Mathematics Stage 2 – Unit 16

Fractions represent multiple ideas and can be represented in different ways

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# Unit description and duration

This unit develops the big idea that fractions represent multiple ideas and can be represented in different ways.

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

* identify fractional parts and complementary parts of a length
* model and represent unit fractions, and their multiples, to a complete whole on a number line
* explore equivalence and multiplicative relationships of fractions.

## 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-MR-01** represents and uses the structure of multiplicative relations to 10 × 10 to solve problems
* **MA2-PF-01** represents and compares halves, quarters, thirds and fifths as lengths on a number line and their related fractions formed by halving (eighths, sixths and tenths)

## 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:

* using concrete materials such as fraction strips and fraction walls to model, label and describe fractions
* using representations, such as drawings, diagrams and/or words to explore a half, a quarter or an eighth, and explain their thinking
* identifying and describing patterns.

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.

# 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)  **Daily number sense learning intention:**   * model and represent unit fractions, and their multiples, to complete a whole on a number line | **Lesson core concept**: a fraction is part of a whole.  **Core concept learning intention:**   * model and represent unit fractions, and their multiples, to a complete a whole on a number line | **Lesson duration**: 60 minutes   * [Resource 1 – Is it half?](#_Resource_1_–) * Masking tape * Paper strips * String * Writing materials |
| [**Lesson 2**](#_Lesson_2)  **Daily number sense learning intention:**   * model and represent unit fractions, and their multiples, to complete a whole on a number line | **Lesson core concept**: bar models and fractions strips can be used to represent fractions.  **Core concept learning intentions**:   * model and represent unit fractions, and their multiples, to a complete whole on a number line * generate and describe patterns | **Lesson duration**: 60 minutes   * [Resource 2 – Is he correct?](#_Resource_2_–) * Glue * Paper strips * Workbooks or grid paper * Writing materials |
| [**Lesson 3**](#_Lesson_3)  **Daily number sense learning intention:**   * model and represent unit fractions, and their multiples, to complete a whole on a number line | **Lesson core concept**: fractions can be represented as measures by partitioning length.  **Core concept learning intentions**:   * create fractional parts of a length using techniques other than repeated halving * model and represent unit fractions, and their multiples, to a complete whole on a number line | **Lesson duration**: 60 minutes   * [Resource 3 – fractured fraction wall 1](#_Resource_3_–) * [Resource 4 – fractured fraction wall 2](#_Resource_4_–) * [Resource 5 – fraction wall](#_Resource_5_–) * Glue * Paper strips * Workbooks or grid paper * Writing materials |
| [**Lesson 4**](#_Lesson_4_1)  **Daily number sense learning intention:**   * teacher-identified task based on student needs | **Lesson core concept**: bar models and fractions strips can be used to represent fractions.  **Core concept learning intentions**:   * create fractional parts of a length using techniques other than repeated halving * model and represent unit fractions, and their multiples, to a complete whole on a number line * generate and describe patterns | **Lesson duration**: 60 minutes   * Glue * Paper strips * Workbooks or grid paper * Writing materials |
| [**Lesson 5**](#_Lesson_5)  **Daily number sense learning intention:**   * recall multiplication facts of 2 and 4, 5 and 10 and related division facts | **Lesson core concept**: equivalent fractions have related denominators.  **Core concept learning intentions**:   * model and represent unit fractions, and their multiples, to a complete whole on a number line * model equivalent fractions as lengths * represent fractional quantities equal to and greater than one | **Lesson duration**: 60 minutes   * [Resource 5 – fraction wall](#_Resource_5_–) * [Resource 6 – gameboard and spinners](#_Resource_6_–) * 10-sided dice * Counters * Individual whiteboards * Paper clips * Workbooks * Writing materials |
| [**Lesson 6**](#_Lesson_6)  **Daily number sense learning intention:**   * recall multiplication facts of 2 and 4, 5 and 10 and related division facts | **Lesson core concept**: equivalent fractions have related denominators.  **Core concept learning intentions**:   * generate and describe patterns * model equivalent fractions as lengths | **Lesson duration**: 60 minutes   * [Resource 5 – fraction wall](#_Resource_5_–) * [Resource 7 – Which doesn't belong?](#_Resource_7_–) * Website: [Polypad – The Mathematical Playground](https://polypad.amplify.com/) * Writing materials |
| [**Lesson 7**](#_Lesson_7)  **Daily number sense learning intention:**   * recall multiplication facts of 2 and 4, 5 and 10 and related division facts | **Lesson core concept**: identifying a complementary fractional part is needed to complete one whole.  **Core concept learning intention:**   * model and represent unit fractions, and their multiples, to a complete whole on a number line | **Lesson duration**: 60 minutes   * [Resource 8 – word problems](#_Resource_8_–) * [Resource 9 – recreate](#_Resource_9_–) the whole * [Resource 10 – recreate the whole memory](#_Resource_10_–) * Individual whiteboards * Writing materials |
| [**Lesson 8**](#_Lesson_8)  **Daily number sense learning intention:**   * teacher-identified task based on student needs | **Lesson core concept**: fractional quantities can be equal to and greater than one.  **Core concept learning intentions**:   * model and represent unit fractions, and their multiples, to a complete whole on a number line * represent fractional quantities equal to and greater than one | **Lesson duration**: 60 minutes   * [Resource 11 – chocolate bars](#_Resource_11_–) * [Resource 12 – blocks of chocolate](#_Resource_12_–) * [Resource 13 – number lines](#_Resource_13_–) * **Writing materials** |

# Lesson 1

**Core concept**: a fraction is part of a whole.

## Daily number sense – Is it half? – 10 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:   * model and represent unit fractions, and their multiples, to complete a whole on a number line. | Students can:   * model fractions with fraction strips and diagrams for halves. |

1. Revise that the term 'half' can be used in everyday language as well as in the mathematics classroom.
2. Students [Think-Pair-Share](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/645) to provide examples of the term ‘half’ being used in both contexts. For example, the phrases ‘half a sandwich’, ‘8-and-a-half years old’ and ‘half-back in a rugby league match’ use the term ‘half’ in everyday language. ‘Half a length of wood’, ‘half a cup of flour’ and ‘half a collection of counters’ are precise mathematical terms which describe 2 equal-sized parts.
3. Remind students that when the word ‘half’ is used in mathematics, it is a precise measurement which requires the creation of 2 equal-sized parts.
4. Display [Resource 1 – Is it half?](#_Resource_1_–)
5. In pairs, students determine which of the children have provided an example of half, justifying their choices.
6. Give each student a strip of paper and ask them to model half.
7. Discuss the conditions that need to be present for their folding to be considered half, such as 2 equal parts and accurate folding.

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students model fractions with fraction strips and diagrams for halves? **[MAO-WM-01, MA2-PF-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):   * InF2, InF3, InF4. |

## Core lesson – halves, quarters and eighths – 40 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:   * model and represent unit fractions, and their multiples, to a complete a whole on a number line. | Students can:   * model fractions with fraction strips for halves, quarters and eighths. |

**Note:** in Stage 2, fractions are represented by partitioning lengths. This enables students to measure with partitioned unit fractions. Stage 2 focuses on fractions with denominators of 2, 3, 4, 6 and 8, as well as 5 and 10. They are represented as measures by partitioning lengths.

1. Prior to the lesson, place masking tape strips of various lengths around the classroom. These could be placed on tables, floors or walls. Ensure there are enough strips for pairs of students to each have one.
2. Review student understanding of fractions.
3. Remind students that fractions can be recorded in words or with symbols. Display the symbol for one-half (see Figure 1). Explain that the 2 shows how much the whole is (2 parts) and the 1 shows how many equal parts of the whole are selected (1 part).

Figure 1 – fraction notation

A rectangle, labelled 'whole' is split down the middle with a dotted line. 1/2 has been written in each half. There are arrows pointing to each number.
An arrow points to 1 and states 'How many parts of the whole we have is written at the top of the symbol'.
An arrow points to 2 and states that "How much" is needed for the whole is written at the bottom of the symbol'. Two arrows point to each half and are labelled: 'There are 2 equal parts called half.'

**Note:** use language that will assist students to develop early fraction ideas. For example, rather than saying ‘1 over 2’, ‘1 of 2’ or ‘1 on 2’ (describing the symbol only), refer to the fractional relationship by saying ‘one half of the whole strip’. The teaching advice states that the terms ‘numerator’ and ‘denominator’ are used in Stage 3.

1. Remind students that to halve a length, 2 equal-sized parts must be created.
2. Ask students to determine how they would find half of a length if they were unable to fold it.
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 a partner to identify other ways to find half.
4. In pairs, students choose one of the masking tape lengths. Pairs estimate half of the length without folding, by making a pencil mark and recording their initials where they believe the halfway point to be. Pairs should use visualisation to help them estimate halfway. Encourage students to justify their placement of the halfway mark.

**Note:** visualisation is used throughout this lesson as a technique to support student understanding of the thirding and fifthing strategy in Lessons 3 and 4.

1. Each pair repeats this process for 4 other masking tape lengths.
2. Regroup and ask:

* How did you estimate the halfway point on the masking tape strips?
* Did you find locating the halfway point on any of the strips challenging? Why or why not?

1. Revise that half is the precise creation of 2 equal parts, so the marks recorded on each strip are estimations of the halfway point. To determine the precise halfway point, students use a piece of string to fold and check their estimates.
2. Pairs cut a piece of string that is the same length as one of the masking tape strips. Using the string, pairs accurately measure and mark half by drawing a line with a marker or highlighter.
3. Students complete a [gallery walk](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/555) to see where other pairs marked half on their lengths.
4. Ask:

* How close were your estimates?
* What would you change to ensure greater accuracy next time?

1. Revise that to find a quarter of a length, 4 equal-sized parts must be created.
2. Pairs repeat steps 14–18 to indicate how the masking tape length could be partitioned into quarters, using a pencil.
3. Regroup and ask:

* How did you determine where the masking tape strip would be partitioned into quarters?
* Did you use any different strategies to help you this time? Why or why not?
* How close were you to the correct partition lines?

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot model fractions with fraction strips for halves, quarters and eighths.   * Support students by modelling the use of other resources such as interlocking blocks or coloured rods, to identify the halfway point of the masking tape strip. * Assist students by encouraging them to create halves by folding an equivalent paper strip into 2 equal parts to see the relationship between the parts and the whole length. | Students can model fractions with fraction strips for halves, quarters and eighths.   * Students make a poster describing the different ways of ensuring equal parts when making fractions. Strategies might include ensuring corners and edges are aligned when folding or placing parts on top of one another to check that they are equal. |

## Consolidation and meaningful practice – 10 minutes

1. Students choose a new partner to work with. Each pair selects a masking tape strip they have not used previously.
2. Using what they know about halves and quarters, pairs determine how the masking tape length could be partitioned into eighths and mark this with a pencil.
3. Pairs check their partitions using a piece of string.
4. Students join with another pair to identify their partitions and explain their thinking.
5. Regroup and ask:

* Did you use any different strategies to help you this time? Why or why not?
* How close were you to the correct partition lines?
* How did you find eighths of a length?
* Were you able to find eighths of a length without folding?

1. Highlight the relationship between halves, quarters and eighths for students, if not already uncovered in the class discussion. Ensure students understand that halves can be created by folding a strip and lining up the corners to create 2 parts. Quarters are created by halving a half. When quarters are halved, eighths are created.

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students model fractions with fraction strips for halves, quarters and eighths? **[MAO-WM-01, MA2-PF-01]** * Can students create fractional parts of a length using techniques other than repeated halving? **[MAO-WM-01, MA2-PF-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):   * InF2, InF3, InF4. |

# Lesson 2

**Core concept**: bar models and fractions strips can be used to represent fractions.

## Daily number sense – Is he correct? – 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:   * model and represent unit fractions, and their multiples, to complete a whole on a number line. | Students can:   * recreate the whole unit from a fractional part. |

1. Display [Resource 2 – Is he correct?](#_Resource_2_–)
2. Ask students to consider:

* Is Fred correct? How do you know?
* What has Fred done incorrectly?
* If he is not correct, what would be the correct answer? How could you work it out?

1. Students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) with a partner to compare their thoughts.
2. As a class, regroup and discuss.
3. Draw a short line on the whiteboard.
4. Ask:

* If this is a quarter, what is the whole?
* If this is an eighth, what is the whole?
* If this is a half, what is the whole?

This table details an opportunity for assessment.

|  |  |
| --- | --- |
| Assessment opportunity | Links |
| What to look for:   * Can students recreate the whole unit from a fractional part? **[MAO-WM-01, MA2-PF-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):   * InF5. |

## Core lesson – fractions on a line – 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:   * model and represent unit fractions, and their multiples, to a complete whole on a number line * generate and describe patterns. | Students can:   * model fractions with fraction strips and diagrams for halves, quarters and eighths * recreate the whole unit from a fractional part (, and ) * model, describe and record patterns of multiples. |

**Note:** this lesson, along with others in this unit, expands upon the fraction folding activities that students have already encountered. Students need to have repeated opportunities to fold and manipulate fractional parts to ensure a thorough understanding of the part-part-whole relationship. This should include materials of different lengths.

When completing the paper folding activities throughout this unit of work, it is suggested (where possible) that students use paper with different coloured sides to help highlight proportion.

1. Provide each student with 3 equal strips of paper. Ensure each strip of paper is a different colour.
2. Students select one strip of paper and fold it in half. Remind students that the folds must be precise and produce 2 equal-sized parts.
3. Using fraction notation, students identify and label each of the folded sections as one-half ( ).
4. Students select the second paper strip and fold it in half and then half again to produce quarters.
5. Using fraction notation, students identify and label each of the folded sections as one-quarter ( ).
6. Ask students to use their knowledge of folding halves and quarters to fold the final strip into eighths.
7. Using fraction notation, students identify and label each of the folded sections as one-eighth ( ).
8. Place the 3 paper strips underneath each other (see Figure 2).

Figure 2 – three paper strips

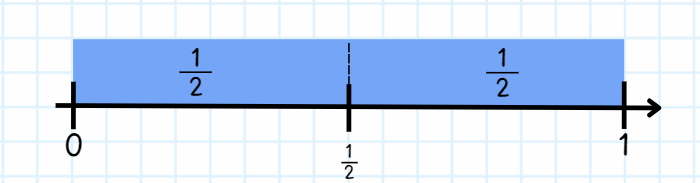
Three coloured paper strips, first strip is divided in halves, second strip is divided in quarters and third strip is divided in eighths.
Each part of the first strip is labelled 1/2.
Each part of the second strip is labelled 1/4.
Each part of the third strip is labelled 1/8.

1. Ask:

* How many halves make up the whole strip of paper?
* How many quarters make up the whole strip of paper?
* How many eighths make up the whole strip of paper?
* How can the same length strip have 2 halves but 8 eighths?

1. Students glue the halves strip into their workbook or onto a piece of grid paper.
2. Under the paper strip, students draw a number line that includes zero, one and an arrow to indicate that the number line continues. Students mark and label the fractions along the line (see Figure 3).

Figure 3 – student work sample 1



1. Students repeat this process for the remaining 2 paper strips (see Figure 4).

Figure 4 – student work sample 2

Three student work samples of number lines from 0 to 1. First example has a bar model which displays halves. Each part is labelled 1/2. The number line underneath is labelled 0, 1/2 and 1.
The second model displays quarters. Each part is labelled 1/4. The number line underneath is labelled 0, 1/4, 2/4, 3/4, 1.
The third model displays eighths. Each part is labelled 1/8. The number line underneath is labelled 0, 1/8, 2/8, 3/8, 4/8, 5/8, 6/8, 7/8, 1.

1. Remind students that when they mark the paper strip, they are highlighting fractions on a line, when they draw the markers along the number line, they are highlighting fractions ofa line.
2. Ask the following questions:

* What patterns can you see when looking at the paper strips?
* Why do these patterns occur? (They occur because the parts are repeatedly halved.)
* What would happen if the pattern continued? (There would be 16 parts in the next strip.)
* What do you notice about the fractions , and ?
* Can you see any other equivalent fractions?

**Note:** fractions of a length indicate a ‘part’ of a line or length and fractions as a number sit at a ‘point’ on a number line. This may be the first time students understand that there are numbers between zero and one.

1. Revise the similarities and/or differences of fractions of a line (bar model) and on a line (number line).

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot model fractions with fraction strips and diagrams for halves, quarters and eighths.   * Demonstrate the halving technique step-by-step for students to follow. * Model fractions using concrete materials such as coloured rods. * Students use a fraction wall to explore halves, quarters and eighths. | Students can model fractions with fraction strips and diagrams for halves, quarters and eighths.   * Students explore equivalence by folding strips of paper. They identify, create and label as many fractions equivalent to one-half as possible. |

## Consolidation and meaningful practice – 15 minutes

1. Provide students with a small strip of paper and writing materials.
2. Ask students to represent their thinking by drawing labelled diagrams to answer the following questions:

* If the strip is one-half ( , how long is the whole?
* If your strip is one-quarter ( ) of the whole, how long is the whole?
* If your strip is one-eighth ( ) of the whole, label two-eighths ( ), four-eighths ( ), six-eighths ( ) and eight-eighths ( ) of the whole.
* If your strip represents 4 wholes, can you draw the length of one-whole?

1. 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 and compare their diagrams.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot recreate the whole unit from a fractional part.   * Provide multiple equal paper strips for students to use to visualise the whole. Tape the pieces together so students can identify the fractional parts. * Provide hands-on materials such as coloured rods to manipulate the fractional parts. | Students can recreate the whole unit from a fractional part.   * Students recreate the whole from non-unit fractions, for example three-quarters ( ) or three-eighths ( ). * In pairs, students select and label one fractional part. Their partner must identify the fractional part needed to recreate one whole. For example, if Student A selected one-quarter, Student B must identify three-quarters as the fractional part needed to recreate the whole. |

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students model fractions with fraction strips and diagrams for halves, quarters and eighths? **[MAO-WM-01, MA2-PF-01]** * Can students recreate the whole unit from a fractional part? **[MAO-WM-01, MA2-PF-01]** * Can students model, describe and record patterns of multiples? **[MAO-WM-01, MA2-PF-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):   * InF2, InF3, InF4, InF5. |

# Lesson 3

**Core concept**: fractions can be represented as measures by partitioning length.

## Daily number sense – fractured fraction wall – 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:   * model and represent unit fractions, and their multiples, to complete a whole on a number line. | Students can:   * determine the fractional part needed to make a whole. |

1. Display [Resource 3 – fractured fraction wall 1](#_Resource_3_–).
2. Read the following scenario: The class had a fraction wall up in the classroom. One day, the teacher left the door open during lunch time and the wind blew some of the fractions off the wall. It is your job to fix the fraction wall so that each row represents one whole.
3. 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) to discuss how they can ensure the correct fractional parts are returned in the correct quantities.
4. Give each student a copy of either [Resource 3 – fractured fraction wall 1](#_Resource_3_–) or [Resource 4 – fractured fraction wall 2](#_Resource_4_–) to complete the fraction wall.
5. Students compare their fraction wall with a partner, discussing the strategies they used to ensure it was complete.

This table details an opportunity for assessment.

|  |  |
| --- | --- |
| Assessment opportunity | Links |
| What to look for:   * Can students determine the fractional part needed to make a whole? **[MAO-WM-01, MA2-PF-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):   * InF3, InF4. |

## Core lesson 1 – the thirding strategy – 20 minutes

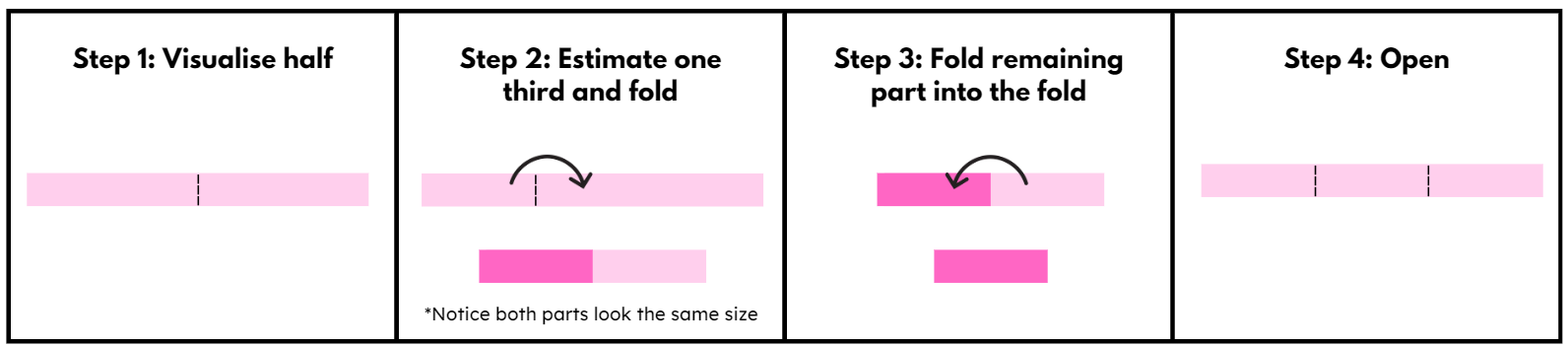
The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Core concept learning intentions | Core concept success criteria |
| Students are learning to:   * create fractional parts of a length using techniques other than repeated halving * model and represent unit fractions, and their multiples, to a complete whole on a number line. | Students can:   * create thirds and fifths of a length * describe fraction families formed by dividing the whole into the same total number of equal parts as having the same denominator. |

This activity is an adaptation of ‘The thirding strategy’ from *Teaching Mathematics: Foundation to Middle Years* by Siemon et al.

1. Pose the following question: We know how to fold halves, quarters and eighths. Can we use this information to help us fold thirds?
2. Give students some paper strips and an opportunity to explore their ideas with a partner.
3. Select students to share ideas with the class. If not already stated, explain that one-third is slightly less than half.
4. Model and explain the thirding strategy to students: when folding the paper strip into thirds, you can visualise half. Then estimate a third as less than that and create your first fold. The rest of the strip can be folded in half into that fold. If you have not created 3 equal parts, adjust your first fold and try again (see Figure 5).

Figure 5 – folding thirds



1. Give students several opportunities to explore this method of folding thirds.
2. Students trace the thirds fold lines and glue the thirds strip into their workbook or onto a piece of grid paper.

**Note:** in [Lesson 5](#_Lesson_5), students will create sixths and tenths. It is important that they leave space beneath the thirds strip for the sixths and beneath the fifths strip for the tenths. This will help them recognise the equivalence between these fractions.

1. As in [Lesson 2](#_Lesson_2), under the paper strip, students draw a number line that includes zero, one and an arrow to indicate the number line continues. Students mark and label the fractions , , along the line and label each part of the strip with (see Figure 7).

## Core lesson 2 – the fifthing strategy – 20 minutes

This activity is an adaptation of ‘The fifthing strategy’ from *Teaching Mathematics: Foundation to Middle Years* by Siemon et al.

1. Pose question: Can we use a similar strategy to the thirding strategy to create fifths?
2. Give students some paper strips and an opportunity to explore their ideas with a partner.
3. Select students to share their ideas with the class. If not already stated, explain that one-fifth is slightly less than a quarter.
4. Model and explain the fifthing strategy to students: when folding the paper strip into fifths, you can visualise quarters by estimating half and then half again. We can then estimate a fifth as less than the quarter and create our first fold. The rest of the strip can be folded in half into that fold and then folded in half into that fold again. If you have not created 5 equal parts, adjust your first fold and try again (see Figure 6).

Figure 6 – folding fifths

Instructions on folding fifths - five steps to fold. Step 1: visualise quarters. Model shows strip divided into quarters. Step 2: estimate one fifth and fold. Bar model shows a quarter and a remaining length. There is a note that reads: Notice the orange part looks like a quarter of the remaining length. Step 3: fold remaining part in behind the folded part. Bar model shows the fold. Step 4: fold remaining part in behind the folded part again. Bar model shows folds with an arrow pointing to half. Step 5: open folds and bar model shows 5 equal parts.


1. Give students several opportunities to explore this method of folding fifths.
2. Students trace the fifths fold lines and glue the fifths strip into their workbook or onto a piece of grid paper.
3. As in [Lesson 2](#_Lesson_2), under the paper strip, students draw a number line that includes zero, one and an arrow to indicate the number line continues. Students mark and label the fractions , , , , along the line and label each part of the strip with (see Figure 7).

Figure 7 – student work sample

Student work sample bar models on a number line. First number line represents thirds with a bar model on top of the line in 3 equal parts. Each part of the bar is labelled 1/3. The number line is labelled 0, 1/3, 2/3, 1.
Second number line displays fifths bar model on top with 5 equal parts displayed. Each part of the bar is labelled 1/5. The number line underneath is labelled 0, 1/5, 2/5, 3/5, 4/5, 1.
Space has been left between the 2 number lines for the next days work.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot create thirds and fifths of a length.   * Support students to estimate half on a paper strip. Students place a pencil mark where they estimate a third to be prior to folding. Using the pencil mark as a guide, support students to make a third before halving the remaining strip. Students use a similar strategy for fifths by placing a pencil mark where they estimate fifths to be prior to folding. * Students use [Resource 5 – fraction wall](#_Resource_5_–) to explore thirds and fifths. | Students can create thirds and fifths of a length.   * Students explore equivalence by folding strips of paper. They identify, create and label as many fractions equivalent to one-third as possible. |

## Discuss and connect the mathematics – 10 minutes

**Note:** in the syllabus, a fraction family is formed by dividing the whole into the same total number of equal parts while having the same denominator.

1. Revise student understanding of fraction families. For example, one quarter, 2 quarters, 3 quarters and 4 quarters.
2. Students look at the folded fraction strips on the number lines. Ask:

* How did your knowledge of halves and quarters help you to make thirds and fifths?
* When looking at the thirds folded strip on the number line, are you able to identify the fraction family it belongs to?
* What fractions belong in the thirds fraction family?
* When looking at the fifths folded strip on the number line, are you able to identify the fraction family it belongs to?
* What fractions belong in the fifths fraction family?

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students create thirds and fifths of a length?  **[MAO-WM-01, MA2-PF-01]** * Can students describe fraction families formed by dividing the whole into the same total number of equal parts as having the same denominator? **[MAO-WM-01, MA2-PF-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):   * InF4. |

# Lesson 4

**Core concept**: bar models and fractions strips can be used to represent fractions.

## 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 – fractions with related denominators – 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:   * create fractional parts of a length using techniques other than repeated halving * model and represent unit fractions, and their multiples, to a complete whole on a number line * generate and describe patterns. | Students can:   * create thirds and fifths of a length * model fractions with fraction strips and diagrams * model, describe and record patterns of multiples. |

1. Revise the folding of thirds and fifths from [Lesson 3](#_Lesson_3).
2. Pose the following question: When we halved quarters, we created eighths. When we halve thirds, what will happen? Ensure students understand that halving thirds will create sixths.
3. Provide pairs with paper strips to explore ideas about how to create sixths.
4. Select students to demonstrate and discuss how they folded their paper strip to create sixths. Highlight that the most efficient method is to fold thirds and then fold in half again.
5. Pose the following question: Using our knowledge of halving quarters to make eighths, and halving thirds to make sixths, how could tenths be made?
6. Provide pairs with paper strips to explore ideas about how to create tenths.
7. Select students to demonstrate and discuss how they folded their paper strip into 10 equal parts. Remind students that the most efficient method is to fold fifths and then fold in half again.
8. Students glue the sixths and tenths strips into their workbook or onto a piece of grid paper, where they left space in [Lesson 3](#_Lesson_3).
9. As in [Lesson 2](#_Lesson_2), under each paper strip, students draw a number line that includes zero, one and an arrow to indicate that the number line continues. Students mark and label the fractions on the line (see Figure 8).

Figure 8 – student work sample

Student work sample of bar models on a number line. 

First number line represents thirds with a bar model on top of the line in 3 equal parts. Each part of the bar is labelled 1/3. The number line is labelled 0, 1/3, 2/3, 1.
Second number line displays a sixths bar model on top with 6 equal parts displayed. Each part of the bar is labelled 1/6. The number line underneath is labelled 0, 1/6, 2/6, 3/6, 4/6, 5/6, 1.
Third number line displays a fifths bar model on top with 5 equal parts displayed. Each part of the bar is labelled 1/5. The number line underneath is labelled 0, 1/5, 2/5, 3/5, 4/5, 1.
Fourth number line displays tenths bar model on top with 10 equal parts displayed. Each part of the bar is labelled 1/10. The number line underneath is labelled 0, 1/10, 2/10, 3/10, 4/10, 5/10, 6/10, 7/10, 8/10, 9/10, 1.

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

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * What do you notice happens when you halve thirds? | * When you halve thirds, you end up with 6 parts – the number of parts doubles. The size of each part is halved. |
| * What do you notice happens when you halve fifths? | * When you halve fifths, you end up with 10 parts – the number of parts doubles. The size of each part is halved. |
| * How are thirds different to sixths? | * They differ in the number of equal parts that divide the whole. The size of each part is also different if the same sized whole is used to represent thirds and sixths. |
| * Refer students to the thirds and sixths strips in their workbook. Can you identify what is similar and different between one-third  ( ) and two-sixths ( )? | * One-third and two-sixths are equivalent, but the number of parts needed are different because the size of the parts are different. When the same sized whole is used, one-third is the same as two-sixths. |

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot model fractions with fraction strips and diagrams.   * Model fractions using concrete materials such as coloured rods. * Students use their fraction wall to explore thirds, fifths, sixths and tenths. | Students can model fractions with fraction strips and diagrams.   * Present students with story problems that involve fractions in realistic scenarios, such as sharing food among friends or dividing resources equally. Encourage them to solve the problems using fractions and explain their reasoning. * Students explore equivalence by folding strips of paper. They identify, create and label as many fractions equivalent to non-unit fractions for thirds and fifths as possible. |

## Discuss and connect the mathematics – 10 minutes

1. Ask students to prove that two-thirds ( ) is equivalent to four-sixths ( ), using concrete materials, diagrams and number lines to demonstrate their understanding.
2. 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 their decisions and the strategies they used.
3. Ask students to repeat the process to prove that three-fifths ( )is equivalent to six-tenths ( ).
4. Students share responses.

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students create thirds and fifths of a length? **[MAO-WM-01, MA2-PF-01]** * Can students model fractions with fraction strips and diagrams? **[MAO-WM-01, MA2-PF-01]** * Can students model, describe and record patterns of multiples? **[MAO-WM-01, MA2-PF-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):   * InF2, InF3, InF4. |

# Lesson 5

**Core concept**: equivalent fractions have related denominators.

## Daily number sense – looking for squares – 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:   * recall multiplication facts of 2 and 4, 5 and 10 and related division facts. | Students can:   * recognise and use the symbols for multiplied by (×), divided by (÷) and equals (=) * link multiplication and division fact families using arrays. |

1. Ask: What are square numbers?
2. Discuss students' responses and provide an example if necessary, such as 3 × 3 = 9. Demonstrate by drawing an array of 3 × 3 for students to visualise the connection with its definition.

**Square numbers:** the result of multiplying a number by itself. For example, 3 × 3 = 9.

1. Display the following numbers: 16, 22, 25 and 9. Ask students to prove which number is not a square number.
2. Students record their responses by including an array and a description linking multiplication and division fact families for each pair (see Figure 9).

Figure 9 – student sample

Student work sample. There are 4 rows of 4 dots represented in an array. 
Student number sentence: 4 rows of 4 is 16 .16 shared into 4 rows is 4.  
Equation representations are 4  x 4 = 16 and 16 ÷ 4 = 4.

1. Ask:

* Can you provide another example of a square number? Prove it.
* What patterns do you notice with square numbers?

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students recognise and use the symbols for multiplied by (×), divided by (÷) and equals (=)?  **[MAO-WM-01, MA2-MR-01, MA2-MR-02]** * Can students link multiplication and division fact families using arrays? **[MAO-WM-01, MA2-MR-01, MA2-MR-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):   * MuS5, MuS6.   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-MT: 2A.9, 2A.10. |

## Core lesson – fraction wall game – 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:   * model and represent unit fractions, and their multiples, to a complete whole on a number line * model equivalent fractions as lengths * represent fractional quantities equal to and greater than one. | Students can:   * represent fractions with the same-size whole to make valid comparisons (denominators of 2, 4 and 8; 3 and 6; 5 and 10) * represent the equivalence of fractions with related denominators as lengths, using concrete materials, diagrams and number lines * rename 2 halves, 3 thirds, 4 quarters, 5 fifths, 6 sixths, 8 eighths and 10 tenths as one whole. |

This activity is an adaptation of ‘Fraction wall game’ from [Top Drawer Teachers](https://topdrawer.aamt.edu.au/Fractions/Good-teaching/Equivalence/Linear-models/Fraction-wall-game) by the Australian Government Department of Education, Employment and Workplace Relations.

1. Display [Resource 5 – fraction wall](#_Resource_5_–) and ask how a fraction wall can help identify fractions that are equivalent.
2. Encourage students to use fractional language. For example, ‘three-quarters’ instead of ‘3 out of 4’. This is helpful for understanding fractional parts within the part-whole and greater than one, for example six-fifths.
3. Highlight that the fraction wall enables students to ‘line up’ particularly difficult fractions to generate equivalent combinations, for example, lining up six-eights ( ) demonstrates its equivalence to three-quarters ( ).
4. Explain that students will use [Resource 6 – gameboard and spinners](#_Resource_6_–) to form fractions and represent these on the fraction wall, attempting to colour in the whole gameboard.
5. Model using a think aloud strategy to help students draw out equivalence. Ask how the fraction wall can be coloured to show two-eights ( ) (see Figure 10).

Figure 10 – first attempt

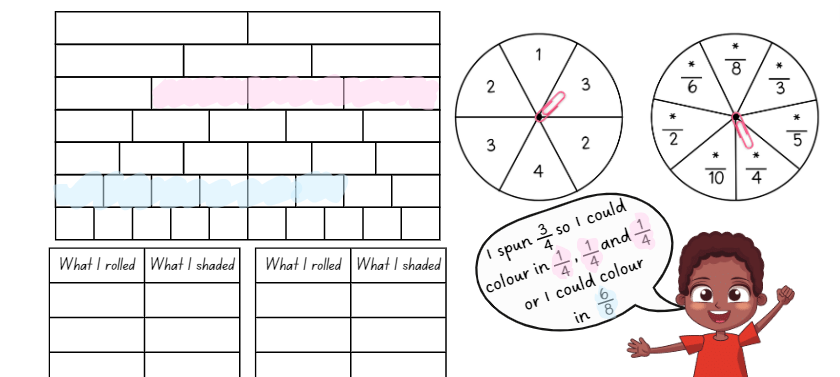
First attempt of the fraction wall game example. A fraction wall that displays 3 groups of paper strips of equal size divided as follows: 
Group 1: halves, quarters and eighths.
Group 2: thirds and sixths.
Group 3: sixths and tenths. 
There are 2 spinners - spinner 1 has a paper clip landing on a 2. Spinner 2 has a paper clip which has landed on 8. There are 2 tables, Option 1 and Option 2. Each table is divided into 2 columns: What I spun, and What I shaded.
The information in the table states that 2 eighths were spun, so 1/8 and 1/8 could be coloured in, or 1/4 could be coloured in.

1. Ask the following questions:

* Is there more than one way this could be done?
* What could you do if you didn’t have enough eighths?
* Could I use halves? Why or why not?

1. Model another example, such as three-quarters ( ), and discuss the equivalent options on the gameboard (see Figure 11).

Figure 11 – second attempt



1. Provide each student with [Resource 6 – gameboard and spinners](#_Resource_6_–).
2. Pairs of students take turns spinning the spinners and decide how to colour the fraction on their gameboard.
3. Each pair decides what they shade on the wall, for example , could be or or .

**Note**: remind students that fractions can be renamed, for example 2 halves, 3 thirds, 4 quarters, 5 fifths, 6 sixths, 8 eighths and 10 tenths as one whole.

1. If a student is unable to take their turn, they simply pass. This may happen if a student spins a fraction greater than one or cannot colour the fraction spun. The winner is the first student who colours in their entire wall. However, the other player is encouraged to continue, with the support of the first player, to fill their fraction wall if there is still time remaining.
2. To finish off the game, students must roll exactly what they need. A larger fraction is not acceptable to finish, for example, if they need to finish and they roll (more than what is needed), they must miss a turn.
3. Students record each turn on [Resource 6 – gameboard and spinners](#_Resource_6_–) (see Figure 12). Encourage students to use different colours for each choice made during the game. This helps with understanding each decision made at each stage of the game. For example, a student might have spun , but shaded and .

Figure 12 – colour fractions gameboard

Example of the coloured fraction wall gameboard. A fraction wall that displays 3 groups of paper strips of equal size divided as follows: 
Group 1: halves, quarters and eighths.
Group 2: thirds and sevenths.
Group 3: sixths and tenths. 
Spinner 1 has landed on the number 3. Spinner 2 has landed on the number 4. 
Student has recorded what they spun and what they shaded in a table. For example, for 2/8 what they shaded was 1/8 and 1/8 in red. 
For 4/10 what they shaded was 1/10, 1/10, 1/10 and 1/10 in blue. 
For 2/4 what they shaded was 1/2 in light blue. 
For 3/8 what they shaded was 1/8, 1/8 and 1/8 in yellow. 
For 4 quarters what they shaded was 1/3, 1/3 and 1/3 in purple. 
For 3/6 what they shaded was 2/4 in green.
The fraction wall shows 1/2 shaded in blue, 2/4 shaded in green, 2/8 shaded in red, 3/8 shaded in yellow, 3/3 shaded purple and 4/10 in blue.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot represent the equivalence of fractions with related denominators as lengths, using concrete materials, diagrams and number lines.   * Use a set of fraction cards (for example, , , , , ) that support the representation of the fractions. The first student to complete a row wins the game. * Provide a reduced fraction wall and in pairs students shade the fraction wall and the first student to complete a row wins the game. For example, students could use the top of the gameboard with only halves, quarters and eighths. | Students can represent the equivalence of fractions with related denominators as lengths, using concrete materials, diagrams and number lines.   * Students fold additional strips to extend their fraction wall with fractions using denominators of their own choosing. For example, twelfths and twentieths. * Challenge students to create their own rules to fill the board and play with a partner using adjusted rules. |

## Discuss and connect the mathematics – 15 minutes

1. Regroup and ask students to share and describe what they spun and what they shaded.

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

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * How many thirds make one whole? | * Three-thirds. |
| * When you look at a fraction wall, how can you tell if 2 fractions are equivalent? | * If 2 fractions are the same length on the fraction wall, they are equivalent fractions. |
| * How can you use the fraction wall to compare fractions and see which one is bigger or smaller? | * If I am comparing unit fractions I can look at the size of the pieces. If one fraction's pieces are longer than another fraction's pieces, then that fraction is bigger. * If I am comparing other fractions I can look at the length of each fraction. Even if the fractional parts look short, the fraction can still be bigger. For example, is bigger than even though each tenth is shorter than each fifth on the fraction wall. |
| * Can you give an example of a fraction family? | * An example of a fraction family is , , I know they are a fraction family because these are all fractions where the whole has been divided into 4 equal parts. |
| * How could you extend your fraction wall to show a fraction larger than one whole? | * Four-thirds is three-thirds and one-third. * Three-halves is two-halves and one-half |
| * Why is it important to find equivalent fractions? Can you give an example? | * It helps us compare and operate with fractions more easily. For example, if you are baking and a recipe needs half a cup of flour, but you only have a one-quarter measuring cup, knowing two-quarters is equivalent to one-half helps you measure the right amount. |

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students represent fractions with the same-size whole to make valid comparisons (denominators of 2, 4 and 8; 3 and 6; 5 and 10)? **[MAO-WM-01, MA2-PF-01]** * Can students represent the equivalence of fractions with related denominators as lengths, using concrete materials, diagrams and number lines? **[MAO-WM-01, MA2-PF-01]** * Can students rename 2 halves, 3 thirds, 4 quarters, 5 fifths, 6 sixths, 8 eighths and 10 tenths as one whole?  **[MAO-WM-01, MA2-PF-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):   * InF3, InF4, InF5. |

# Lesson 6

**Core concept**: equivalent fractions have related denominators.

## Daily number sense – using arrays – 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:   * recall multiplication facts of 2 and 4, 5 and 10 and related division facts. | Students can:   * recognise and use the symbols for multiplied by (×), divided by (÷) and equals (=) * link multiplication and division fact families using arrays. |

1. Roll two 10-sided dice and use the numbers rolled to form an array. For example, if 3 and 8 are rolled, an array of 3 eights is created.
2. From the array, record multiplication and division number sentences, see Figure 13.

Figure 13 – array number sentences

Student work example for using arrays.
There are black dots in 2 arrays to represent that 3 rows of 8 is 24, and 8 rows of 3 is 24. 
24 shared into 3 rows is 8, and 24 shared into 8 rows is 3. The corresponding number sentences have been written next to each statement, for example, 3 × 8 = 24.

1. Highlight to students:

* the link between multiplication and division
* the commutative property of multiplication.

1. Once students are confident, provide them with two 10-sided dice, counters and their workbooks. Students record the array and their number sentences in their workbook.

**Note**: students may wish to use grid paper rather than counters to help draw arrays, particularly with larger arrays.

1. Select students to share and explain their arrays and number sentences.

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students recognise and use the symbols for multiplied by (×), divided by (÷) and equals (=)?  **[MAO-WM-01, MA2-MR-01, MA2-MR-02]** * Can students link multiplication and division fact families using arrays? **[MAO-WM-01, MA2-MR-01, MA2-MR-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):   * MuS6.   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-MT: 2A.9, 2A.10. |

## Core lesson – Which does not belong? – 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:   * generate and describe patterns * model equivalent fractions as lengths. | Students can:   * model, describe and record patterns of multiples * represent the equivalence of fractions with related denominators as lengths, using concrete materials, diagrams and number line. |

1. Ask students to identify and record any fractions equivalent to one-half, one-third, one-quarter and one-fifth on an individual whiteboard by using concrete materials, diagrams or number lines, see Figure 14. Students may wish to use [Resource 5 – fraction wall](#_Resource_5_–).

Figure 14 – equivalent fractions

A whiteboard with diagrams showing one-third is equivalent to 2 sixths and 4 twelfths.


1. Ask students what they notice about these groups of fractions. Highlight the multiplicative relationship between the equivalent fractions. For example, a student may reason that one-fifth ( ) is equivalent to two-tenths ( ) because if fifths were halved, each fifth would be equivalent to two-tenths ( ).
2. Have students use the fraction wall or [Polypad – The Mathematical Playground](https://polypad.amplify.com/) to identify any other equivalent fractions and record these in their workbooks. Encourage students to find equivalent fractions for non-unit fractions such as two-thirds ( ), six-tenths ( ), and so on.
3. Ask students to record any additional equivalent fractions that go beyond the fraction wall and justify their responses.

**Note:** although fractions with other denominators are not explicitly included in the syllabus, this activity highlights the multiplicative pattern of equivalent fractions.

1. Display [Resource 7 – Which doesn't belong?](#_Resource_7_–).
2. Select one example from [Resource 7 – Which doesn't belong?](#_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) to determine which fraction does not belong.
3. Regroup and select students to share the strategies used to determine the answer.
4. Provide pairs or small groups of students with [Resource 7 – Which doesn't belong?](#_Resource_7_–) and writing materials. Students work together to determine the fraction that does not belong using concrete materials, diagrams or number lines.
5. Regroup and ask students to explain and justify the answer for each card.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot represent the equivalence of fractions with related denominators as lengths, using concrete materials, diagrams and number line.   * Support students to identify the fractions on [Resource 7 – Which doesn't belong?](#_Resource_7_–) on [Resource 5 – fraction wall](#_Resource_5_–). | Students can represent the equivalence of fractions with related denominators as lengths, using concrete materials, diagrams and number line.   * Students create their own series of cards and share then with their peers to justify why some fractions do not belong. |

## Discuss and connect the mathematics – 15 minutes

1. Display [Resource 5 – fraction wall](#_Resource_5_–). Ask:

* What patterns do you notice on the fraction wall?
* Can you identify any patterns with equivalent fractions?
* What pattern is created when a whole is repeatedly halved?
* What patterns do you notice with equivalent fractions for one-half?

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students model, describe and record patterns of multiples? **[MAO-WM-01, MA2-MR-01]** * Can students represent the equivalence of fractions with related denominators as lengths, using concrete materials, diagrams and number lines? **[MAO-WM-01, MA2-PF-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):   * InF5 * NPA3, NPA4. |

# Lesson 7

**Core concept**: identifying a complementary fractional part is needed to complete one whole.

## Daily number sense – solve the problem – 15 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:   * recall multiplication facts of 2 and 4, 5 and 10 and related division facts. | Students can:   * recognise and use the symbols for multiplied by (×), divided by (÷) and equals (=) * generate multiplication fact families for multiples of 2 and 4, 5 and 10. |

This activity is an adaptation of the [National Assessment Program](https://www.acara.edu.au/assessment/naplan/naplan-2012-2016-test-papers) by ACARA.

1. Display and read [Resource 8 – word problems](#_Resource_8_–).
2. In pairs, students solve and record their solutions on a whiteboard.
3. Regroup as a class and ask:

* How could you represent the problem using a number sentence?
* Can you explain the steps you took to solve the problems?
* How did your knowledge of fact families help you solve the problems?
* Did you find any patterns while working on this activity?
* Is there anything you would do differently next time?

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students recognise and use the symbols for multiplied by (×), divided by (÷) and equals (=)? **[MAO-WM-01, MA2-MR-01, MA2-MR-02]** * Can students generate multiplication fact families for multiples of 2 and 4, 5 and 10? **[MAO-WM-01, MA2-MR-01, MA2-MR-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):   * MuS6.   Links to suggested Interview for Student Reasoning (IfSR) tasks:   * IfSR-MT: 2A.4, 2A.5, 2A.6. |

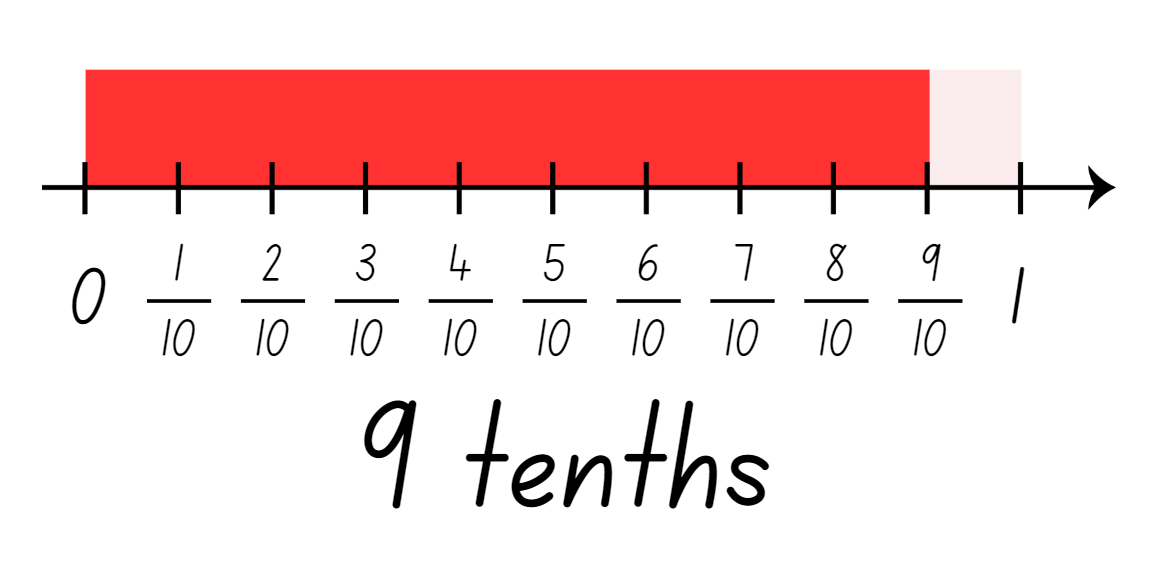
## Core lesson – recreate the whole – 35 minutes

The table below contains 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:   * model and represent unit fractions, and their multiples, to a complete whole on a number line. | Students can:   * determine the complementary fractional part needed to complete one whole (halves, quarters, eighths, thirds) * recreate the whole unit from a fractional part ( and . |

1. Display [Resource 9 – recreate](#_Resource_9_–) the whole.
2. Explain that a number line has been drawn underneath each red paper strip. Draw attention to the position of 0 and 1 on the number lines to indicate that each red strip represents a fractional part of a whole strip.
3. Revise the term ‘complementary fraction’ as the unit fraction needed to create one whole.
4. Discuss and model identifying the complementary fractional part for the example nine-tenths ( . Explain that one-tenth ( is the unit fraction that is complementary as they represent 2 fractional parts needed to complete one whole (see Figure 15).

Figure 15 – finding the complement



1. Explain that sometimes the fractional part needed to create a whole unit is not a unit fraction. Ask: What fraction would be needed to recreate the whole from the fractions given?
2. Students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) to identify the fractional part needed for the other examples.
3. Regroup and ask students how they used the number line to determine the fraction required to recreate the whole.
4. In pairs, provide students with [Resource 10 – recreate the whole memory](#_Resource_10_–). Explain the following game instructions:
5. Shuffle the cards and lay out all the cards face down in an array formation.
6. Take turns flipping over 2 cards at a time, aiming to find pairs of fractions that will create a whole.
7. Keep the cards and take another turn if the fractions on the cards make a whole.
8. Flip the cards back over. The next player has a turn if the fractions do not make a whole.
9. The game continues until all fractions have been matched.
10. Regroup and discuss some of the fraction pairs.

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot determine the complementary fractional part needed to complete one whole (halves, quarters, eighths, thirds).   * Model using [Fraction number line](https://www.didax.com/apps/fraction-number-line/) to create a green bar and 4 orange quarter-bars. Remove one quarter-bar to demonstrate the complement. * Support students to use a fraction wall to identify complementary unit fractional parts. | Students can determine the complementary fractional part needed to complete one whole (halves, quarters, eighths, thirds).   * Students find the non-unit fractional part used to recreate the whole. Express them as an equivalent fraction. For example, is . |

## Discuss and connect the mathematics – 10 minutes

1. Display the following fractions:

* .

1. Ask students to identify the complementary fraction or the fractional part needed to recreate the whole. Students record their answers on an individual whiteboard to check for understanding. Students can use the fraction wall, number lines or bar models to support their reasoning.
2. Regroup as a class and ask students to share their strategies.

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students determine the complementary fractional part needed to complete one whole (halves, quarters, eighths, thirds)?  **[MAO-WM-01, MA2-PF-01]** * Can students recreate the whole from a fractional part ( , and )? **[MAO-WM-01, MA2-PF-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):   * InF5. |

# Lesson 8

**Core concept**: fractional quantities can be equal to and greater than one.

## 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 – fractions beyond a whole – 40 minutes

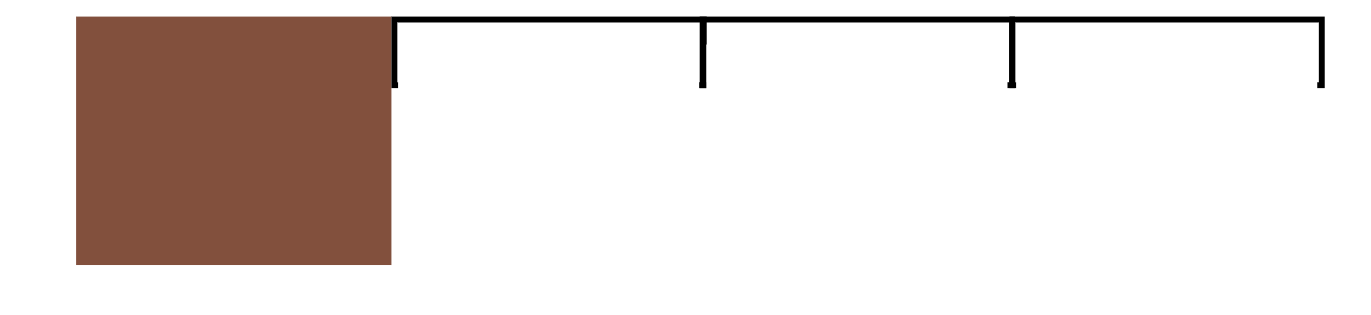
The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Core concept learning intentions | Core concept success criteria |
| Students are learning to:   * model and represent unit fractions, and their multiples, to a complete whole on a number line * represent fractional quantities equal to and greater than one. | Students can:   * recreate the whole unit from a fractional part ( and ) * regroup fractional parts beyond one * represent totals of halves, thirds, quarters and fifths that extend beyond one * determine the relative location of one-quarter and one-half when a number line extends beyond one. |

This activity is an adaptation of ‘[Fractions beyond one whole](https://teaching.betterlesson.com/lesson/551878/fractions-on-a-number-line-beyond-one-whole?from=master_teacher_curriculum)’ from [BetterLesson](https://lab.betterlesson.com/home) by Valentine.

1. Display [Resource 11 – chocolate bars](#_Resource_11_–). Highlight the first piece of chocolate and explain that this represents one-quarter ( ) of a whole chocolate bar.
2. 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 how the whole bar could be recreated from this fractional part. Model drawing and labelling how to recreate the whole (see Figure 16).

Figure 16 – sample of a whole



1. Provide students with [Resource 11 – chocolate bars](#_Resource_11_–) to recreate the whole chocolate bar if the pieces represent one-quarter ( ), one-third ( ) and one-fifth ( ) of the whole.
2. Regroup and ask the following questions:

* What strategy did you use to determine the size of the whole chocolate bar?
* How did you know how many parts would be needed to make the whole chocolate bar?
* What do you know about fractions that helped you with this task?

1. Display [Resource 12 – blocks of chocolate](#_Resource_12_–) and pose the following questions. Model the first example, with students completing the following 2 in pairs or independently.

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

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * If this is the whole chocolate bar, what might a chocolate bar 3 halves the size look like? | * Two halves make a whole, so 3 halves would be bigger than one. * I know 2 halves make a whole. If I partition this chocolate bar into 2 equal parts, this helps me find the size of one-half. * I can see after partitioning that I already have 2 halves. Now I just need to extend the bar by one more half. This is now 3 halves. |
| * How could 3 halves be renamed as a fraction greater than one? | * Three halves can also be renamed as 1. |

**Note**: fractions can be renamed in multiple ways. For example, 1 can be renamed . In the syllabus, the expression ‘fraction greater than one’ is used instead of the terms ‘improper fraction’ or ‘mixed numeral’.

1. Provide students with [Resource 12 – blocks of chocolate](#_Resource_12_–) to solve the following problems:

* If this is the whole chocolate bar, what might a chocolate bar the size look like? How could it be renamed?
* If this is the whole chocolate bar, what might a chocolate bar the size look like? How could it be renamed?

1. Write and on the board and ask:

* Where would these fractions go on a number line marked with zero and one?
* What strategy can you use to determine their location? (Half is between 0 and 1. The line can be partitioned into 2 equal parts and then a quarter is half of a half.)
* How does the relationship between halves and quarters help you place them on a number line?

1. In pairs, students locate one-quarter and one-half on the first number line marked 0–1 on [Resource 13 – number lines](#_Resource_13_–).
2. Draw students’ attention to the second number line marked 0–2 on [Resource 13 – number lines](#_Resource_13_–) and ask:

* Where would one go on this number line? How do you know?
* Where would halves and quarters be placed on the 0–2 number line?
* What is similar between the 2 number lines? What is different? (They both have 0, 1, marked, and are between 0 and 1, however the second number line will need other fractions between 1 and 2).
* What fractions might go between 1 and 2?
* Where might go?
* How does renaming as a fraction greater than one, help you decide where it goes?

1. Write and on the board. Ask students to place these on the number line marked 0–2.
2. Regroup as a class and ask:

* Where did you place and ?
* What strategies did you use to help you place these fractions?
* What do you know about fractions, halves and quarters that helped you with this task?

This table details opportunities for differentiation.

|  |  |
| --- | --- |
| Too hard? | Too easy? |
| Students cannot regroup fractional parts beyond one.   * Provide strips of paper to represent each fractional part of the chocolate bar. Use the strips to model adding on the remaining fractions to make the whole bar. | Students can regroup fractional parts beyond one.   * Students draw and label their own fractional parts of chocolate bars, such as thirds, fifths or eighths. They swap with another student, who solves them by finding the size of a full bar or a bar larger than one. |

## Discuss and connect the mathematics – 10 minutes

1. Display the following question: How could you use diagrams and words to explain what you understand about the fraction ? How could it be renamed?
2. Ask students to reflect on the strategies used and write a response in their workbooks including a visual representation of their work. Students should recognise that ten-eighths ( ) is larger than one because if the whole has been partitioned into 8 parts, 8 eighths make a whole. There are an additional 2 eighths, therefore ten-eighths ( ) is equivalent to 1.

This table details opportunities for assessment.

|  |  |
| --- | --- |
| Assessment opportunities | Links |
| What to look for:   * Can students recreate the whole unit from a fractional part ( and )? **[MAO-WM-01, MA2-PF-01]** * Can students regroup fractional parts beyond one?  **[MAO-WM-01, MA2-PF-01]** * Can students represent totals of halves, thirds, quarters and fifths that extend beyond one? **[MAO-WM-01, MA2-PF-01]** * Can students determine the relative location of one-quarter and one-half when a number line extends beyond one?  **[MAO-WM-01, MA2-PF-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):   * InF5, InF6. |

# Resource 1 – Is it half?

Four students around a table with different items. Above is the text: The teacher asked the students to find something that shows half. Here's what they found.  
Student 1: 1/2 an apple. 
Student 2: a strip of paper with a horizontal line showing half. One half is green and the other is white. 
Student 3: a sandwich cut into halves. 
Student 4: a strip of paper, from zero to 6, against a ruler measuring from zero to 12.  
A question is below the image: Which students are correct? How do you know?

# Resource 2 – Is he correct?

Text reads: Fred was given a strip of paper and told this was one-half of the whole length. Fred drew a diagram to show how big the whole would be. Is Fred correct? 
There is an image of a boy writing on a whiteboard with an arrow pointing to his response. The strip above the whole looks to be about a quarter of the whole on the whiteboard.

# Resource 3 – fractured fraction wall 1

A fractured coloured fraction wall. Half the wall displays fractions cut up into pieces and put out in random pieces. Displayed are halves, thirds, quarters, fifths, sixths, eighths and tenths. Second part of the page has parts that can be cut out to fill in the missing fractions on the fraction wall.  
The fraction wall on the left displays the following:
A blue strip labelled 1.
A dark blue strip labelled 1/2.
Two pink strips each labelled 1/3.
Two green strips each labelled 1/4.
Two yellow strips each labelled 1/5.
Three dark pink strips each labelled 1/6.
Four purple strips each labelled 1/8.
Five orange strips each labelled 1/10.
The section on the right contains enough fractions to complete the missing sections, with surplus fractions left over.

# Resource 4 – fractured fraction wall 2

Fractured fraction wall. Half the wall displays fractions cut up into pieces and put out in random pieces. Displayed are halves, thirds, quarters, fifths, sixths, eighths and tenths. Second part of the page has parts that can be cut out to fill in the missing fractions on the fraction wall.  

The fraction wall on the left displays the following:
A strip labelled 1.
A strip labelled 1/2.
Two strips each labelled 1/3.
Two strips each labelled 1/4.
Two strips each labelled 1/5.
Three strips each labelled 1/6.
Four strips each labelled 1/8.
Five strips each labelled 1/10.

# Resource 5 – fraction wall

Coloured fractional wall representing a whole, halves, thirds, quarters, fifths, sixths, eighths and tenths as separate coloured bars.  


# Resource 6 – gameboard and spinners

Gameboard and spinners. 
Blank fraction wall broken into 3 sections - halves, quarters and eights.
Blank fraction wall broken into 2 sections - thirds and sixths.
Blank fraction wall broken into 2 sections - sixths and tenths. 

Two blank tables with two columns for students to fill in their results. First column is: What I spun. Second column is: What I shaded. 

The spinner on the left represents the number of parts (1/*, 3/*, 2/*, 4/*, 3/* , 2/*).
The spinner on the right represents how many parts ( */8, */3, */5, */4, */10, */2, */6).

# Resource 7 – Which doesn’t belong?

Which doesn't belong? Four cards displayed:
Card 1: one half, 3 fifths, 4 eighths.
Card 2: 3 quarters, 4 sixths, 6 eighths.
Card 3: one half, 4 tenths, 2 fifths. 
Card 4: 4 sixths, 3 fifths, 2 thirds.

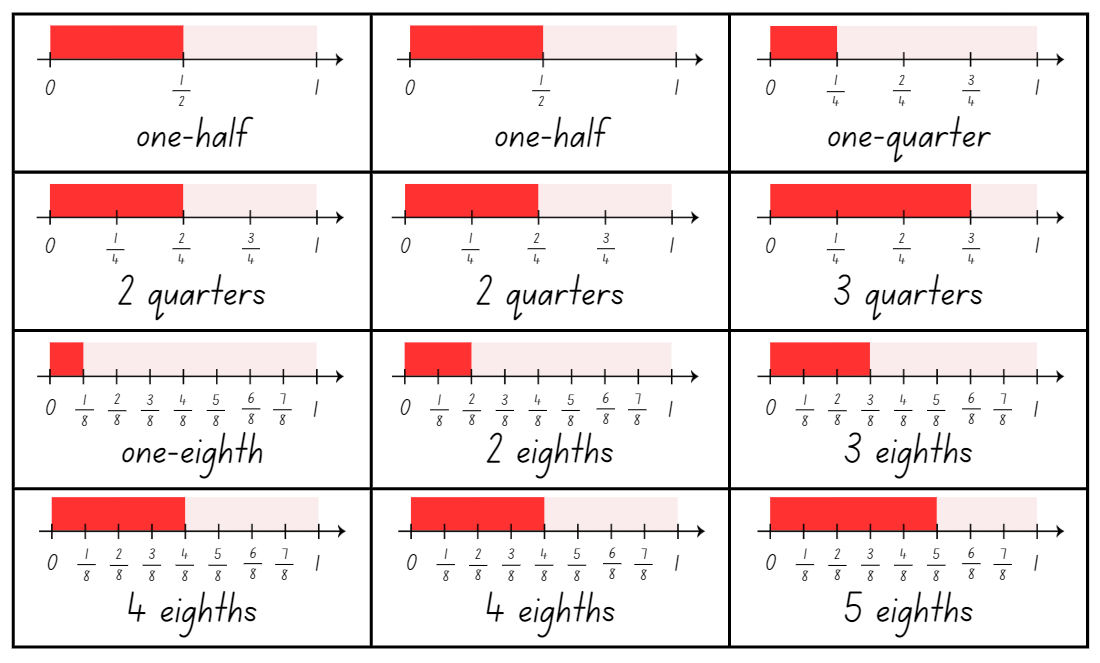
# Resource 8 – word problems

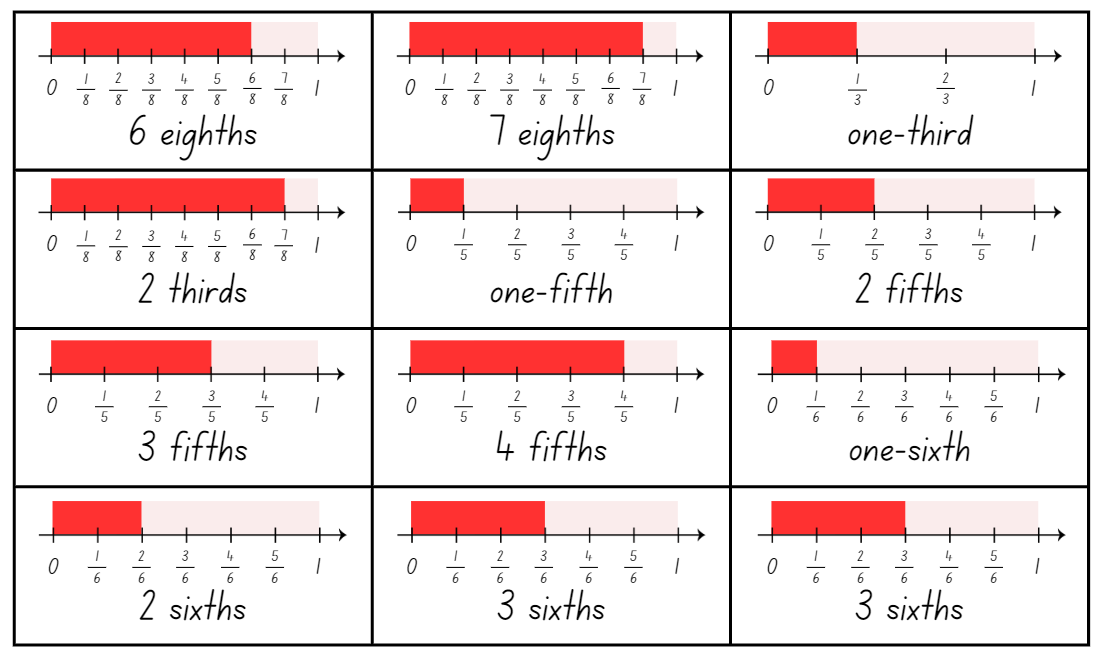
Word problems. 
Problem 1 - Samuel had 4 fish tanks. Each tank had 10 fish in it. He then bought one more tank. He shared all the fish equally between the 5 tanks. How many fish were then in each tank? 
Problem 2 - Nat had $24. She spent $4 each day. How many days did it take for Nat to spend all her money? 
Problem 3 - A shop sells cupcakes in trays and boxes. Each tray holds 6 cupcakes. Each box holds 8 cupcakes. Julia buys a total of 50 cupcakes. She buys 4 boxes and some trays. How many trays does Julia buy?

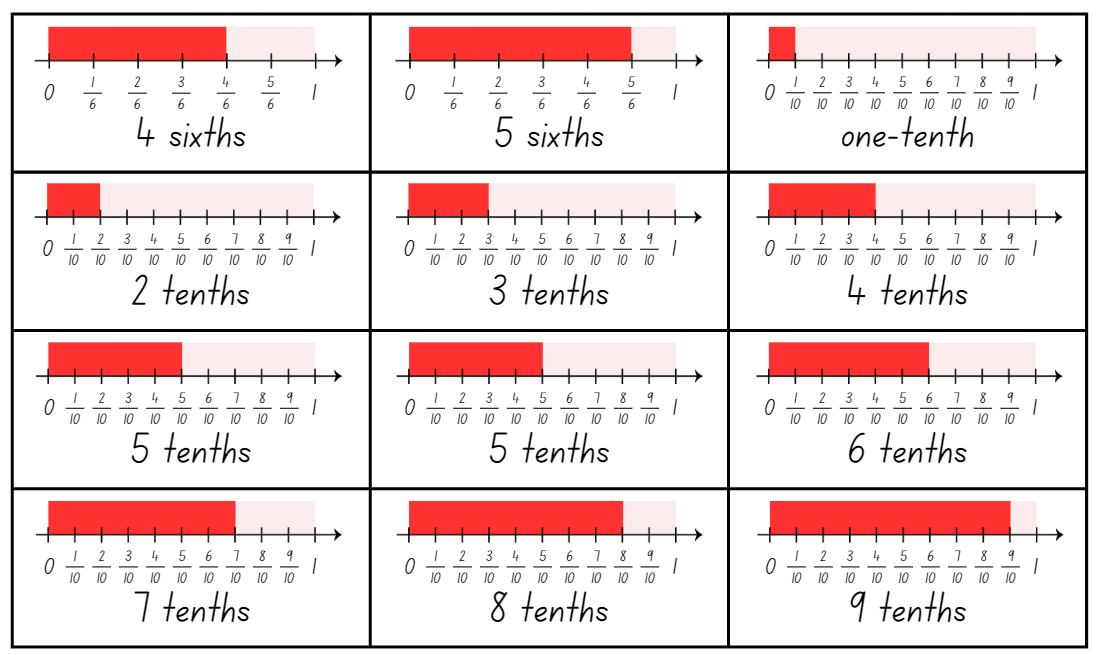
# Resource 9 – recreate the whole

Six examples of complementary fractions. Each example is a zero to one number line with a bar model above it representing the fraction. There are notations to indicate the location of each fraction on the number line, for example, 0, ¼, ½, ¾ and 1.
The fractions represented are one-quarter, one-half, one-eighth, 3 quarters, 9 tenths and 3 eighths.

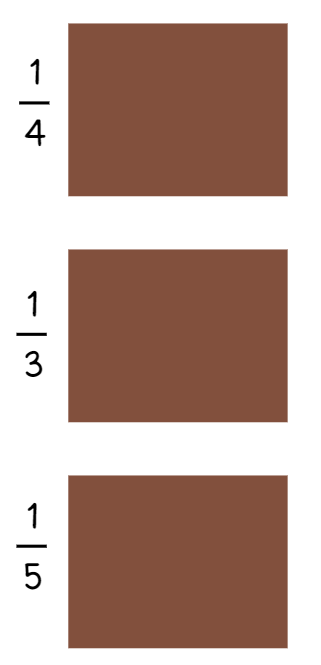
# Resource 10 – recreate the whole memory







# Resource 11 – chocolate bars



# Resource 12 – blocks of chocolate



# Resource 13 – number lines

Two number lines.
The first number line is marked with 0 and 1.
The second number line is marked with 0 and 2.

# 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 |
| **Multiplicative relations A**: Generate and describe patterns  **MAO-WM-01, MA2-MR-01** |  |  |  |  |  |  |  |  |
| * Model, describe and record patterns of multiples |  | x |  | x |  | x |  |  |
| **Multiplicative relations A**: Recall multiplication facts of 2 and 4, 5 and 10 and related division facts  **MAO-WM-01, MA2-MR-01** |  |  |  |  |  |  |  |  |
| * Recognise and use the symbols for multiplied by (×), divided by (÷) and equals (=) |  |  |  |  | x | x | x |  |
| * Link multiplication and division fact families using arrays |  |  |  |  | x | x |  |  |
| * Generate multiplication fact families for multiples of 2 and 4, 5 and 10 |  |  |  |  |  |  | x |  |
| **Partitioned fractions A**: Create fractional parts of a length using techniques other than repeated halving  **MAO-WM-01, MA2-PF-01** |  |  |  |  |  |  |  |  |
| * Make thirds of a length |  |  | x | x |  |  |  |  |
| * Create fifths of a length |  |  | x | x |  |  |  |  |
| **Partitioned fractions A**: Model and represent unit fractions, and their multiples, to a complete whole on a number line  **MAO-WM-01, MA2-PF-01** |  |  |  |  |  |  |  |  |
| * Model fractions with fraction strips and diagrams for halves, quarters, eighths, thirds | x | x |  | x | x |  |  |  |
| * Describe fraction families formed by dividing the whole into the same total number of equal parts as having the same denominator |  |  | x |  | x |  |  |  |
| * Determine the complementary fractional part needed to complete one whole (halves, quarters, eighths, thirds) (Reasons about relations) |  |  |  |  |  |  | x |  |
| * Recreate the whole unit from a fractional part (, and ) (Reversible reasoning) |  | x |  |  |  |  | x | x |
| **Partitioned fractions B**: Model equivalent fractions as lengths  **MAO-WM-01, MA2-PF-01** |  |  |  |  |  |  |  |  |
| * Represent the equivalence of fractions with related denominators as lengths, using concrete materials, diagrams and number lines |  |  |  |  | x | x |  |  |
| * Represent fractions with the same-size whole to make valid comparisons (denominators of 2, 4 and 8; 3 and 6; 5 and 10) |  |  |  |  | x |  |  |  |
| **Partitioned fractions B**: Represent fractional quantities equal to and greater than one  **MAO-WM-01, MA2-PF-01** |  |  |  |  |  |  |  |  |
| * Rename 2 halves, 3 thirds, 4 quarters, 5 fifths, 6 sixths, 8 eighths and 10 tenths as one whole |  |  |  |  | x |  |  | x |
| * Regroup fractional parts beyond one |  |  |  |  |  |  |  | x |
| * Represent totals of halves, thirds, quarters and fifths that extend beyond one |  |  |  |  |  |  |  | x |
| * Determine the relative location of one-quarter and one-half when a number line extends beyond one |  |  |  |  |  |  |  | x |

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