PAINT WITH NUMBERS
Lesson 1: Mixing Paint

Australian Curriculum: Mathematics (Year 7)

ACMNA173: Recognise and solve problems involving simple ratios.

Lesson abstract

Students mix two batches of pink paint, one batch mixing red and white paint in the ratio 1:2 and the other batch in the ratio 1:5. They explore how to keep the ratio constant when increasing the quantity of red or white paint.

Mathematical purpose (for students)

We will determine strategies to keep the ratio constant when increasing quantities.

Mathematical purpose (for teachers)

Students learn that a ratio is a multiplicative comparison between two quantities. They recognise that equality between ratios is maintained through the use of multiplication and division, not addition and subtraction.

Suggested presentation: One lesson of one hour

Vocabulary encountered
- parts
- ratio

Lesson materials
- Syringes
- Red and white paint and brushes
- Student Sheet - Mixing Paint

Teacher Notes: 10 mL syringes were used in testing this task to accurately measure and add paint. 1mL of paint can serve as “one part”. Watering down the paint for ease of use is recommended.

We value your feedback after this lesson via our website.

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Introduction

Explain that students will be making two different batches of pink paint by mixing red and white paint in the ratios 1:2 and 1:5. Before mixing the paints, have students predict how the colours of the batches will vary and why.

Have students create the two batches of paint:

- One batch mixing red and white in the ratio 1:2
- One batch mixing red and white in the ratio 1:5

Record the measurements of paint, ratios used and the colours made on Student Sheet – Mixing Paint.

Exploration

Pose the problems:

- *I want to make pink paint using a 1:2 ratio of red to white paint. I used 12 parts white paint. How many parts red do I need to use to keep the ratio 1:2?*
- *I want to make pink paint using a 1:5 ratio of red to white paint. I used 3 parts red paint. How many parts white do I need to use to keep the ratio 1:5?*

Have students test their working by mixing paints in the new ratios and comparing the colours made to their original batches.

Possible Student Strategy: using repeated addition

- *I used 12 parts white paint. How many parts red do I need to use to keep the ratio 1:2?*
    - Students can use repeated addition and/or doubling strategies to solve this problem. These methods can be organised in a ratio table. For example, counting in 2s:

Number of parts of red paint	1	2	4	6				
Number of parts of white paint	2	4	8	12				

        - To derive how much red paint is required to keep the ratio constant:
            - Add together 4 parts white + 8 parts white which equals 12 parts white. The corresponding amount of red is 6 parts.
            - Alternatively subtract 4 parts white from 16 parts white to leave 12 parts white. The corresponding amount of red is 6 parts.
- *I used 3 parts red paint. How many parts white do I need to use to keep the ratio 1:5?*

Number of parts of red paint	1	2	4					
Number of parts of white paint	5	10	20					

        - To derive how much white paint is required to keep the ratio constant:
            - Add together 1 part red + 2 parts red. The corresponding amount of white is 15 parts.
            - Alternatively subtract 1 part red from 4 parts red. The corresponding amount of white is 15 parts.

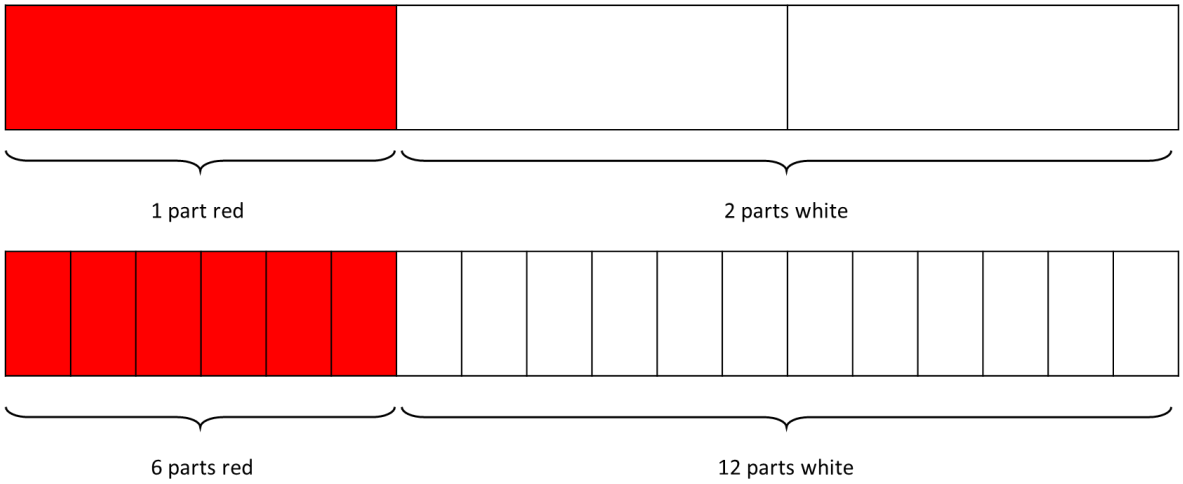
Possible Student Strategy: using multiplication

- *I used 12 parts white paint. How many parts red do I need to use to keep the ratio 1:2?*
    - The amount of white paint has been multiplied by 6 and so the amount of red paint also needs to be multiplied by 6.
        - (1 x 6) : (2 x 6) = 6:12 → 6 parts red to 12 parts white

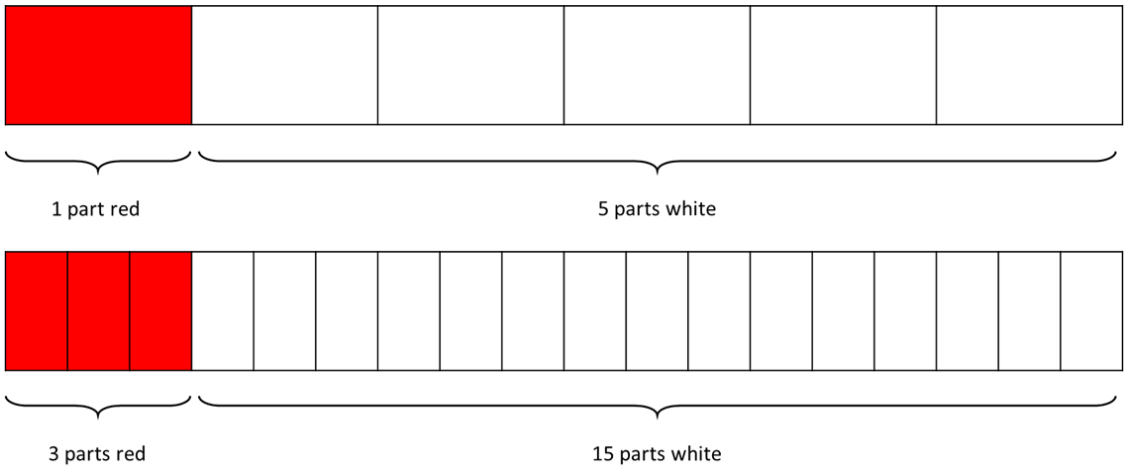
- *I used 3 parts red paint. How many parts white do I need to use to keep the ratio 1:5?*
    - The amount of red paint has been multiplied by 3 and so the amount of white paint also needs to be multiplied by 3.
        - (1 x 3) : (5 x 3) = 3:15 → 3 parts red paint to 15 parts white paint.

Possible student strategy: bar model

- *I used 12 parts white paint. How many parts red do I need to use to keep the ratio 1:2?*



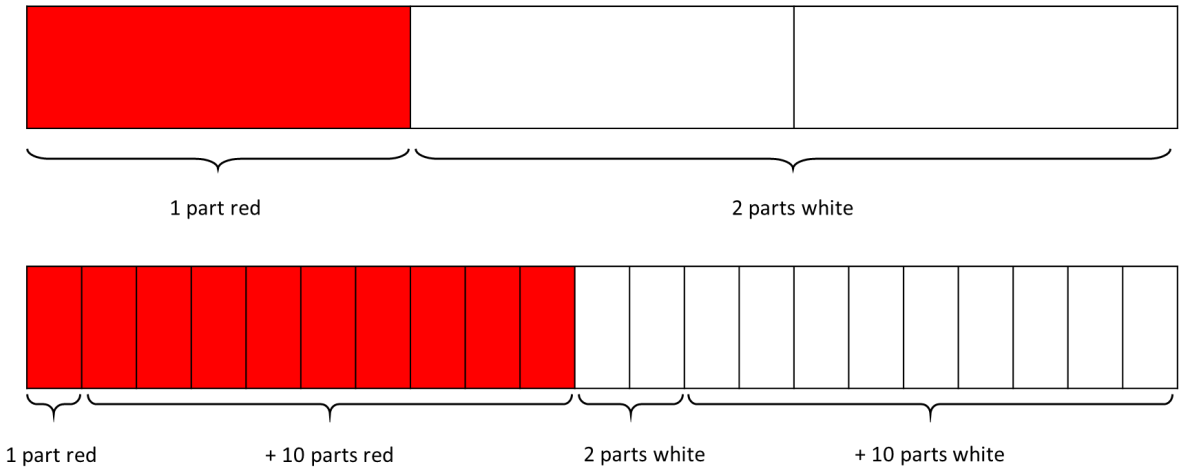
    - If 12 parts white are used, then 6 parts red are required to keep the ratio constant.
- *I used 3 parts red paint. How many parts white to keep the ratio 1:5?*



    - If 3 parts red are used, then 15 parts white are required to keep the ratio constant.

Misconceptions and errors

- Students may reason additively instead of multiplicatively. For example:
    - *I want paint with a ratio 1:2. There are 12 parts white. 10 parts white were added and so I need to add 10 parts red.*
- The bar model shows that this reasoning does not keep the ratio constant:



Questions to prompt deeper thinking

- *Can you see a relationship between the numbers in the new ratio formed?*
    - In the case of 1:2 and the new ratio 6:12, the amount of white is half the amount of red paint. This reinforces that the ratio has been kept constant.
- *How much red paint and white paint would you need to mix if you wanted to make 1.2L of pink paint in the ratio 1:2? In the ratio 1:5?*
    - For a ratio of 1:2 you would need 400 mL red and 800mL white paint.
    - For a ratio of 1:5 you would need 1L red and 200mL white paint.

Class discussion

Select and sequence student responses

Identify students who have used the following strategies and have them present to the class:

- Additive instead of multiplicative reasoning, i.e. 10 parts white were added in the first case so I need to add 10 parts red (producing paint with a 11:12 ratio)
    - *Was the new paint you mixed the same colour as the paint mixed in the ratio 1:2?*
    - *What did you learn?*
- Using repeated addition strategies
- Using multiplication
- Using the bar model
    - If there were no students who solved the problem using the bar model, present this to the class as the strategy that you used to solve the problem.

Connecting student strategies

- Can you see a connection between the bar model and the use of repeated addition strategies and multiplication strategies?

Mixing Paint

Name: _____

Amount of red paint: ___mL Amount of white paint: ___mL Ratio of red to white paint: ___:___ Paint sample:	Amount of red paint: ___mL Amount of white paint: ___mL Ratio of red to white paint: ___:___ Paint sample:
Amount of red paint: ___mL Amount of white paint: ___mL Ratio of red to white paint: ___:___ Paint sample:	Amount of red paint: ___mL Amount of white paint: ___mL Ratio of red to white paint: ___:___ Paint sample:

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