YuMi Deadly Maths

Year 7 Teacher Resource:

NA – How much is this part?

Prepared by the YuMi Deadly Centre
Faculty of Education, QUT

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ACKNOWLEDGEMENT

We acknowledge the traditional owners and custodians of the lands
in which the mathematics ideas for this resource were developed,
refined and presented in professional development sessions.

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Year 7 Number and Algebra

How much is this part?

Learning goal Students will multiply proper, improper and mixed fractions.

Content description Number and Algebra – Real numbers

- Multiply and divide fractions and decimals using efficient written strategies and digital technologies (ACMNA154)

Big idea Number – factor-factor-product

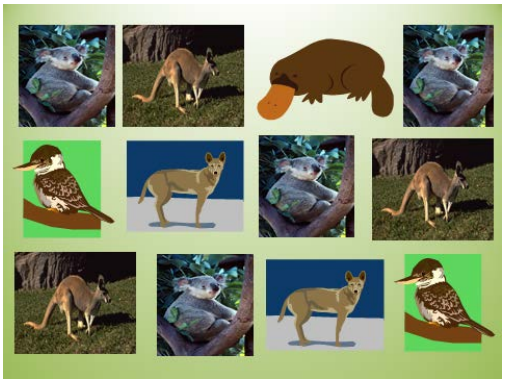
Resources Animal picture chart, Maths Mat, elastics of different colours, strip mat, chalk, coloured pencils and paper, fraction overlays

Reality

Local knowledge Students can identify animals as they trek through the bush, count and compare them in terms of fractions.

Prior experience Ensure that students understand that fractions partition the whole into parts, that the denominator indicates the number of parts into which the whole has been partitioned and the numerator indicates the number of those parts we are discussing; e.g. $\frac{3}{4}$ must be seen as 3 parts out of 4 parts. Use the chart and questions below to check knowledge of parts of a fraction and students' ability to identify fractions.

Animals we saw today



What fraction of the animals are kangaroos?

What fraction of the animals' names begin with the letter "k"?

What fraction of the animals are birds?

What fraction of the animals swim?

What two animals are the same fraction?

Which animal represents $\frac{1}{3}$ of the animals?

Kinaesthetic Have four students take an elastic and show 60 squares on the Maths Mat or hundred board. Ask another four students to take a differently coloured elastic to show $\frac{1}{3}$ of the 60 squares. *What did you do to show the one-third?* [Put the elastic around one of three equal lots of the 60 squares.] *What is one-third of 60?* [20]. *When we say one-third of 60 or any other number, the "of" stands for times, as in one-third times 20 or 20 multiplied by one-third, $\frac{1}{3} \times 20$. "Of" means multiply*. Have the students say $\frac{1}{3}$ of 60 or $\frac{1}{3}$ times 60 is 20. *What is another way to get from 60 to 20?* [60 ÷ 3 is 20]. *What operation is performed by the vinculum in a fraction?* [Division]. *So $\frac{1}{3}$ of 60 means $(60 \div 3) \times 1$*. Repeat process with other unit fractions and different numbers. When students are confident in multiplying with unit fractions, move on to multiplying by the multiples, $\frac{3}{4}$, $\frac{3}{5}$, $\frac{5}{6}$ and so on. Always find the unit fraction first, e.g. $\frac{1}{5}$ of 40, and then extend the elastic around to show the multiples $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$ of 40. *How did we find $\frac{2}{5}$ of 40? We divided 40 into 5 equal parts and then took 2 of those equal parts.* [$\frac{1}{5}$ of 40 is 8; $\frac{2}{5}$ of 40 is 2 lots of 8 = 16]. Repeat using other examples.

Abstraction

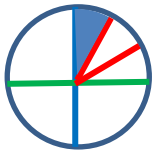
Body Draw a large circle on the ground. Have one student take an elastic and stand holding the middle of the elastic in the centre of the circle. Have another two students take each end of the elastic and move to the circumference of the circle in a straight line through the centre. *How many parts has the circle been cut into?* Two other students take a differently coloured

elastic, pass it through the student in the centre and stand at the circumference so that all parts are equal. *How many parts are there now?* [4 parts or 4 quarters]. *What will we get if we take ½ of ¼?* Have one student take a differently coloured elastic, give one end to the student in the centre and go back to the circumference so that ¼ is cut into two equal pieces. *What name would we give to one of these pieces that is half of one quarter?* [⅛]. *So ½ × ¼ = ⅛.*

$^{2}/_{2}$ $^{4}/_{4}$ $^{1}/_{2} \times {}^{1}/_{4} = {}^{1}/_{8}$ $^{8}/_{8}$

Can you see that if we cut all the quarters in half we would end up with Ⅷ?

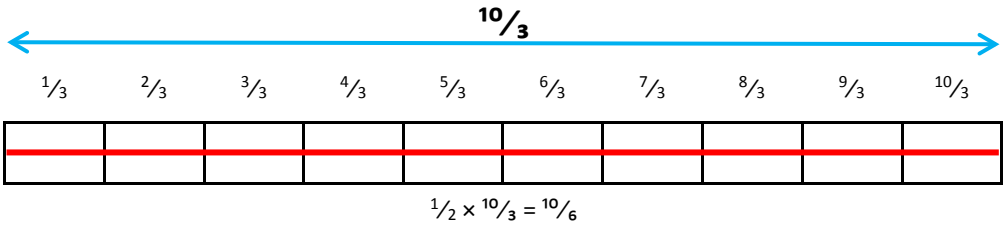
Have another student take the same colour elastic as the previous student, give one end to the student in the middle and move to the quarter that was cut into halves; shuffle the positions of the two students so that now the two students cut that quarter into three pieces or thirds.



$^{1}/_{12}$

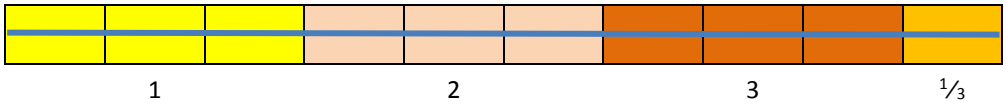
If we went around all the quarters, cutting them into thirds, how many pieces would we get? [12]. *What is ⅓ of ¼?* [$^{1}/_{12}$]. *What fraction would ⅔ of ¼ be?* [$^{2}/_{12}$]. *Can anyone see that $^{2}/_{12}$ could be seen in another way? If we thought of the $^{2}/_{12}$ as one part instead of two smaller pieces, how many of these parts would make up the whole?* [6]. Have students demonstrate with elastics that joining $^{2}/_{12}$ together all around the circle gives 6 equal parts or sixths. *So $^{2}/_{12}$ is equal to ⅙.* Repeat the process for other fractions: ⅕ of ¼, ⅗ of ¼ and so on. *Can anyone see a pattern when we are multiplying fractions together?* [multiply the denominators, then multiply the numerators].

Provided that the students understand the concept of improper fractions, use the strip mat to show $^{10}/_{3}$. *Each of the squares is representing a third, so the unit is a third, we are counting in thirds. From our circle investigation, what happens when we take ½ of ⅓?* [⅙]. *What will ½ of $^{10}/_{3}$ be?* [$^{10}/_{6}$]. Use an elastic to cut the $^{10}/_{3}$ into halves lengthways, making sixths. *What fraction is ½ of $^{10}/_{3}$?* [$^{10}/_{6}$].



$^{1}/_{2} \times {}^{10}/_{3} = {}^{10}/_{6}$

Repeat using other examples of proper fraction × improper fraction.



How is $^{10}/_{3}$ written as a mixed number? [$3^{1}/_{3}$, every $^{3}/_{3}$ = 1 whole]. *Give me another way of saying ½ of $^{10}/_{3}$?* [½ of $3^{1}/_{3}$]. *What is the pattern for multiplying fractions whether they are proper or improper fractions? How can we use this pattern to help us multiply mixed*

numbers such as $1\frac{1}{4} \times 3\frac{3}{5}$? [Change the mixed numbers to improper fractions, multiply the denominators, multiply the numerators to obtain a new fraction. If the new fraction is improper, convert it to a mixed number.] Model other examples of mixed number × mixed number as above.

Hand

Distribute paper and have the students draw pizzas, liquorice strips and chocolate blocks to follow the process above using different examples, e.g. $\frac{2}{3} \times \frac{1}{5}$; $\frac{3}{4} \times \frac{8}{5}$. Record the results and write the pattern – multiply denominators, multiply numerators, simplify if possible. For example:

$$\frac{2}{3} \times \frac{1}{5} = \frac{2}{15}$$

(2 × 1 over the numerators; 3 × 5 under the denominators)

Mind

Close your eyes and see a pizza cut into eighths. Your little sister comes in and you kindly cut your eighth into halves. What fraction do you now have to eat? Imagine a whole chocolate block has been divided into thirds. If you are given $\frac{2}{5}$ of $\frac{1}{3}$, how much of the whole block did you get?

Creativity

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

Mathematics

Language/ symbols

denominator, numerator, vinculum, fraction, improper fraction, mixed number, multiply, simplify, lowest terms

Practice

1. Students are given examples of all four types of multiplication of fractions to work through using manipulatives if necessary. *Check that your fractions are in their lowest terms.*
2. Create word problems for multiplication of fractions; e.g. *In Tom's class, $\frac{2}{5}$ of the students have a pet cat. Of the students who have a pet cat, $\frac{3}{4}$ of them also have a pet dog. How many students have both a pet cat and a pet dog?*
3. Students create a word problem, solve it and give it to their partner to solve.

Connections

Relate to decimal fractions.

Reflection

Validation

Students discuss situations where multiplication of fractions are found in their world; e.g. cutting into fractions and then cutting again into smaller pieces. *Check your partner's solution to your word problem.*

Application/ problems

Provide applications and problems for students to apply to different real-world contexts independently; e.g. *Mrs Jackson is tuckshop convenor. On Wednesday she used $\frac{3}{4}$ of a bag of hot-dog buns. On Thursday she used $\frac{1}{2}$ as many hot-dog buns as on Wednesday. How much of the bag of hot-dog buns did Mrs Jackson use on Thursday?*

Extension

Flexibility. Students are able to use different models to represent multiplication of fractions, e.g. set/size, area, volume, number line and fraction circles, when multiplying different types of fractions.

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

Generalising. *When multiplying fractions, denominators are multiplied to represent the new type of part being obtained and numerators are multiplied to show how many there are of the new part. The resulting fraction is simplified, if possible, to reduce the fraction to its lowest terms and improper fractions are converted to mixed numbers. When multiplying mixed numbers, they are first converted to improper fractions and then denominators and numerators are multiplied. Again, the resulting fraction is simplified, if possible, to reduce the fraction to its lowest terms and improper fractions are converted back to mixed numbers.*

Changing parameters. Teach students to use scientific calculators to calculate multiplication of fractions.

Teacher's notes

- Ensure that students have a thorough understanding of fractions from their prior experience before proceeding to multiplication of fractions.
- Students must know that:
  - "of" means multiply
  - the vinculum stands for division so that, for example, $12 \times {}^{3}\!/_{4}$ is the same as $(12 \div 4) \times 3$.
- Sequence for multiplication with fractions is:
  (a) fraction times whole number
  (b) fraction times proper fraction
  (c) fraction times improper fraction (Do not proceed to improper fractions until the formula for multiplication of fractions is well understood. The concept of an improper fraction also needs to be understood before multiplication with improper fractions is introduced.)
  (d) fraction times mixed number (students need proficiency in conversion to improper fractions).
- Students should be encouraged to identify the pattern for multiplication of fractions at stage (b), that is: multiply the denominators to obtain the new fraction then multiply the numerators. Once understood, the formula may then be applied to multiplication involving improper fractions and mixed numbers.
- Fraction equivalence and writing fractions in their lowest terms is a separate concept and must be taught in another lesson with the understanding that every fraction has an infinite number of equivalent fractions obtained by multiplying or dividing the fraction by 1 (the identity element for multiplication) in any of its terms: 1, ${}^{1}\!/_{1}$, ${}^{2}\!/_{2}$, ${}^{3}\!/_{3}$, ${}^{4}\!/_{4}$, ${}^{5}\!/_{5}$, ${}^{6}\!/_{6}$ … (e.g. ${}^{9}\!/_{12} \div {}^{3}\!/_{3} = {}^{3}\!/_{4}$). If this skill has been previously taught, students can simplify the fraction and bring it to its lowest terms.
- 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 a quarter of an apple, 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 an eighth of a pizza.
- 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.

