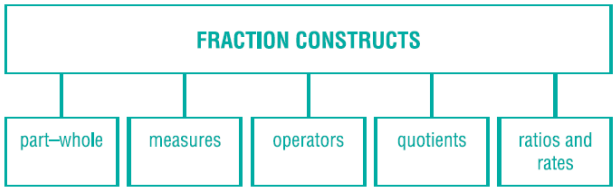
Upper primary

Fractions sample unit plan



Curriculum descriptors (and relevant proficiencies)		
Year 4 (BELOW) • Investigate equivalent fractions used in contexts (ACMNA077 – • Count by quarters halves and thirds, including with mixed numerals. Locate and represent these fractions on a number line (ACMNA078 • Recognise that the place value system can be extended to tenths and hundredths. Make connections between fractions and decimal notation (ACMNA079	**Year 5 (AT)** • Compare and order common unit fractions and locate and represent them on a number line (ACMNA102 • Investigate strategies to solve problems involving addition and subtraction of fractions with the same denominator (ACMNA103 - S • Recognise that the place value system can be extended beyond hundredths (ACMNA104 – • Compare, order and represent decimals (ACMNA105	**Year 6 (ABOVE)** • Compare fractions with related denominators and locate and represent them on a number line (ACMNA125 • Solve problems involving addition and subtraction of fractions with the same or related denominators (ACMNA126 • Find a simple fraction of a quantity where the result is a whole number, with and without digital technologies (ACMNA127 – • Make connections between equivalent fractions, decimals and percentages (ACMNA131 -

Year 5 Proficiencies

- **understanding** includes making connections between representations of numbers, using fractions to represent probabilities, comparing and ordering fractions and decimals and representing them in various ways, describing transformations and identifying line and rotational symmetry
- **fluency** includes choosing appropriate units of measurement for calculation of perimeter and area, using estimation to check the reasonableness of answers to calculations and using instruments to measure angles
- **problem-solving** includes formulating and solving authentic problems using whole numbers and measurements and creating financial plans
- **reasoning** includes investigating strategies to perform calculations efficiently, continuing patterns involving fractions and decimals, interpreting results of chance experiments, posing appropriate questions for data investigations and interpreting data sets.

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Summary of learning trajectory (development of mathematical concept)

Numeracy Learning Progression – Interpreting fractions ACARA

- InF1 – Creating halves
- InF2 – Repeated halving
- InF3 – Repeating fractional parts
- InF4 – Re-imagining the whole
- InF5 – Equivalence of fractions
- InF6 – Fractions as numbers
- InF7 – Using fractions

Key mathematical ideas

Students know and understand:

PART-WHOLE

- Fractions are parts of a whole [an object (discrete) or collection (continuous)]
- Fractions can be modeled, recorded and represented in different ways
- Fractions are not always less than 1.
- The same fraction can have different names (equivalent fractions).
- Fractional numbers can be renamed (mixed numbers and improper fractions)

MEASURES

- Estimating/benchmarking helps us to compare and order fractions.
- There are different ways of comparing and ordering fractions. Using equivalent fractions helps but there are other ways as well.
- Fractions are a number that can be ordered and placed on a number line using both mixed and improper fractions

OPERATORS

- Fractions can be multiplied, added, subtracted and divided.
- There are different approaches to adding fractions depending on the denominators of those fractions (same/related/different).
- It is important to read word problems carefully and to find an answer that makes sense.
- Everything we do with whole numbers we can also do with fractions, including estimating.
- Common fractions, decimals and percentages are all fractions and we can convert between them to helps us think flexibly about problems.

QUOTIENT

- Fractions as division.
- A fraction is a number that can represent a quotient of two integers and/or describe a comparison of two integers

RATIO

Key skills & strategies

Students can:

- Partition proper fractions as equal sized parts using a rectangular regions and other shapes (as part of a whole)
- Find a whole from a given part
- Name the equal sized parts using the language of "out of" and ordinal names e.g. 3 out of 5 equal parts or 3 fifths and match to region model and fraction symbol (p. 138 Booker)
- Order/Compare/Rename common fractions (on a number line)
- Represent improper (e.g. 7/4) and mixed numbers (e.g. 1 3/4) using rectangular regions and other shapes.
- Identify/Compare equivalent fractions and mixed numbers
- Count by a variety of fractions
- Identify fractions of a collections
- Estimate relative size to compare two or more fractions
- Add, multiply, subtract, divide fractions

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- A fraction is a number that can represent a scale factor used to shrink or stretch an amount or item.

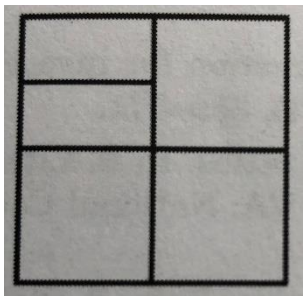
Formative assessment

Assessment of students' current mathematical knowledge:

- Fraction and decimal online interview

Fraction initial assessment.docx | Fractions formative checklist.doc | Booker fraction intervention test.pd

1. List as many fractions that can be represented by this figure as you can. Explain to a partner why each fraction is possible.



2. List some fractions that cannot be represented by the figure. Explain and justify your reasons.

Language focus

Key language, vocabulary and structures

Numerator	Halves, quarters	equal, collection
Denominator	Divide, whole	Compare, label
Mixed number	Thirds, ninths,	Eights, fifths
Improper fraction	Shape, size	Convert, same as
Equivalent, measure	Share, partition	Between, different
Simplest form	Simplify, decimal	Ratio, percent
Integer/s		

Lesson Structure

Each lesson ideally consists of 4 phases

1. ***Number Fluency*** – short, sharp fluency task. Ideally does not require much equipment. (5mins)
2. ***Launch Phase*** – whole class focus involving explicitly teaching, explanation, exploration of a concept. (10mins)
3. ***Explore Phase*** – students work on a learning task in various ability groupings depending on the purpose/nature of the task. The teacher will also work with a focus group if necessary, otherwise the teacher is roving and prompting/checking-in on student thinking and setting up the discussion for the summary phase. (20-25mins)
4. ***Summary Phase*** – verbal and/or written reflections or a combination of the two. Students discuss their learning in relation to the learning intention and build on each other's understandings. This may also involve reflections (10-15mins)

Making pedagogy explicit

- Specifically encourage students to:
  - persist
  - record their work
  - explain their thinking
  - listen to other students
  - work by themselves for a while

Session 1

Mathematical Focus – Equal parts of the whole

Launch:
Invite students to play with real or virtual pattern blocks. In particular, encourage them to explore the relationship between the pieces. E.g., Ask *"How many triangles make a trapezium?"*

Language focus
ninths, thirds, trapezium, triangle, label, hexagon, rhombus, compare, equivalent, whole, equal parts

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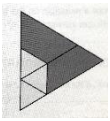
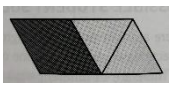
<table>
<tr><td rowspan="2"></td><td>Explore: This shape made out of pattern blocks is worth 1. Using either triangles or trapeziums, or both, what different fractions of the whole shape can you make? Draw and label your fraction.

Enabling Prompt: Advise students that the shape is made out of pattern blocks is worth 1. Ask: Using either the triangles or the rhombus, or both, what fractions of the whole shape can you make?

Extending Prompt: If the shape was made out of 2 trapeziums and 2 triangles and had a value of 1, what fractions could you make?</td><td>Anticipated responses
- Each parts of the fraction from 1/9 to 9/9 can be made
- Need to make connection between triangles and trapezium</td></tr>
<tr><td>Summary:
• What other fractions could you see? Opportunity to discuss equivalence of 1/3 and 3/9
• Make the connections explicit at the end
• Have students come up to front and share strategies, what patterns did they find? How did it help them?
• While students are listening to each other's strategies, you might ask "Have you got any questions about that explanation?", "Who can re-explain that?" while other student checks if that explanation is correct (deepens the explanation)
• What have you learned or thought about from this task, that you didn't know or think about before?</td><td>Required materials
• Isometric dot paper
• Pattern blocks
• P. 60 Sullivan (2018) for additional tasks</td></tr>
<tr><td rowspan="3">Session 2</td><td colspan="2">Mathematical Focus – Equal sharing (Fractions as division) - when we divide an object or a group into equal parts we are creating fractions</td></tr>
<tr><td>Launch: Create a story involving sharing and discuss the possibilities</td><td>Language focus
- equal parts
- fractions as division
- numerator
- denominator</td></tr>
<tr><td>Explore: I need to share 6 chocolate bars equally between 8 friends. How might I do this? Give 2 different options. What fraction of a bar does each friend get? Label your fractions.

Enabling prompt: How might you share 4 chocolate bars equally between 8 children?

Extending prompt: Ask students to suggest two different options for sharing 3 chocolate bars equally between 5 children.

**It is important that the items being shared does not have obvious parts e.g. a Mars bar, as opposed to a block of Cadbury chocolate.</td><td>Anticipated responses
• divide 4 bars into halves, and the other 2 bars into quarters, and give each person one half and one quarter
• divide each bar into eights, and give each child 6 of the eights
• take ¾ of each bar, and give them to 6 of the children. The other two children each get 3 of the quarter parts that left. This requires only 6 cuts.</td></tr>
<tr><td>Summary:
• Highlight the idea of 'when we divide an object or a group into equal parts we are creating fractions'.
• Which method requires fewer cuts of the chocolate?</td><td>Required materials
p. 62 Sullivan (2018) for additional tasks.</td></tr>
</table>

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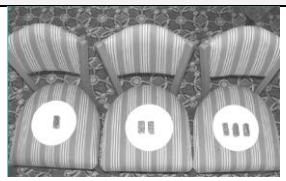
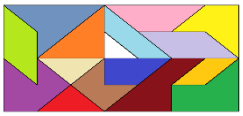
<table>
<tr><td rowspan="4">Session 3</td><td colspan="2">Mathematical Focus – Fractions as division: When we divide an object or a group into equal parts we are creating fractions</td></tr>
<tr><td>Launch: Fraction chairs (Clarke, 2006)
Ask 10 students to enter the room one by one and select which chair they will stand behind – more chocolate is better.
Ask: Where do you chose to stand and why?
  </td><td>Language focus
- equal parts
- fractions as division
- numerator
- denominator</td></tr>
<tr><td>Explore: Each group, together with rest of class, discuss how much chocolate they will each get, how do you know?

Enabling prompt: Reduce the amount of chairs/chocolate.
How might you share 4 chocolate bars equally between 8 friends?

Extending prompt:
• If at the end, you had the choice to move to a different chair, would you do so? Why? Where would you move to?
• Where would you choose to stand in the queue? Is it best to go first or last?
• What strategies would you use if you were in the line?
• How might you share the chocolates so that everyone, might get a similar/equal share? Is that the only way?</td><td>Anticipated responses
• last person could be faced with equivalent alternatives e.g. 5ppl/3blocks, 3ppl/2blocks, 1pax/1block</td></tr>
<tr><td>Summary: How many people knew before they came to class today, without calculating, that two blocks shared between three people must mean two thirds each?
Discuss/reflect – “One meaning of 2/3 is ‘2 divided by 3’. Or “What does the numerator/denominator mean?”</td><td>Required materials
- 3 chairs, 6 blocks of chocolate (not marked)
- APMC paper</td></tr>
<tr><td rowspan="4">Session 4</td><td colspan="2">Mathematical Focus – Fractions are numbers and are not always less than 1. We can compare, add and multiply fractions.</td></tr>
<tr><td>Launch: Number talk using picture– Fractions are not always less than 1. Ask: If the white triangle is 1, what other numbers can you see.
  </td><td>Language focus
Equivalent, same as, more than, less than, compare, whole, parts, proper, improper fractions, mixed numbers</td></tr>
<tr><td>Explore: Using Cuisenaire rods think about the following questions
• What fraction of the brown rod is the red rod?
• IF the purple is 2/3, which rod is the whole?
• If the brown rod is 4/3, which rod is one?
• If the blue rod is 1 1/2, which rod is 2/3?
 

Enabling prompt – If the white rod is ½, which is a whole?

Extending prompt – What other fractions/numbers can you see? Create a design, what is it worth?</td><td>Anticipated responses

Move from part to whole, whole to part, and part to part.

Reaslisation that numerator can be ‘larger’ than the denominator

Arranging rods in a ‘staircase’ and then counting down from the white rod and then calling the orange rod ten-ninths

Use of benchmarking 0, ½ , 1</td></tr>
<tr><td>Summary: Focus on ‘Compare and Connect’ discussion strategy. What strategies did you use to find the worth of the rods? Who approached it a different way? Is your</td><td>Required materials
Cuisenaire rods</td></tr>
</table>

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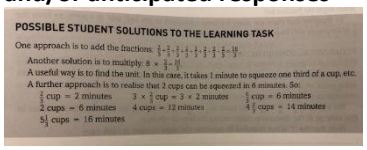
<table>
<tr><td></td><td>strategy the same or different? If you had to teach someone else about equivalent fractions what would you say / do?</td><td></td></tr>
<tr><td rowspan="4">Session 5</td><td colspan="2">Mathematical Focus – Fractions are numbers and are not always less than 1. We can compare, add and multiply fractions.</td></tr>
<tr><td>Launch:
Tell students a story that matches the learning task. Adapt the context to one with which students might be familiar.</td><td>Language focus
Mixed number, improper fractions, numerator, denominator</td></tr>
<tr><td>Explore: It takes 2 minutes to squeeze 2/3 of a cup of juice. How much juice could I squeeze in 16 minutes? How long would it take to squeeze 4 cups of juice? Show your answer in two different ways.

Enabling prompt – If it takes 5 minutes to squeeze 2 cups of juice, how much could I squeeze in 30 minutes? What about if it takes 5 minutes to squeeze ½ cup of juice, how much could I squeeze in 30 minutes?

Extending prompt – It takes 5 minutes to squeeze 1 2/3 cupt of juice. How much could I squeeze in 2 ½ hours? How could you represent your answer?</td><td>Indicators of student learning and/or anticipated responses
 
POSSIBLE STUDENT SOLUTIONS TO THE LEARNING TASK
One approach is to add the fractions: $\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}=\frac{12}{3}$.
Another solution is to multiply: $8\times\frac{2}{3}=\frac{16}{3}$
A useful way is to find the unit. In this case, it takes 1 minute to squeeze one third of a cup, etc.
A further approach is to realise that 2 cups can be squeezed in 6 minutes. So:
$\frac{1}{3}$ cup = 2 minutes $3\times\frac{1}{3}$ cup = $3\times$ 2 minutes $\frac{1}{2}$ cup = 6 minutes
2 cups = 6 minutes 4 cups = 12 minutes $4\frac{1}{2}$ cups = 14 minutes
$5\frac{1}{3}$ cups = 16 minutes</td></tr>
<tr><td>Summary:
Focus on ‘Compare and Connect’ discussion strategy to explore how students found two ways to solve the task/s and record solutions using fractions notation. Model the ways that number lines can be used to represent the solution. Emphasise the connections between the solutions the students create.</td><td>Required materials
p. 64 Sullivan (2018) for additional tasks.</td></tr>
<tr><td rowspan="3">Session 6</td><td colspan="2">Mathematical Focus – Estimating helps us to compare and order fractions</td></tr>
<tr><td>Launch:
“Zero, One-Half, or One” p.74 (3.4, Van de Walle 6-8).
On board write a collection of 10-15 fractions. A few should be greater than 1 (9/8 or 11/10), with the others ranging from 0-1. Let students sort the fractions into three groups: those close to 0, half, 1. For those close to half, have students decide if the fraction is more or less than half. (Difficulty of task depends on fractions used). E.g. Easy – 1/20, 53/100, 9/10. Harder, use fractions with most of the denominators less than 20. Students are required to explain their thinking for each fractions.</td><td>Language focus
Benchmark, closest to, smaller, larger, half, zero, 1, more than, less than, compared to</td></tr>
<tr><td>Explore
Present pairs of fractions. Invite students to decide which fraction is greater and explain their reasoning. They can test their choice using any model they wish to use. They should write a description of how they made their test and whether or not it agreed with their choice. If their choice was incorrect, they should try to say what they would change in their thinking. In the student explanations, try to rule out drawing as an option. Explain to students that drawings are sometimes inaccurate and can lead to faulty conclusions for these tasks.

Enabling prompt
• Using rectangular region models
• activity 3.6 p. 75 “About How Much”</td><td>Anticipated responses
• Watch for misconception that ‘larger bottom number means smaller fractions’ – revisit this in class and in summary
• Approaches includes:
1. More of the same-size parts
2. Same number of parts but parts of different sizes</td></tr>
</table>

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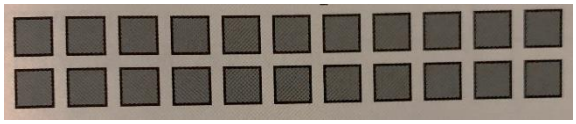
	Extending prompt • marking as accurately as possible on a (blank) number line • Show your thinking in at least two different ways	3. More and less than one half or one whole 4. Distance from one half or one whole.
	Summary - Focus on size of fractions, not algorithm or process. - Students share their explanations. What helped them to decided which fractions is bigger or smaller? - Hand out fraction number cards, put yourselves in order from smallest to biggest.	**Required materials** • Fraction pair cards • Follow up with number line type tasks, Construct a Sum.
Session 7	***Mathematical Focus*** *– We can represent fractions in many ways (multiplicative comparisons)* Fractions are numbers that can be represented using pictures and symbols. Everything we do with whole numbers we can do with fractions	
	Launch: Buzz – game warm up. Revise mixed numbers/improper fractions, e.g. If I have 3 ½ oranges, how many ½ oranges is that? We can write that as 7/2/	**Language focus** Mixed number, improper fractions, convert, equivalent
	Explore: If this represents 3 2/3, draw what represents 1 1/2 . Work this out in 2 different ways. Explain your thinking clearly  *Enabling prompt:* If the diagram represents 11, draw what represents 5. If it represents 7 1/3, draw what represents 2. *Extending prompt:* Find a third way to do the question. *E.g., If the diagram represents 8 4/5, draw what represents 2.4.*	**Anticipated responses** • 3 2/3 is the same as 11/3. 22 squares, each one represtns 1/3 • If we group the squares into 3 groups, there would be 7 in each group with 1 left over, which doesn't help solve the problem. There could be 6 in each group with 4 left over… • 22 divided 11/3… • 3 2/3 x 3 is 11 and 22 x 3 is 66 so…. • We can draw 3 squares and 2/3 of a square, divide each square into thirds (making 11 parts) and hten divide those parts in 2 (making 22). We can no color in 1 and ½ of the original squares.
	Summary: Monitor, select and sequence students' responses to show ways of sophistication in solving the task – some involve numbers, some involve diagrams. Emphasise the mathematics between the strategies and the representations.	**Required materials** Copies of main task with tiles.
Session 8	***Mathematical Focus*** *– Fractions between: Fractions are numbers that we can compare and arrange in order. It's easier to do this if the fractions we are comparing have the same denominator.*	
	Launch: One-third of the class likes eating broccoli. How many students might there be in the class and how many might like broccoli? Discuss possible answers to illustrate that there are different ways of writing the same fraction	**Language focus** Denominator, numerator, equivalent, between, different, convert, change
	Explore	**Anticipated responses**

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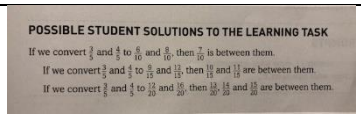
	What are five different fractions between 3/5 and 4/5? (Sullivan, 2018, p. 68) *Enabling prompt* Give four fractions between 3/10 and 7/10 *Extending prompt* What fraction is halfway between 4/7 and 5/7…. Between 2/7 and 5/7?	 POSSIBLE STUDENT SOLUTIONS TO THE LEARNING TASK If we convert $\frac{2}{5}$ and $\frac{4}{5}$ to $\frac{6}{10}$ and $\frac{8}{10}$, then $\frac{7}{10}$ is between them. If we convert $\frac{3}{5}$ and $\frac{4}{5}$ to $\frac{9}{15}$ and $\frac{12}{15}$, then $\frac{10}{15}$ and $\frac{11}{15}$ are between them. If we convert $\frac{3}{4}$ and $\frac{4}{5}$ to $\frac{15}{20}$ and $\frac{16}{20}$, then $\frac{31}{40}$, $\frac{32}{40}$ and $\frac{33}{40}$ are between them.
	Summary: - Share students' strategies – Can you re-explain what student X said? - What can help us compare and order fractions? - Where are connections to everyday life (see supplementary tasks).	**Required materials** See Sullivan (2018, p. 69) for additional tasks.
Session 9	***Mathematical Focus*** *– Comparing fractions: There are different ways of comparing and ordering fractions. Using equivalent fractions helps but there are also other ways.*	
	Launch: Discuss which is bigger ½ or 99/200. ½ or 100/199	**Language focus**
	Explore (p.74, Sullivan, 2018) Explain how to work out which is larger 2/3 or 201/301. Use 2 different methods to find the answer. While the answer is straightforward, there are many ways to explain the answer. *Enabling prompt* Which is bigger: ½ or 1/3? How do you know? *Extending prompt* Ask students to explain how to work out which is more: 3/5 or 299/499. Have them use two different methods to work it out.	**Anticipated responses** • Find common denominators and compare • Use a calculator to divide numerator by denominator • Building to the whole • Putting it into context e.g. basketball throws
	Summary: Have students share various strategies. Explain the mathematical basis behind the strategies and how they are connected to each other	**Required materials** • Fractions wall/strips (optional) • See p. 75 for additional tasks.
	Mathematical Focus *– Adding and subtracting – There are different approaches to adding and subtracting fractions depending on the denominators of those fractions.*	
	Launch: Provide pairs of students a set of laminated fraction cards and have them sort the addition tasks into three groups, then describe their groups	**Language focus** Equivalent, numerator, denominator, simplest form, compare, simplify, convert
	Explore I did a fraction addition question on the computer, but when I printed it out some numbers did not print. What might the missing numbers be? 2 ?/4 + ?/8 = 3 ?/? Give as many reasons as you can.	**Anticipated responses** 2 ¼ + 7/8 = 3 1/8 2 ¾ + 4/8 = 3 2/8 = 3 ¼ 2 ¾ + 3/8 = 3 1/8

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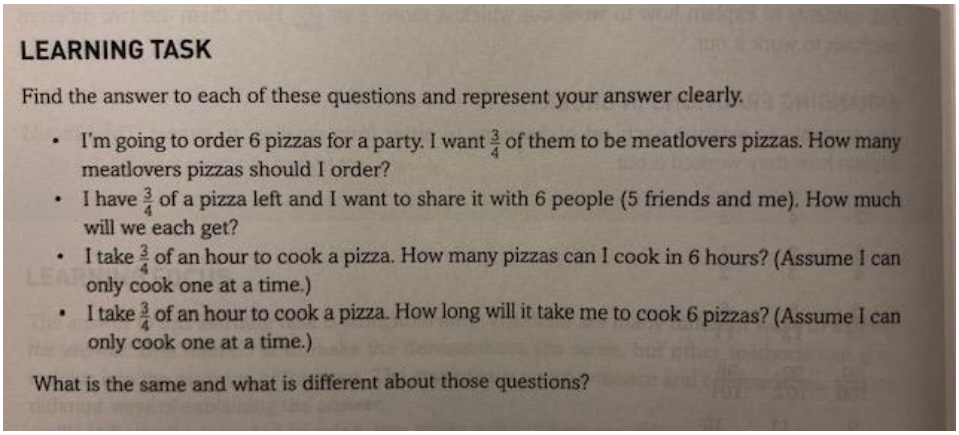
	Enabling prompt Offer the following, What might the missing numbers be? ?/4 + ?/8 = ?/8 *Extending prompt* Convince me that you have all the possible solutions	
	Summary: What helps you to add fractions with different/same denominators? Share strategies and focus on denominators – the most efficient method depends on the combination of numbers.	**Required materials** • Laminated cards – sorting fractions p. 171 Sullivan (2018)
Session 10	***Mathematical Focus*** *– Worded fractions (division and multiplication introduction): It's important to read word problems carefully and to find an answer that makes sense.*	
	Launch: Using BLM 13 Fraction Match up – have students match up the different representations and discuss. (Sullivan, 2018, p. 76). Can act out a scenario or arrange the cards with the word 'pizza' in order of difficulty and explain their choices. They can then match the other cards.	**Language focus** How many, left. Share, much, each, same, different
	Explore  **LEARNING TASK** Find the answer to each of these questions and represent your answer clearly. • I'm going to order 6 pizzas for a party. I want $\frac{3}{4}$ of them to be meatlovers pizzas. How many meatlovers pizzas should I order? • I have $\frac{3}{4}$ of a pizza left and I want to share it with 6 people (5 friends and me). How much will we each get? • I take $\frac{3}{4}$ of an hour to cook a pizza. How many pizzas can I cook in 6 hours? (Assume I can only cook one at a time.) • I take $\frac{3}{4}$ of an hour to cook a pizza. How long will it take me to cook 6 pizzas? (Assume I can only cook one at a time.) What is the same and what is different about those questions? *Enabling prompt –Draw a picture.* I'm going to order 6 pizzas for a party. I want ½ of them to be meatlovers pizza. How many meatlovers pizzas should I order? I have 2 pizzas left and I want to share them between 6 people (5 friends and myself). How much do we each get? *Extending prompt* I take 1 ¾ hours to cook a pizza. How many pizzas can I cook in 6 hours? I take 1 ¾ hours to cook a pizza. How long will it take for me to cook 6 pizzas?	**Anticipated responses** - **Students may draw a picture, use numberlines or symbols.**
	Summary: Encourage students to explain and justify their answers and representations. See p. 77 for follow-up tasks.	**Required materials** • BLM 13 Fraction match up

SAMPLE PLANNER ONLY

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Assessment	**Summative Assessment task** Revisit initial assessment and update Fraction and Decimal interview data
Reflection	**What additional opportunities are there for ongoing exploration of the concepts, practice, and making mathematical connections in other contexts after the unit?** Pending team discussion and individual teacher judgements

References:

- Peter Sullivan (2018) "Challenging Mathematical Tasks"
- Doug Clarke (2011) "Fractions as Division: The forgotten notion?" APMC article
- Jenni Way & Janette Bobis (Eds) (2011). "Fractions Teaching for Understating", AAMT book
- Van de Walle et al., (2012). *Teaching Student-Centered Mathematics 6-8.*

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Prepared by Aylie Davidson. Updated December 2019