol means ‘the same value as’.

There is also an example bar model. There is a rectangle with the label 78 in the top bar. The second bar has 2 rectangles with the label 28 in one rectangle and the label 50 in the other. The third bar has 2 rectangles with the label 58 in one rectangle and the label 20 the other.

# Resource 2 – word problem

Question states: There are 58 students in Year 3. 39 of them spend lunch time on the oval playing ball games. The remaining students play under the COLA. 

How many students play under the COLA?

Underneath the question are 2 images: a group of various sporting balls and a hopscotch game. 

# Resource 3 – bar models

Three bar models labelled A, B and C. Each model has 2 rows of equal length to show the part-part-whole relationship.

Bar Model A has 77 on the top row.  On the second row, the bar is split, with 56 on the left side and a question mark on the right side.

Bar Model B has 83 on the top row.  On the second row, the bar is split, with 56 on the left side and a question mark on the right side. 

Bar Model C has 49 on the top row. On the second row, the bar is split, with 12 on the left side and a question mark on the right side.

# Resource 4 – Stage 2 house groups

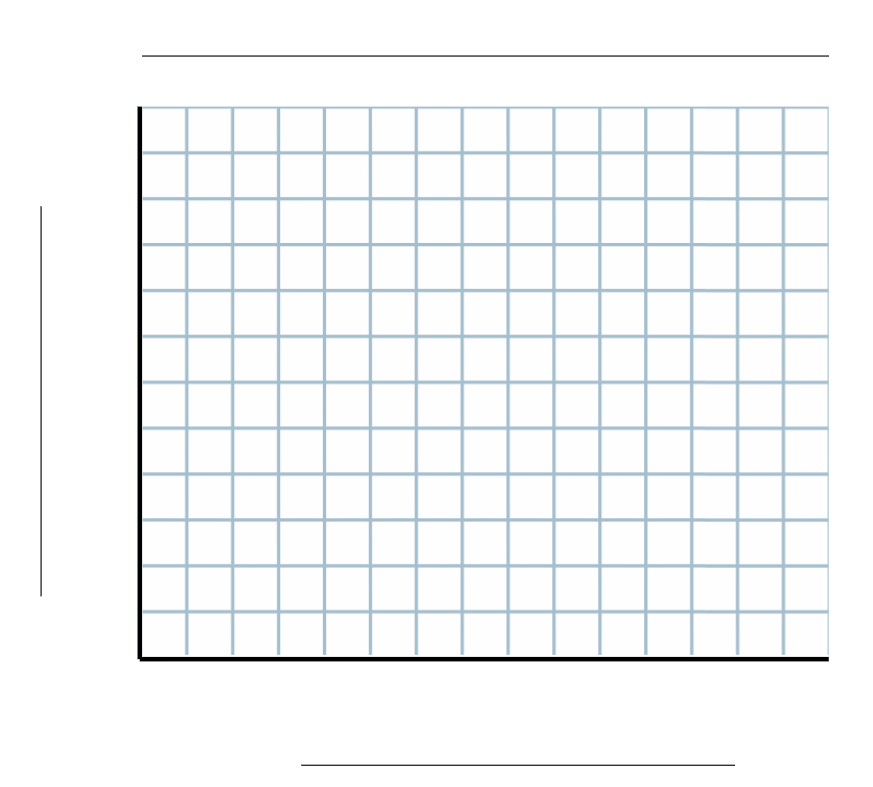
Stage 2 house groups data for 4 different classes, each displayed differently. 
3A's house group data is displayed in a tally table. Koalas has 8 tally marks, Kangaroos has 7 tally marks, Emus has 6 tally marks, Wombats has 8 tally marks. 
3B's house group data is displayed as a class roll, with the house group listed next to student names. There are 8 students in the Wombats house, 9 students in the Koalas house, 7 students in the Emus house and 4 students in the Kangaroos house.
4C's house group data is displayed as a column graph with 1 to 1 intervals, from 1 to 12. The column labelled Kangaroos has 4 students. The column labelled Emus has 6 students. The column labelled Wombats has 11 students. The  column labelled Koalas has 9 students. 
4D's house group data is displayed as a handwritten list on a torn off piece of note paper. The number of each students are written next to the name of each house. Kangaroos 9, Koalas 8, Emus 6 and Wombats 7.


# Resource 5 – house group allocations

Two tables titled: 'Class results' and 'Our results'. Each table has the House groups in the first column: Wombats, Koalas, Emus and Kangaroos. 

The other 3 columns have been left blank for students to complete and are titled 'Predicted results', 'Actual results tally' and 'Actual results total'.

# Resource 6 – column graph



# Resource 7 – chance scale

A line representing a scale with: impossible, unlikely, equally likely, likely and certain, marked and labelled at equal points on the scale. 

Five additional vocabulary cards are in  text boxes below. These say: less likely, possible, least likely, most likely and more likely.


# Resource 8 – mystery lunch

Two digital devices upright on a canteen counter. 
The first digital device screen has the heading ‘food’. Underneath, is a spinner with 4 equal segments, labelled and an image of each outcome: chicken burger, avocado sushi, vegetarian lasagne and hotdog. 

A black arrow pinned from the middle of the spinner points to the hotdog segment. Underneath the spinner is a red spin button. 

The second digital device screen has the heading ‘drink’. Underneath is a spinner with 2 equal segments, labelled and with an image of each outcome: water and apple juice. 

A black arrow pinned from the middle of the spinner points to the apple juice segment. Underneath the spinner is a red spin button.

# Resource 9 – lunch combinations

A table with 3 rows and 5 columns. 

The top row represents the food outcomes with images of a chicken burger, an avocado sushi roll, a hotdog and a vegetarian lasagne, one in each column. 

The drink outcomes represented in the first column are an apple juice and a water, one in each row.

# Resource 10 – 3B's lunch selections

A column graph with a grid paper background titled ‘3B's Lunch Selections’ displays the lunch combinations spun in the class experiment. 

The x-axis, labelled ‘Lunch combinations’, has 8 categories displayed in grey columns, each separated by a column width.

The y-axis, labelled ‘Number of students’, is marked in equal intervals using a 1 to 1 scale, up to 10.

Data for the combinations shows: 

Chicken burger and water has 5 students.

Chicken burger and juice has 4 students.

Avocado sushi and water has 4 students.

Avocado sushi and juice has 3 students.

Hotdog and water has 5 students.

Hotdog and juice has 6 students.

Vege lasagne and water has 1 student.

Vege lasagne and juice has 3 students.

Under the graph are questions for students to answer on the provided lines.

Question 1: How many students participated in the experiment?

Question 2: How many students received a chicken burger?

Question 3: How many more hotdogs were given to students than avocado sushi?

Question 4: Which combinations had an equal result? 

Question 5: Which combinations were selected less than vegetarian lasagne and juice? 

Question 6: Which combination was given to 6 students? 

Question 7: Which statement is true? 

(a) More students were given avocado sushi and water than chicken burger and juice. 

(b) The number of students who received juice was equal to the number of students who received water. 

(c) The hot dog and water combination was selected the most. 

(d) Meat options were selected less than vegetarian options.

# Resource 11 – dice sums

A table that shows the sum of 2 numbers when 2 dice are rolled. The y-axis is labelled 'First die' and the x-axis is labelled 'Second die'. 

There is a plus sign in the cell where the header row and columns intersect, and the numbers 1–6 are written in the header rows along the x- and y-axes. 

The numbers in the header row and column show the possible outcomes when one die is rolled. Where the 2 numbers meet, the sum of the 2 is recorded.


# Resource 12 – true or false

A heading stating ‘True or False’ is at the top of the page. 

There are 6 boxes below which are numbered. There is one question in each of the 6 numbered boxes. 

1. Each outcome (sum) has an equally likely chance of occurring. 

2. 5 is more likely to occur than 3. 

3. 2 and 12 are least likely to occur. 

4. 5 and 8 are equally likely to occur. 

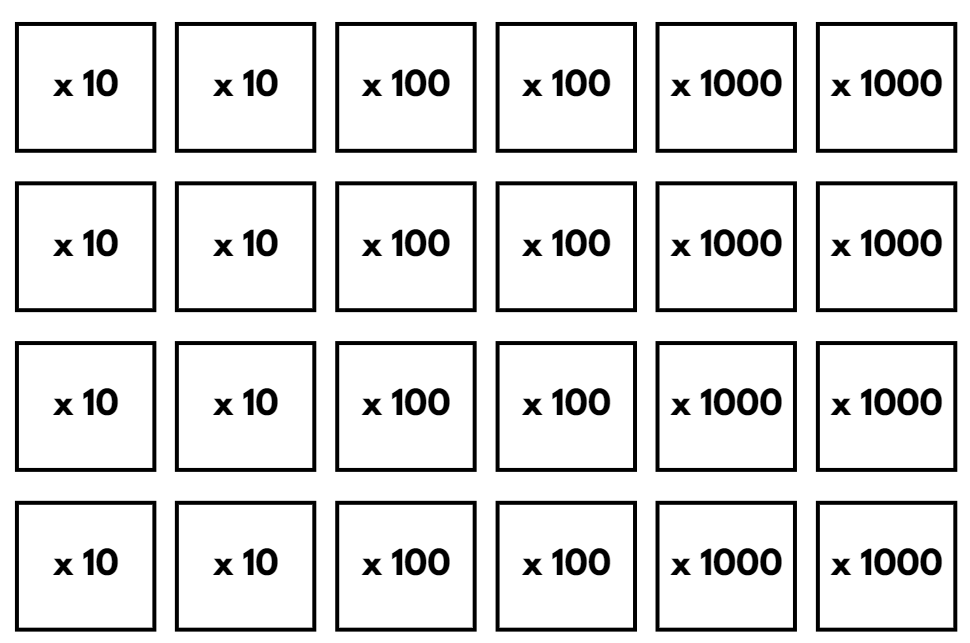
5. 6 is less likely to occur than 8. 

6. 1 is a possible outcome.

# Resource 13 – race to win

A gameboard organised in a grid. 
The first column has 12 boxes with the numbers 1–12, a number in each row. This axis is labelled 'Lane number (sum of dice)'.
The second column is filled red with the word 'start'. A grid of 6 ×12 white squares follows the red start line. This is followed by a black and white checked finish line. 
The white grid has the numbers 2–6 under each column and the title 'number of times rolled'.

# Resource 14 – place value cards



# Resource 15 – council research

Three data displays are represented. 
A horizontal bar graph titled ‘Favourite playground equipment’ shows the number of responses recorded on the x-axis in intervals of 5 from zero to 65. 

Equipment categories are listed on the y-axis with the categories: ball game facilities, swings, skate and bike ramp, climbing equipment and slides. 

Ballgame facilities is represented by a green bar and shows 60 responses. 

Swings is represented by a pink bar and shows 15 responses. 

Skate and bike ramp is represented by a blue bar and shows 25 responses. 

Climbing equipment is represented by a purple bar and shows 60 responses and slides is represented by a yellow bar and shows 40 responses.

A tally table titled ‘Playground User Information’, with the heading ‘Age of children using another local playground (Saturday 3:00 PM–4:00 PM)’ is recorded in the top row merged cell. 

In the first column, the age ranges of 0–2, 3–5, 6–9, 10–13, 14+ have been recorded in 5 rows.

In the 0–2 range, there are 16 tally marks. In the 3–5 age range, there are 20 tally marks. 

In the 6–9 age range, there are 28 tally marks. In the 10–13 range, there are 10 tally marks. In the 14 plus range, there are 7 tally marks. 

A many-to-one column graph titled ‘Facilities and Infrastructure Priorities’ is shown with green columns. Facilities are represented pictorially with icons and in text on the x-axis. 

The facilities include: shade, toilets, water station, bins, parking, seating, fencing and BBQ. On the y-axis the number of votes is represented in equal intervals increasing by tens with the numbers 0, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. 

Shade has 95 votes, toilets have 100 votes, water station has 70 votes, bins have 45 votes, parking has 10 votes, seating has 40 votes, fencing has 35 votes, barbecue has 5 votes. 

Under the table the text ‘100 people were surveyed an asked to select their top 4 facilities they would like at the playground’ is written.

# Resource 16 – interpreting data 1

A many-to-one column graph titled ‘Facilities and infrastructure priorities’ is shown with green columns. Facilities are represented pictorially with icons and in text on the x-axis. The facilities include: shade, toilets, water station, bins, parking, seating, fencing and BBQ. On the y-axis the number of votes is represented in equal intervals increasing by tens with the numbers 0, 10, 20, 30, 40, 50, 60, 70, 80, 90 and, 100. Shade has 95 votes, toilets have 100 votes, water station has 70 votes, bins have 45 votes, parking has 10 votes, seating has 40 votes, fencing has 35 votes, barbecue has 5 votes. 
Under the table the text ‘100 people were surveyed an asked to select their top 4 facilities they would like at the playground’ is written. 

Questions:
1. How many people were surveyed?
2. Do you think adults or children were surveyed? Why? 
3. Toilets are one of the most important facilities for everyone surveyed. Why is this important to know? What decisions could this impact? 
4. If respondents were only able to select only one option, how would this change the data?   
5. How many facilities received more than 50 votes?  

# Resource 17 – interpreting data 2

A tally table titled ‘Playground User Information’, with the heading ‘age of children using another local playground (Saturday 3:00 PM – 4:00 PM)’ is recorded in the top row merged cell. In the first column, the age ranges of 0–2, 3–5, 6–9, 10–13, 14+ have been recorded in 5 rows.
In the 0–2 range there are 16 tally marks. In the 3–5 age range there are 20 tally marks. In the 6–9 age range there are 28 tally marks. In the 10–13 range there are 10 tally marks. In the 14 plus range there are 7 tally marks. 
Questions:
1. How many children were at the playground at the time the data was collected?
2. This data was collected over a period of one hour on one day. How might the data change if the data was collected at different times and on different days?
3. 6-9 year olds used the park the most at on the day the data was collected. Why is this important to know? What decisions could this impact?  
4. Which age groups had more than 10 children at the playground?
5. How many children under 5 attended the playground?

# Resource 18 – interpreting data 3

A horizontal bar graph titled ‘Favourite playground equipment’ shows the number of responses recorded on the x-axis in intervals of 5 from zero to 65. Equipment categories are listed on the y-axis with the categories: ball game facilities, swings, skate and bike ramp, climbing equipment and slides. Ballgame facilities is represented by a green bar and shows 60 responses. Swings is represented by a pink bar and shows 15 responses. Skate and bike ramp is represented by a blue bar and shows 25 responses. Climbing equipment is represented by a purple bar and shows 60 responses, and slides is represented by a yellow bar and shows 40 responses.

Questions:
1. How many people responded to this survey?
2. What question do you think the community was asked to gather this information? 
3. Who do you think completed this survey, adults or children? How might this change the data?
4. Why has a many-to-one data display been used to present this information? 
5. How many more people want ball game facilities than swings?

# Resource 19 – climbing equipment options

Nine images of climbing equipment have been represented in a table. 
1. a spherical climbing net. 
2. a rock climbing wall 
3. a high ropes course
4. yellow monkey bars
5. wooden slanted bridge with rock climbing holds
6. ladder and spider net climbing equipment
7. a rope bridge
8. pyramid climbing net 
9. a tunnel tube.


# Resource 20 – 10 times larger

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Number rolled** | **× 10** | **× 100** | **× 1000** |
| *Example* | *62* | *620* | *6200* | *62 000* |
| Roll 1 |  |  |  |  |
| Roll 2 |  |  |  |  |
| Roll 3 |  |  |  |  |
| Roll 4 |  |  |  |  |
| Roll 5 |  |  |  |  |
| Roll 6 |  |  |  |  |
| Roll 7 |  |  |  |  |
| Roll 8 |  |  |  |  |

# Resource 21 – councillor’s email

A screenshot of an email that has been composed. At the top, is a blue banner with an image of an envelope and the text ‘New message’. 
The ‘To’ field has the email address: you teacher@education.nsw.gov.au.
The subject line states: ‘Council park development plan’
The email content is: Potential survey questions: 

1. What playground equipment pieces would you like included in the park plan? List all ideas. 

2. Which of the following playground equipment pieces would you like included in the plan: basketball court, twirly slide, rock climbing, skate or bike track, ninja course, table tennis, round net swing, swinging bridge, flying fox and spider web tower? Select one option. 

3. Which piece of playground equipment do you enjoy the most when visiting a local park? Record your favourite option.

# Resource 22 – trial survey question

A poster asking ‘Which of the following playground equipment pieces would you like included in the park plan? Select one option. The options (with included images) are:
Basketball court, twirly slide, flying fox, rock climbing, swinging bridge, round net swing, spiderweb tower, skate/bike track, table tennis and ninja course.


# Resource 23 – truth detective

The heading banner contains an image of a male cartoon detective. To the right of the detective image is the heading, ‘Truth detective’. Underneath the heading banner, instruction text states: ‘Help Detective Solve-It identify the true statement. Be prepared to justify your choice.’ 
There are 3 choices, A, B and C as follows:
A: ‘Alex has $285 in their bank account. Jesse has $2850 in his bank account. Jesse has 100 times as much money as Alex.’ 
B: ‘Kel made 165 friendship bracelets. Denise made 1650. Denise made 10 times more bracelets than Kel.’ 
C: ‘Warwick collected 152 trading cards. Paul collected 1520 trading cards. Paul has 1000 times the number of cards that Paul has.’ 


# Resource 24 – Rivenoak School’s results

On the left hand side of the page is a clipboard with the following text: ‘Which of the following playground equipment pieces would you like included in the park plan? Select 2 options.’

Underneath this text are square tick boxes with the options: basketball court, skate/bike track, twirly slide, rock climbing, round net swing, table tennis, flying fox, swinging bridge, spider web tower and ninja course. 

On the right-hand side of the page, are the Rivenoak Public School Stage 2 student responses represented in a table. 

The first column indicates the type of equipment and the second column indicates the number of votes received. 

Results in the table are: basketball court: 65 votes, skate bike/track: 30 votes, twirly slide: 23 votes, rock climbing: 19 votes, round net swing: 22 votes, table tennis: 4 votes, flying fox: 33 votes, swinging bridge: 29 votes, spider web tower: 16 votes and ninja course: 79 votes.

# Resource 25 – many-to-one displays

Two many-to-one column graphs are positioned side-by-side above a table. On the left is a column graph with the heading ‘Rivenoak PS Stage 2 results’. On the x-axis, titled ‘Equipment’ there are 10 categories representing the playground equipment. On the y-axis, titled ‘Number of votes’ the equally-spaced intervals are labelled with the numbers 0, 10, 20, 30, 40, 50, 60, 70, 80 and 90. The results are represented by red columns. The results are: basketball court 65, skate/bike track 30, twirly slide 23, rock climbing 19, round net swing 22, table tennis 4, flying fox 33, swinging bridge 29, spider web tower 16, ninja course 79.
On the right, is a column graph with the heading ‘Rivenoak PS Stage 2 results’. On the x-axis, entitled ‘Equipment’ there are 10 categories representing the playground equipment. On the y-axis, entitled ‘Number of votes’ the equally-spaced intervals are labelled with the numbers 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80 and 85. The results are represented by blue columns. The results are: basketball court 65, skate/bike track 30, twirly slide 23, rock climbing 19, round net swing 22, table tennis 4, flying fox 33, swinging bridge 29, spider web tower 16, ninja course 79.
Below the column graphs is a table with 2 columns and 10 rows. In the first column playground equipment pieces have been listed in the second column the number of votes received for each playground piece of equipment have been recorded. The results are: basketball court 65, skate/bike track 30, twirly slide 23, rock climbing 19, round net swing 22, table tennis 4, flying fox 33, swinging bridge 29, spider web tower 16, ninja course 79.


# Resource 26 – chance examples

Eight cards representing chance examples as follows:
Flipping a coin, selecting a card at random from a deck and keeping it, rolling a die, taking a lolly from the jar, name drawn out of a hat to allocate class jobs, game of bingo, carnival prize wheel and craft stick student selector.


# Syllabus outcomes and content

The table below outlines the [syllabus outcomes](https://curriculum.nsw.edu.au/learning-areas/mathematics/mathematics-k-10-2022/overview) and range of relevant syllabus content covered in this unit. Content is linked to [National Numeracy Learning Progression](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) (version 3).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcomes and content | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **Representing numbers using place value B:** Whole numbers:Recognise and represent numbers that are 10, 100 or 1000 times as large  **MAO-WM-01, MA2-RN-01** |  |  |  |  |  |  |  |  |
| * Recognise the number of tens, hundreds or thousands in a number |  |  |  |  |  | x |  |  |
| * Describe how making a number 10, 100 or 1000 times as large changes the place value of digits |  |  |  |  | x | x | x |  |
| **Additive relations A:** Recognise and explain the connection between addition and subtraction  **MAO-WM-01, MA2-AR-01, MA2-AR-02** |  |  |  |  |  |  |  |  |
| * Use number relation principles to solve related problems | x | x |  |  |  |  |  |  |
| * Demonstrate how addition and subtraction are inverse operations | x | x | x |  |  |  |  |  |
| * Explain and check solutions to problems, including by using the inverse operation |  |  | x |  |  |  |  |  |
| **Data A:** Organise and display data using tables and graphs  **MAO-WM-01, MA2-DATA-01** |  |  |  |  |  |  |  |  |
| * Create a list or table to organise the data | x | x |  |  |  |  |  |  |
| * Construct column graphs (with scale intervals of 1) and dot plots using relevant software where appropriate | x | x |  | x |  |  |  |  |
| * Mark equal spaces (intervals) on axes, name and label axes and choose appropriate titles for column graphs |  | x |  |  |  |  |  |  |
| **Data A:** Interpret and compare data  **MAO-WM-01, MA2-DATA-01, MA2-DATA-02** |  |  |  |  |  |  |  |  |
| * Describe and interpret information presented in tally tables and column graphs | x |  |  |  | x |  | x |  |
| * Investigate how data is interpreted to make decisions |  |  |  |  | x | x | x | x |
| * Represent the same dataset using more than one type of display and compare the displays (Statistical reasoning) | x |  |  |  |  |  | x |  |
| **Data B:** Select and trial methods for data collection  **MAO-WM-01, MA2-DATA-01, MA2-DATA-02** |  |  |  |  |  |  |  |  |
| * Refine survey questions as necessary after a small trial |  |  |  |  |  | x |  |  |
| * Compare the effectiveness of different methods of collecting and recording data | x |  |  |  |  | x |  | x |
| **Data B:** Construct and interpret data displays with many-to-one scales  **MAO-WM-01, MA2-DATA-01, MA2-DATA-02** |  |  |  |  |  |  |  |  |
| * Use a given many-to-one scale to represent discrete data in column graphs |  |  |  |  |  |  | x |  |
| * Use data in a spreadsheet to create column graphs with units on vertical axes that are in multiples |  |  |  |  |  |  | x |  |
| * Interpret and evaluate the effectiveness of various data displays found in media and in factual texts where displays represent data using a scale of many-to-one |  |  |  |  | x |  | x |  |
| **Chance A:** Identify possible outcomes from chance experiments  **MAO-WM-01, MA2-CHAN-01** |  |  |  |  |  |  |  |  |
| * Use the term *outcome* to describe any possible result of a chance experiment |  | x | x |  |  |  |  | x |
| * Record all possible outcomes in a chance experiment where the outcomes are equally likely |  | x | x |  |  |  |  |  |
| * Record all possible combinations in a chance situation where the outcomes are equally likely |  |  | x |  |  |  |  |  |
| * Predict the number of times each outcome might occur in a chance experiment involving a set number of trials |  | x |  |  |  |  |  | x |
| * Conduct experiments and compare the predicted and actual results where the outcomes are equally likely |  | x |  |  |  |  |  | x |
| **Chance B**: Describe the likelihood of outcomes of chance experiments  **MAO-WM-01, MA2-CHAN-01** |  |  |  |  |  |  |  |  |
| * Use the terms equally likely, likely and unlikely to describe the chance of everyday events occurring |  | x | x | x |  |  |  | x |
| * Compare the likelihood of obtaining particular outcomes in a simple chance experiment by predicting, conducting the experiment and comparing the results with the prediction |  | x |  | x | x |  |  | x |
| **Chance B:** Identify when events are affected by previous events  **MAO-WM-01, MA2-CHAN-01** |  |  |  |  |  |  |  |  |
| * Identify and discuss events where the chance of one event occurring will not be affected by the occurrence of the other |  | x | x | x |  |  |  | x |
| * Compare events where the chance of one event occurring is affected by the occurrence of the other |  |  | x |  |  |  |  | x |

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