YuMi Deadly Maths

Year 4 Teacher Resource:

NA – Walking the rope

Prepared by the YuMi Deadly Centre
Faculty of Education, QUT

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ACKNOWLEDGEMENT

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Year 4 Number and Algebra

Walking the rope

Learning goal

Students will:

- develop an understanding of the proportion and relationships between fractions in the third, sixth and ninth family
- represent fractions using linear models and symbols
- form a generalisation about fractions equivalent to one whole.

Content description

Number and Algebra – Fractions and decimals

- 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)

Big idea

Number – part-whole, equivalence

Resources

Cartons of different sizes (6/12/18) of water/soft drink/eggs, ropes of different lengths, fraction flags, masking tape, paper squares/circles, coloured paper strips, worksheets, fraction mat

Reality

Local knowledge

Tell me something that can be cut into smaller parts so that it can be shared (e.g. cutting blocks of chocolate, cakes, pizzas into parts to give each person an equal share). *Tell me something that comes packed in bulk amounts* (e.g. cartons of water/soft drink/eggs).

Prior experience

Check students' knowledge of terms – numerator, denominator, vinculum symbol for fractions, and their experience in finding halves and quarters of shapes and objects.

Kinaesthetic





Investigate how various cartons of soft drink, water, eggs may be represented firstly in thirds and sixths, noting the equivalence between the thirds and sixths, then progressing to ninths. Take the cans/eggs from two cartons of six, place them in lines, one under the other, and divide into thirds then sixths. Note the equivalent fractions. Repeat using items from cartons of 12 and finally introduce thirds, sixths and ninths from cartons of 18.

After the linear model has been investigated the area and set models could be explored.

Abstraction

Body

Lay out a 20 m rope. Clarify that the starting point is always zero. Stretch the rope to its full length. Hammer in the flags that show zero and one whole. Line everyone up at the starting line and walk the whole distance to experience the whole length of the rope. Point out that ropes of different sizes give different-sized parts.

Have students predict where a third of the distance for the rope will be. Lay the third flag down at the estimates. Check this by taking the end of the rope back to the predicted third position. One person holds the rope down at the predicted third mark while another person takes the rope back to the starting point and then returns to the estimated third. Is the prediction accurate? Do we have three equal parts? Adjust if necessary and hammer the third flag into its third position. Take the whole rope back to the end. Everyone lines up at the starting point and walks to a third of the rope. *We have walked a third of the rope. How much is left?* [two thirds] *What will we do to divide the two thirds left into third parts?* [Fold the rope from the end back to the original third and mark the rope to indicate the two-thirds position.] *From the start walk to the end of the rope counting the thirds as you go.*

Three thirds make one whole.

In short:

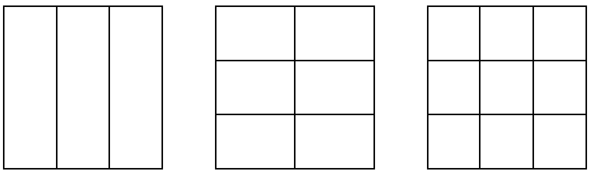
- walk the whole length of the rope
- divide the rope into $\frac{1}{2}$, walk the distance
- predict where $\frac{1}{3}$ will be, walk the distance
- repeat for $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{8}$, walking each distance
- at each division, place a marker showing $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{8}$

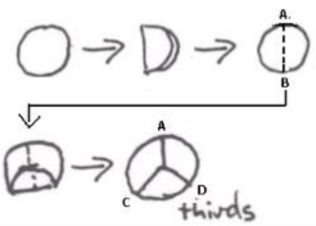
Have students predict where a sixth will be and put a flag down to show their estimate. Check by folding the rope into third position and then taking the third back to the start so that the third has been halved. Hammer in the sixth flag. Bring the rope back to the start and then back up to the sixth position, backwards and forwards twice, and then back to the start again so that six parts have been formed. Check they are all the same. Adjust if necessary. Mark each of the sixths with masking tape to show the multiples. Stretch the rope out to its full length and walk to the sixth flag. *This far is one sixth of the rope. When we walk another sixth, we are up to the third position.* Continue to walk the other sixths and notice that four sixths are the same as two thirds; six sixths are the same as one whole.

Throughout these activities compare thirds and sixths. *Look at one third. How many sixths are equal to one third? Put the symbols side by side: $\frac{1}{3}$, $\frac{2}{6}$. What has the numerator 1 in $\frac{1}{3}$ been multiplied by to equal the numerator 2 in $\frac{2}{6}$? What has the denominator 3 in $\frac{1}{3}$ been multiplied by to equal the 6 in $\frac{2}{6}$? What does the fraction $\frac{2}{2}$ equal?* [1] *So to make an equivalent fraction what are we multiplying by? How else can 1 be written as a fraction?* [$\frac{3}{3}$, $\frac{4}{4}$ and so on]. Emphasise that equivalent fractions are made by multiplying a given fraction by ONE in any of its many fraction forms.

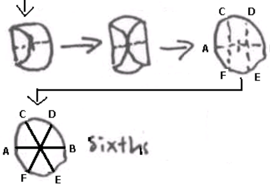
Hand

Give students practice with multiple pieces of paper to fold into thirds, sixths and ninths both as squares and circles:





Thirds: Fold in half, crease lightly and open (see AB). Fold from B to the centre. Open out and you should see two points (see CD). Draw lines from A to the centre, and from C and D to the centre.



Sixths: Fold in half, crease, open and draw a line across the crease (see AB). Fold from A to the centre; fold from B to the centre; open out and you should see 4 points (see CDEF); draw lines from C to E and from D to F.

Using coloured paper strips of equal size, students glue a whole strip onto a landscape A4 blank sheet of paper and write the name/numeral beside it (one/1). Partition another strip into thirds, i.e. fold the paper into a circle and a half so that there are three equal parts, crease, cut out one third of the strip and paste under the whole. Write fraction and name. Halve the third to make one sixth, cut and paste under the third. Write fraction and name. Partition into ninths by folding it into four and a half circles, crease, cut and paste under the one-sixth strip. Write fraction and name. Reverse: Worksheet with line segments on paper showing a third, a sixth, a ninth. Make the whole.

Mind

Close your eyes and in your mind see a whole cake, see thirds, sixths and ninths (called randomly).

Creativity

Students draw themselves and divide their bodies into thirds, sixths, ninths.

Mathematics

Language/ symbols

partition, halve, half, third, sixth, ninth, unit fraction, numerator, denominator, vinculum, equivalent fraction, one whole

Practice

1. Students represent, shade and name thirds, sixths, ninths and their multiples on various linear models using symbols and words.
2. Use the fraction mat to identify equivalent fractions and record these in symbols, e.g. $^{3}/_{3} = 1$.
3. Use the fraction wall to colour the vertical lines showing equivalent fractions. Record the equivalent fractions as soon as they have been identified.
4. Practise making equivalent fractions using only the symbols, for example:

$$^{1}/_{3} = {}^{?}/_{9} \qquad ^{1}/_{6} = {}^{?}/_{12} \qquad ^{5}/_{6} = {}^{?}/_{18} \qquad ^{4}/_{9} = {}^{?}/_{18}$$

Connections

Explore relation of fractions to division, process and symbol.

Reflection

Validation

Students check where they would use thirds, sixths, ninths, e.g. sharing cakes with family or friends, and what they would do to make thirds into sixths if six people were involved.

Application/ problems

Provide applications and problems for students to apply to different contexts independently; e.g. partition a broad range of materials and diagrams, investigating how to create successively smaller fractions with larger denominators through repetitive halving; thinkboard problems.

Extension

Flexibility. Students can describe fractions in many ways: e.g. third, one part of three equal parts, $^{1}/_{3}$, $^{2}/_{6}$, $^{3}/_{9}$.

Reversing. Students are able to work in any part of the process of telling stories about thirds, sixths, ninths ↔ acting it out ↔ using language and symbols ↔ making models, beginning at any point and then developing all the others.

Generalising. *A whole has the same number of pieces in the numerator as there are in the denominator. One whole can be represented in an infinite number of ways, e.g. 1 =* $^{2}/_{2}$, $^{3}/_{3}$, $^{4}/_{4}$, $^{5}/_{5}$, $^{6}/_{6}$, *…. The number on the bottom of the fraction, the denominator, tells us how many equal parts the whole has been cut into. The number on the top, the numerator, tells us how many of the equal parts we are looking at.*

When the whole is partitioned into more pieces, the pieces get smaller, e.g. sixths are smaller than thirds and ninths are smaller again. The more pieces we cut the whole into, the less we have in each piece, the smaller the piece becomes.

Changing parameters. Students investigate the equivalence of thirds and sixths to twelfths. *What do we call fractions that are broken into Fred bits?* [Fred**ths**].

Teacher's notes

- *Are all wholes the same?* [No, two different-sized apples, two different-sized ropes, different family groups, and so on.]
- *Are all halves the same?* [Yes, if they're part of the same whole; No, if the halves came from different wholes.]
- Ensure that students understand that when a whole is partitioned, the denominator (the number on the bottom) describes the number of pieces that have been made, e.g. halves, thirds, sixths, ninths. The numerator (the number on the top) always describes how many of those pieces are taken. The vinculum is a division symbol.
- 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 kookaburra, 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 different bird.
- 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.

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