# Farm fence fractions

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| Year levelStrand(s)Lesson lengthCD Code: | * Years 5­—6
* Number / Measurement
* 80 mins
* [AC9M5N05](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/mathematics/year-5/content-description?subject-identifier=MATMATY5&content-description-code=AC9M5N05&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)
* [AC9M5M02](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-5_year-6/content-description?subject-identifier=MATMATY5&content-description-code=AC9M5N02&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)
* [AC9M6N04](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-6/content-description?subject-identifier=MATMATY6&content-description-code=AC9M6N04&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)
* [AC9M6N05](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-6/content-description?subject-identifier=MATMATY6&content-description-code=AC9M6N05&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)
* [AC9M6N07](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-6/content-description?subject-identifier=MATMATY6&content-description-code=AC9M6N07&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)
* [AC9M6M02](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/mathematics/year-6/content-description?subject-identifier=MATMATY6&content-description-code=AC9M6M02&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)
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| Lesson summary | In this third lesson of the series, we explore farm and paddock design as we delve into the world of fractions, decimals and perimeter using Cuisenaire rods or Unifix cubes as fencing materials. Note: Year 5 (fractions only); Year 6 (includes decimals and percentages).This lesson was developed in collaboration with the Australian Association of Mathematics Teachers (AAMT).  |
| Learning intention | * We are learning how to add fractions with the same denominator, including sums that result in improper fractions, and understand how to convert fractions as expressed as tenths to decimals.
* We are calculating the perimeter of rectangles and composite shapes by understanding how to add decimals with one decimal place.
* We are calculating percentage discounts and increases (extension activity).
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| Success criteria | By the end of this lesson, students can:* add lengths expressed in tenths of a metre to give improper fractions and can convert these lengths to decimals
* find the perimeter of rectangular shapes (including composite shapes) by adding decimals to one decimal place
* calculate a common percentage discount (25%) and decrease/increase an amount by this percentage (extension activity).
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| Why are we learning about this? | Perimeter is a mathematical concept with real-world application in estimating space and materials used by fencing contractors, builders, architects, landscapers and graphic designers. The key to finding perimeter is the ability to correctly add measurements, whether expressed as fractions or decimals. Skills adding fractions and decimals are also used in many other fields from financial contexts (banking and accounting) to baking! |
| Prerequisite student knowledge and language | * Basic arithmetic skills (addition, subtraction and multiplication)
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| **Resources** | Teacher’s slides (PowerPoint)Farm animal cut-outs sheet (Word)Large sheets of paperScissorsCuisenaire Rods or Unifix CubesOptional: stopwatches for TimekeeperPreparation tips:Each Farm animal cut-outs sheet is divided into three sets of animals. One sheet provides cards for three groups. |

Curriculum information

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| Achievement standard | * Year 5: Students order and represent, add and subtract fractions with the same or related denominators. They represent common percentages and connect them to their fraction and decimal equivalents. Students solve problems involving perimeter and area.
* Year 6: Students order, add and subtract fractions with related denominators. They use all four operations with decimals and connect decimal representations of measurements to the metric system. They solve problems involving finding a fraction, decimal or percentage of a quantity.
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| Content description(s) | Students solve problems involving addition and subtraction of fractions with the same or related denominators, using different strategies. [AC9M5N05](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/mathematics/year-5/content-description?subject-identifier=MATMATY5&content-description-code=AC9M5N05&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)Students solve practical problems involving the perimeter and area of regular and irregular shapes using appropriate metric units. [AC9M5M02](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-5_year-6/content-description?subject-identifier=MATMATY5&content-description-code=AC9M5N02&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)Students apply knowledge of place value to add and subtract decimals, using digital tools where appropriate; use estimation and rounding to check the reasonableness of answers. [AC9M6N04](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-6/content-description?subject-identifier=MATMATY6&content-description-code=AC9M6N04&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)Students solve problems involving addition and subtraction of fractions using knowledge of equivalent fractions. [AC9M6N05](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-6/content-description?subject-identifier=MATMATY6&content-description-code=AC9M6N05&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)Students solve problems that require finding a familiar fraction, decimal or percentage of a quantity, including percentage discounts, choosing efficient calculation strategies and using digital tools where appropriate. [AC9M6N07](https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-6/content-description?subject-identifier=MATMATY6&content-description-code=AC9M6N07&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick)Students establish the formula for the area of a rectangle and use it to solve practical problems. [AC9M6M02](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/mathematics/year-6/content-description?subject-identifier=MATMATY6&content-description-code=AC9M6M02&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick) |
| General capabilitiesCross-curriculum priority | Numeracy* Interpreting fractions ([Level 8](https://v9.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/numeracy?element=0&sub-element=4))
* Place value ([Level 7](https://v9.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/numeracy?element=0&sub-element=0))
* Additive strategies ([Level 9](https://v9.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/numeracy?element=0&sub-element=0))
* Understanding units of measurement ([Level 6](https://v9.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/numeracy?element=1&sub-element=0))

Personal and social capability* Collaboration ([Level 4](https://v9.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/personal-and-social-capability?element=3&sub-element=1))

Critical and creative thinking* Consider alternatives ([Level 4](https://v9.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/critical-and-creative-thinking?element=1&sub-element=1))
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| Areas of challenge | Some students may:* apply whole number thinking and incorrectly add both the numerators and denominators of fractions. Having students model the addition using blocks allows them to count the blocks and recognise that they still have a particular number of tenths (not twentieths)
* have difficulty adding decimals, relating decimal addition to whole number addition (for instance, applying rules about carrying over). Have students carefully align the decimal points in the column and ensure that whole numbers are also reflected to one decimal place, as in 1.0
* use sloping/diagonal fences (for instance, with non right-angled corners). Paddock fences may not join up if sloping sides are used, as sloping sides will not be rational number lengths. Students should be encouraged to change their designs to ensure that there are no gaps in the fence for animals to escape. Right-angled corners will ensure that this is the case
* get confused between the concepts of perimeter and area. Clarify the two different meanings: perimeter (total length of the boundary of the shape) and area (amount of interior space bounded by the perimeter) – see [glossary](https://v9.australiancurriculum.edu.au/downloads/learning-areas#accordion-b71b085f07-item-f1428171c5). Explain that we need to find the length of the fence needed, which should make explicit the need to find perimeter, which is facilitated using concrete materials.
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| Strategies | * Collaborative learning
* Concrete, Representational, Abstract model (CRA)
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Lesson structure

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| Learning hook10 mins | **Farm fence fractions warm-up challenge: Always, sometimes, never**Show the warm-up activity from the Teacher’s slides (slide 1). Students use mini-whiteboards or their mathematics book to prove whether this statement is always/sometimes/never true. (Statement: The numerator is ‘always/sometimes/never’ smaller than the denominator.)Expect responses such as:* + Always: because they may not have encountered improper/mixed fractions previously.
	+ Never: because they may be confusing the terms numerator and denominator or be unsure and simply be guessing.

Rate the responses. Gather or annotate some students’ answers. Have a class discussion as to why the answer is sometimes true. * + *‘Usually the numerator (how many pieces) is smaller than the denominator (how many pieces it has been cut into) because we often divide up one thing to create fractions, and that’s where we start when we begin learning fractions.’*
	+ *‘However, sometimes it can be bigger, such as if we need* $1\frac{1}{2}=\frac{3}{2}$ *watermelons to feed a big sports team! In this case, it means we have more than one whole part, and that's why the numerator is bigger than the denominator.’*

**Differentiation** (extension): Design your own ‘always/sometimes/never’ statement for your class peers using the context of fractions. **Differentiation** (support): Use of concrete materials, peer tutoring. |
| Explore55 mins | **Introduction** (10 mins) Present the students with their mission (slide 2): ‘Morning Farm Crew, I’m Farmer Oz, and today I need your help to design some paddocks for my animals’. ‘Have you ever looked at a map or a photo where you can see everything from above, just like a bird? What do you notice when you look at places from a bird’s-eye view?’Tell students they will be working in groups to design a paddock plan for 4 pigs, 8 chickens, 4 deer, 2 alpacas and 3 sheep.Let students know that each group will have 4 members, each with with various roles (slide 5). * + **Illustrator**: The illustrator is responsible for making the map visually attractive and creative.
	+ **Timekeeper**: The timekeeper ensures that the group stays on schedule, allocates tasks, and keeps everyone on track.
	+ **Materials manager**: The materials manager gathers and organises all necessary supplies for the project.

**Presenter**: The presenter prepares and delivers the presentation about the group's map, explaining its purpose and the fractions used.**Setting the scene** (5 mins)Display the learning intention (slide 3) and success criteria (slide 4) for the lesson, emphasising the importance of understanding fractions/decimals in finding perimeters.Engage students about the challenge ahead: designing animal paddocks for the farm. Emphasise the importance of efficient design and the use of fractions and decimals to measure the needed fencing. The goal is to create a well-designed set of paddocks that have enough space for all the animals and to calculate how much fencing will be needed, using both fractions and decimals.Explain that fencing can be bought in different lengths varying from 0.1m (or $\frac{1}{10}$m) to 1m, and that the fencing cannot be cut. Introduce the tools they will use – Cuisenaire rods or Unifix cubes – which will help them visually represent and measure the fencing for their paddocks. Each Cuisenaire rod or 10 Unifix cube lengths will represent a whole (1) piece of fencing. Smaller segments of these tools denote fractions of the whole.Display the teacher’s slides ‘Your fences’ slide (slide 8) and instruct students that the **Materials manager** is responsible for making fence pieces in all the different lengths and looking after the fence supplies.**Map designs on a large sheet of paper** (15 mins)Use slide 9 to illustrate an example of how the students might form a paddock enclosure and calculate its perimeter as both a fraction and decimal.Provide each group of students with a large piece of butcher's paper as their design platform for the farm and the Farm animals cut-outs sheet and scissors. Inform students that the whole piece of paper represents the whole farm and that their role is to create spaces with fences between the various animal areas in order to keep them safe and happy. They’ll need to cut out the animal shapes. Everyone can be involved in the preparation of supplies and farm design, but the **Illustrator** is responsible for drawing the design (with assistance, if they wish), just as the **Materials manager** has responsibility for the fences and animals.Students estimate how many fences they will need and the rough lengths required (using informal language).Re-explain that they have 4 pigs, 8 chickens, 4 deer, 2 alpacas and 3 sheep to accommodate in their animal paddocks. Use the following prompt questions to help students as they create their designs.* + *‘Do all of the animals need separate paddocks?’*
	+ *‘Do any of the animals need more or less space?’*
	+ *‘Can the same length of fence be used to create different-sized paddocks?’*
	+ *‘What shape of paddock gives the largest area for the animals for the shortest length of fence?’*
	+ A rectangle gives a larger area than an L shape using the same length of fence. Different rectangles can have the same perimeter, but different areas. The overall most efficient shape (giving maximum area) is a square.
	+ *‘Do the paddocks all need to be separate?’*
	+ Sharing fence boundaries between paddocks allows for less fencing to be used, reducing the overall cost to Farmer Oz.

Instruct groups to create their farm layout on the butcher's paper (drawing round the Unifix cube lengths or Cuisenaire rods) depicting the features and landmarks of their bird's-eye view design.Offer guidance on labelling and representing the students’ chosen designs.Encourage groups to use estimation to plan the size of each animal's area efficiently. (Extension: Students could research how much space different types of animals need and plan accordingly.)Timekeeper provides group with time updates.**Fencing: creating and adding fractions** (20 mins)Students begin laying out the Cuisenaire rods/Unifix cubes, representing the proposed fencing for their farm.Students keep a tally of the fencing used and calculate efficiently in fractions and decimals. Use the example on the Teacher’s slides (slide 9) to demonstrate how the students could set out their calculations. (Teacher note: differentiate and provide support for individuals/groups as required; explicitly teach the addition of fractions, if required.)Instruct groups to calculate and label the total length of fencing needed for different features on their maps, such as the length of fencing for each type of animal and the grand total.Encourage groups to discuss their designs and the different approaches they took in creating their efficient paddock layouts.**Pricing the fencing** (extension)Present slide 10 from the teacher’s slides.At the hardware shop, fencing costs $100 per metre.* + Calculate the total cost of fencing the paddocks.
	+ There are two special deals available at the hardware shop. With Offer A, you get a 25% discount off the total price. With Offer B, you get 25% extra free. Think of as many reasons as you can why Farmer Oz might choose Offer A or Offer B. Answers might include:
		- * + Prefer Offer A – save money straight away. The farmer may never use the extra fence from Offer B, so it’s a waste of money. They might not have room to transport or store the extra fence from Offer B.
				+ Prefer Offer B – it might be good to have spare fence if it gets damaged (for example, in a storm) or if the animals breed and need more space.
	+ Which is the best deal?
		- * + Financially, the students may believe that there is no real difference between the two offers. The counter-intuitive answer is that Offer A is actually a better deal. Let’s assume that the farmer needs 10m of fence at $100 per metre, which would mean a total cost of $10×\$100=\$1,000.$
				+ With Offer A, the farmer saves 25% of the cost, so then saves $\frac{\$1000}{4}=\$250$. The Offer A price is $\$1,000-\$250=\$750$ for 10m of fence. This equates to $\$750÷10=\$75$ per metre.
				+ With Offer B, the farmer would get 25% more fence, so that would mean 12.5m of fence at a cost of $1,000. This equates to a cost of $$1,000÷12.5=\$80 $per metre.
				+ Therefore, Offer A is better as $75 per metre is cheaper by $5 per metre than Offer B.

**Sharing and discussion** (5 mins)The **Presenter** from each group briefly shares their group’s map design and how much fencing they needed.Gallery Walk: students walk around the room observing the chosen designs of all groups. Teacher (standing in for Farmer Oz) gives a synopsis of the chosen designs and identifies which design would be most beneficial for the animals. Conclude the lesson by emphasising how this activity has helped them understand fraction and decimal addition in an applied context, and has introduced them to the concept of efficient use of resources when designing animal paddocks.(Optional additional lesson: link the task with creating and sticking to a budget. If fences are $100/$80 for each length, how much would your total fencing cost? Are there any ways in which money could be saved?) |
| Summary and reflection5 mins | Summarise the lesson's key points.Invite students to reflect on what they've learned:* *‘What did you learn about adding fractions in fencing?’*
* *‘What do we know about numerators and denominators?’*
* *‘In what ways did you use your knowledge of fractions to create your design?’*
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| Assessment5 mins | * Reserve time at the end of the lesson for students to reflect and demonstrate their learning.
* Use Farm fence fractions exit ticket on the teacher’s slides (slide 11).
* Which one of these designs uses the most fencing? Prove your answer.
* Expect responses such as*:* Treating each piece as one whole; difficulty adding fractions with different denominators.
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