YuMi Deadly Maths

Year 7 Teacher Resource:

NA – Form one family

Prepared by the YuMi Deadly Centre
Faculty of Education, QUT

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ACKNOWLEDGEMENT

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refined and presented in professional development sessions.

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Year 7 Number and Algebra

Form one family

Learning goal	Students will add and subtract fractions with related denominators.
Content description	Number and Algebra – Real numbers • Solve problems involving addition and subtraction of fractions, including those with unrelated denominators (ACMNA153)
Big idea	Number – equivalence, part-part-whole, additive structure
Resources	Ropes, arrow cards for fractions: halves, thirds, quarters, fifths, sixths, eighths, tenths, twelfths and their multiples, elastics, three paper strips of different colours (A3 length), templates

Reality

Local knowledge

Discuss the concept of being "common" and the need for renaming different groups to refer to a common name; e.g. *What's the common name? – adding the number of pets we have: 3 dogs and 2 cats make 5* ***animals****; buying 6 apples and 4 oranges makes a total of 10 pieces of* ***fruit****; 12 boys and 11 girls make 23* ***students*** *in the class; car yard with 50 cars and 9 trucks, the day's sales of 15 cars and 1 truck, how many* ***vehicles*** *left? Dad, Mum, brother, sister, grandparents make one* ***family****.* Establish that addition and subtraction occur with items that have the same or can be given a common name.

Prior experience

Check students' understanding of addition and subtraction of fractions with the same denominator; e.g. with fraction circles, show one quarter and two quarters make three quarters. Give other examples including subtraction. Revise equivalent fractions with overlays and base boards for half, third, quarter, fifth unit fractions. *How many ways can we show one half?* [two quarters, three sixths, four eighths, five tenths, six twelfths, seven fourteenths, …]. *Is this the end?* [No, we can go on infinitely in this way.]

Kinaesthetic

Establish the need for fractions with a common name in addition and subtraction of fractions (halves and halves, thirds and thirds, quarters and quarters and so on). *The denominator is the name for the type of fraction so for addition and subtraction the denominators must be changed so that all the fractions have the same name or denominator.*

Using a rope/s, students explore fractions that are related in the one family; e.g. fold the rope into halves then quarters, eighths, sixteenths (would be getting very small but it could be done). Students place arrow fraction cards appropriately. Fold another rope (same size) into thirds, sixths, ninths, twelfths. Compare to see that 1 half on the first rope is the same as 3 sixths on the second rope so halves and thirds could be added if we called them both sixths: 1 half is 3 sixths and 1 third is 2 sixths, so 3 sixths and 2 sixths make 5 sixths. *Sixths is an extended family of halves and thirds just like some of your cousins may have a different family name but they still belong to your family. You are all related. Fractions are related when we change their family name, or denominator, to a common family name that is a multiple of both denominators.*

Orally name the fraction family for quarters: quarters, eighths, twelfths, sixteenths, twentieths and so on. *What do you notice?* [The fraction family is the same as the multiples of 4.] Name the fifth fraction family: fifths, tenths, fifteenths, twentieths. *Could we add quarters and fifths? What name would we give the fractions? What multiple was the same for both quarters and fifths?* [twentieths]. *Can we make a fraction family for any type of fraction?* [Yes. In any type of fraction family, the denominator will always be the family of multiples for that denominator.]

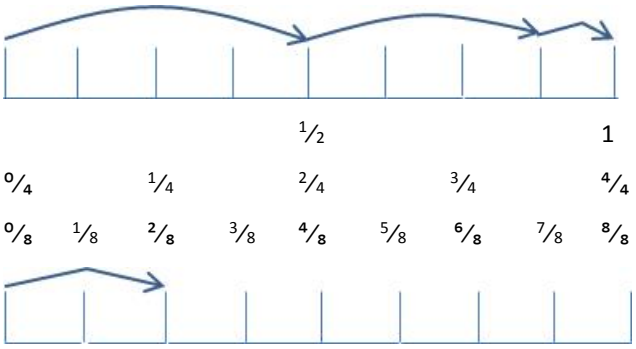
Why would we try to find the lowest common denominator? [We want the fraction family to have the fewest parts possible; the more parts we have the smaller the parts are becoming. If we divide a pizza into eight pieces, everyone gets a decent slice but if we have to divide one pizza into 24 pieces, the slices are getting to be very small.]

Abstraction

Body

Investigation: *If the family ate some liquorice out of the Ekka showbag, how many liquorice sticks would be eaten if Dad ate half a stick, Mum ate three eighths, you ate one quarter and baby ate one eighth?* Students work in groups with ropes or masking tape on the ground to lay out arrow cards to represent the above fractions. Discuss: *Who is getting the smallest piece? How much is it?* [one eighth]. Divide both ropes into eighths by dividing the rope into halves and putting an arrow card to mark the half position. Mark off all the fractions so formed with the fraction cards so that where appropriate all the equivalent fractions have all equivalent terms side by side.

Use elastics to link the liquorice story parts together.



The diagram shows that one half (that is four eighths) and three eighths and one eighth and one quarter (that is two eighths) add up to 10 eighths in total; 4 + 3 + 1 + 2 will always add up to 10 whether they are oranges, students or eighths that we are talking about. We see that the 10 eighths can also be seen as 8 eighths and 2 eighths or $1\frac{2}{8}$ which is $1\frac{1}{4}$. Explore subtraction in a similar manner.

Reverse: *Look at the ropes and tell me a story of fractions that will add up to $1\frac{3}{4}$. Tell me a subtraction fraction story that will leave 5 eighths.*

(Consolidation lessons can occur using thirds, sixths, ninths, twelfths then fifths, tenths, fifteenths, twentieths and so on.)

Hand

Distribute three differently coloured paper strips to each student (same size: A3 length). Students fold the first paper strip into halves, draw a line down the fold and mark ½ on the line, then fold and draw lines/marks for quarters, then the same for eighths. The next paper strip is folded into thirds, then the thirds into sixths and the sixths into twelfths. Mark the sections. The next paper strip is folded into fifths and the fifths into tenths. Mark the sections.

Students explore where the strips line up to make equivalent fractions and investigate fraction parts that can be added and subtracted. They record sentences of their addition and subtraction of fractions. Teachers may begin this investigation by modelling a few examples.

Mind

Close your eyes and see three pizzas. Now see how much is left after one whole pizza has been eaten and 5 eighths of another has also been eaten. Give similar examples that include addition and subtraction of fractions.

Creativity

Students work with fraction overlays, fraction circles and strips to create their own representations of adding and subtracting fractions working with proper, improper and mixed numbers.

Mathematics

Language/ symbols

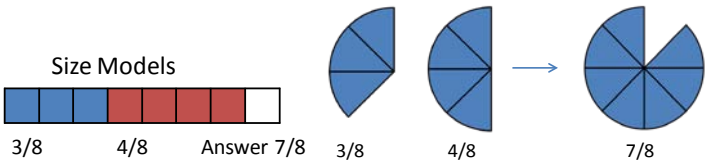
compare, equivalent, related, unrelated, denominator, mixed number, improper, lowest common denominator, lowest terms

Practice

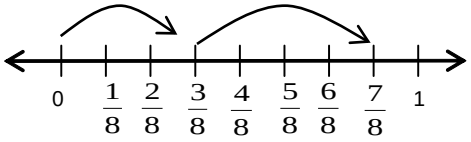
Students work with various models as shown below to represent addition and subtraction of fractions and record their findings.

1. Simple operations

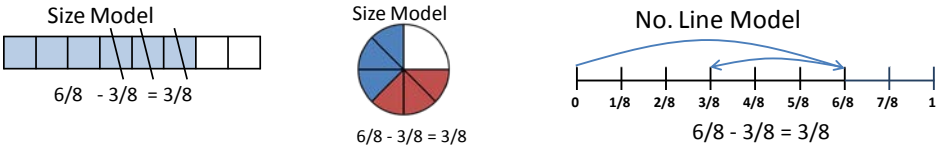
Example $^3/_8 + {}^4/_8$. For the **size model**, shading areas will work as will joining eighth pieces (see below).



For the **number-line model**, the shading or the materials are replaced with hops along a line as shown below. Eighths are shown on a line 0–1 divided into eight equal parts. This can be done by 3 hops and then 4 hops, or by a hop of $^3/_8$ and a hop of $^4/_8$.



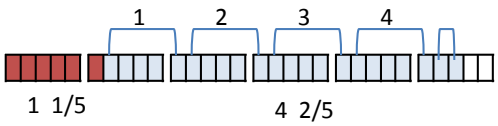
Example $^6/_8 - {}^3/_8$. Subtraction is done the same way as below.

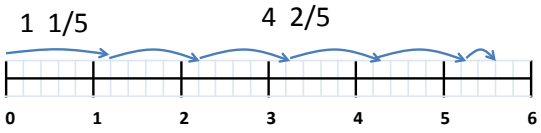


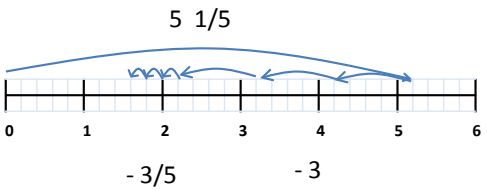
2. Mixed numbers

Example $1^1/_5 + 4^2/_5$ and $5^1/_5 - 3^3/_5$. Mixed number addition and subtraction can be done in the following three ways.

(a) Use models as in Step 1:







(b) Change to improper fractions and use pattern:

$1\frac{1}{5} + 4\frac{2}{5} = \frac{6}{5} + \frac{22}{5} = \frac{28}{5} = 5\frac{3}{5}$; $5\frac{1}{5} - 3\frac{3}{5} = \frac{26}{5} - \frac{18}{5} = \frac{8}{5} = 1\frac{3}{5}$

(can also do **additive sequencing**: $3\frac{3}{5} \rightarrow \frac{2}{5}$ to 4 $\rightarrow 1\frac{1}{5}$ to $5\frac{1}{5}$, so difference is $1\frac{3}{5}$; and **compensation**: $5\frac{1}{5} - 3\frac{3}{5} = 5\frac{3}{5} - 4$ by adding $\frac{2}{5}$ to each number).

(c) Use a whole-part chart:

Whole	Part
1 + 4	$\frac{1}{5}$ + $\frac{2}{5}$
5	$\frac{3}{5}$

Whole	Part

Whole	Part
~~4~~ ~~5~~ – 3	$\frac{6}{5}$ ~~$\frac{1}{5}$~~ – $\frac{3}{5}$
1	$\frac{3}{5}$

Whole	Part

The above examples use sequencing for (a); sequencing, additive sequencing and compensation for (b); and separation for (c). This also extends work done in the YDM Number book for (a) and (c) – showing that, where possible, operations should be done as an extension of numeration work, not as a new topic.

Connections Relate to whole numbers and decimal fractions.

Reflection

Validation Students discuss situations where addition and subtraction of fractions are needed and used. Write and solve stories that illustrate this; e.g. *A block of Cadbury Fruit and Nut chocolate was divided into 36 small pieces. Bob ate 4, Tom ate 6 and Sue ate 2 pieces. How much was left out of the 36 pieces for the rest of the group? Draw the chocolate block and calculate the fraction eaten by each of the three students, the total amount they ate and the fraction that was left. Are your fractions in their lowest terms?*

Application/ problems Provide applications and problems for students to apply to different real-world contexts independently; e.g. *If a circle was cut into 24 equal sectors, how could you colour these sectors so that different fractions were obtained for different colours? You may be able to show more than one example.*

Extension **Flexibility**. Use different models to represent addition and subtraction of fractions, e.g. set/size, area, volume, number line and fraction circles.

Reversing. Students are able to move between telling a fraction story ↔ acting it out ↔ writing and representing addition and subtraction of fractions ↔ interpreting fraction diagrams and stories, starting from and moving between any given point.

Generalising. *Addition and subtraction can only occur with like or the same type of objects. All fractions have an infinite set of equivalent fractions. That means equivalent fractions are able to be made with a common denominator from two, three or more related (and unrelated) fractions. There are also an infinite set of equivalent common denominators that could be used to add or subtract fractions. The lowest common denominator is chosen to simplify the calculation*.

Changing parameters. Add and subtract fractions with unrelated denominators. Add and subtract decimal fractions.

Teacher's notes

- Ensure that students have a sound understanding of multiples and ways to select the lowest common denominator for different fraction types. The number of parts in the numerator can be added or subtracted, if and when the denominators are the same. The denominator shows that we are adding or subtracting the same type of parts.
- Students need to be taught the skill of visualising: closing their eyes and seeing pictures in their minds, making mental images; e.g. show a picture of half a cake, students look at it, remove the picture, students then close their eyes and see the picture in their mind; then make a mental picture of a quarter of an orange.
- Suggestions in Local Knowledge are only a guide. It is very important that examples in Reality are taken from the local environment that have significance to the local culture and come from the students' experience of their local environment.
- Useful websites for resources: www.rrr.edu.au; https://www.qcaa.qld.edu.au/3035.html
- Explicit teaching that **aligns with students' understanding** is part of every section of the RAMR cycle and has particular emphasis in the Mathematics section. The RAMR cycle is not always linear but may necessitate revisiting the previous stage/s at any given point.
- Reflection on the concept may happen at any stage of the RAMR cycle to reinforce the concept being taught. Validation, Application, and the last two parts of Extension should not be undertaken until students have mastered the mathematical concept as students need the foundation in order to be able to validate, apply, generalise and change parameters.