

Challenging topics

Understanding ratio

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Introduction

Ratio is used in a range of contexts across vocational areas and an understanding of the underlying principles is essential to support practice in application in a whole range of workplace situations. The session can be used in any setting. The early examples are all about mixing orange squash and water in particular ratios but these could be replaced with suitable examples from vocational areas. Similarly, the questions designed for childcare learners could be replaced with more relevant examples for learners from other specialisms.

The focus of this session is on combining quantities in a given ratio. Dividing a quantity in a given ratio is required for the application of the ideas to a childcare context included at the end of the session.

Learning objectives and outcomes

When they have completed this session, learners should be able to:

- identify the ratio of two quantities
- understand the ratio notation
- understand the meaning of ratio
- identify equivalent ratios
- combine quantities in a given ratio
- divide a quantity into a given ratio.

Resources required

For each small group of learners you will need:

- **Card set A: Ratios**
- **Card set B: Containers**
- **Card set C: Equivalent ratios**
- glue stick
- felt tip pens
- large sheet of paper for making a poster.

For each learner you will need:

- mini-whiteboard.

Starting points

This is a short introduction to understanding the meaning and notation used in ratio. No prior knowledge is required.

Dividing a quantity into a given ratio is not the focus of the session, but learners should be able to extend their reasoning to enable them to complete this type of problem. Application of the knowledge and skills is illustrated for the childcare setting.

Planning learning in multiple environments

As teachers, we spend a lot of time planning the learning experience in our classroom, workshop or training area. However, it is worth considering how we can encourage our learners to explore learning beyond these confines. Pointing learners in the direction of a relevant television programme, newspaper article or even an advert can bring learning alive. There might be opportunities to ask learners to observe something on the way to work or college, to reflect on an aspect of their own social or home lives, or to apply a newly learned skill in a workplace situation. All these can help the learning process, making it more real and relevant.

Mathematics occurs everywhere in our lives. Helping the learners start to recognise the occasions where it pops up and to incorporate these into their own thinking is a step towards real and useful learning.

Time needed for this session

Approximately one hour.

Suggested approach

Stage 1

Ratios

Give each pair of learners **Card set A: Ratios** and have a pile of cards from **Card set B: Containers** (a mixture of both sizes) on the table.

Explain that **Card set B: Containers** are quantities of orange squash and water, and the squash needs diluting.

You may need to explain that there are two sizes of container, one is half the size of the other and that they are either filled with orange squash or water.

Ask learners to choose a mix of containers that reflect the ratios on each of the cards in **Card set A**.

Reviewing the learning for Stage 1

When learners have completed the task, ask groups to feed back to the whole group and compare different answers. Do they all work?

Ask learners to explain what the ratios mean.

Some groups may have used only small containers, some may have used only large containers and some may have used a mixture. Ask the learners if it matters whether large or small containers are used and draw out that it does not. A ratio such as orange squash to water = 1:2 does not have units provided the same units are used, so for every one measure of water there are two measures of squash.

If no-one has used a mixture of sizes ask the question "Under what circumstances can we get the ratio correct and yet use a mixture of small and large containers?"

If someone has used a mixture of different sizes, ask all the learners to consider their combination and ask how they would test whether it was valid.

Draw out that we can use a large container to represent the two provided there is twice as much liquid in the large container as in the small one. Learners may like to check whether this is possible for these measures by cutting two small ones up to see if they can fit onto a large one, or by calculating areas.

Ask the learners to look at the following cards and their solutions.

- The ratio of squash to water is 1:2.
- The ratio of water to squash is 2:1.

Ask for observations about these two. The learners should have noticed that they are identical. Ask the learners to make up some other pairs that would be identical.

Extending the learning for Stage 1

This discussion could be repeated for other starting ratios if learners need further activities to understand the ideas (see **Card set A2: More ratio cards**).

If you feel that some learners need to explore some more challenging ratios use **Card set A3: Extension ratio cards**.

Putting this work in context

To make the activity more relevant to particular learners and their vocational preferences, orange squash and water could be replaced by vocationally relevant contexts. For example:

- different sand and cement mixes in Construction and the built environment
- staff to child ratios for playgroups in a childcare context (see page 7)
- ratio of different metals for particular alloys in Engineering.

Suggested approach

Stage 2

Equivalent ratios

This session continues with combining orange squash and water but you could replace this with examples from learners' own chosen vocational setting.

Give out **Card set C: Equivalent ratios** to pairs or small groups of learners. Tell learners that the required ratio of squash to water is 1:4.

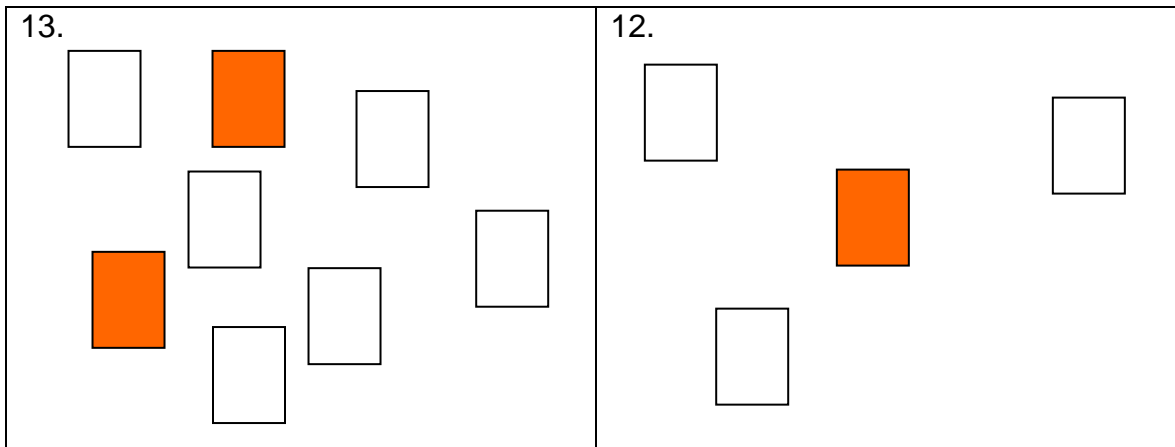
Ask pairs or groups of learners to sort the cards into those that result in squash weaker than 1:4 and those that result in squash stronger than 1:4. You might need to check that the learners understand the concept of 'stronger' and 'weaker' by asking questions such as:

- Is a ratio of squash to water of 1:4 stronger than 1:3?
- Give me a ratio of squash to water that is weaker than 1:4?

If any groups are unsure about how to proceed suggest that they use some of the cards from **Card set B** to help them.

Ask groups to compare their sorting with another group and discuss any differences until they come to a consensus. Then ask them to sort the ratios into those that give the same strength of squash, stick them down together and write down the ratio under each one but circling the ratio that uses the smallest numbers.

Ask learners to write an explanation of how the other ratios relate to this simplest ratio. It will look something like:



Ratio of squash to water = 2:6

Ratio of squash to water = 1:3

2:6 can be simplified to 1:3 by dividing both numbers by 2.

Reviewing the learning

Cards 12, 13 and 18 should be discussed in detail. Some learners may have written 1:3 and others may have written 2:6. Discuss why both are correct.

Card 6 can only be written as 1:1, not as 1:2 because the quantities of water and squash are equal.

Define equivalent ratios and give out mini-whiteboards to each learner. Ask questions such as:

- Give me an example of a ratio that is equivalent to 3:1.
- Give me an example of a ratio that is equivalent to 15:3.

Then move onto questions such as:

- Give me an example of a ratio that is equivalent to 10:6.

Ask learners to explain what this ratio means in terms of the squash and water context or another context relevant to their course of study (such as staff to children in a range of Society, health and development settings as shown below).

If needed, learners could use the cards from **Card set B: Containers** to help them understand.

Continue questioning in this way until learners are confident in simplifying ratios and finding equivalent ratios.

Putting this work into a childcare context

The following questions are designed to review and extend understanding of ratio in a childcare scenario. Similar questions, reflecting the use of ratio in other specialisms, could be developed by the teacher.

Ask learners to record their answers on mini-whiteboards and hold up their answers to show the teacher.

If learners are unsure or cannot proceed they could use cards to represent the children, and different cards to represent the staff so they have something to move around.

Discuss the recommended ratios of staff to children.

- What do they mean?
- Do they know about these?
- Have they met these on placements?
- What happens to the actual ratio when children are ill?
- What about when staff are ill?

Recommended ratios of staff to children

- Under 2 years – 1:3
- Aged 2 years – 1:4
- Aged 3 to 5 years – 1:8

In a day nursery group of two year olds the ratio of staff to toddlers is 1:4.

- If there are three staff what is the maximum number of two year olds allowed?
- and if another member of staff joins?
- and another?

In a playgroup there are 32 children aged from 3 to 5 years. The recommended ratio of staff to children is 1:8.

- What would be the minimum number of staff required to run the playgroup?
- and for 16 children?
- and for 12 children?
- and for 17 children?

In a day nursery there are a total of 30 children and 6 staff.

- What is the ratio of staff to children?
- and the ratio if a member of staff left?
- and the ratio for 25 children and 10 staff?

A day nursery has 42 places for children up to 5 years of age and 9 staff.

- What possible combinations of ages of children could there be using the recommended ratios?

Card set A1: Ratios

The ratio of squash to water is 1:2

The ratio of squash to water is 2:1

The ratio of water to squash is 3:1

The ratio of water to squash is 2:1

Card set A2: More ratio cards

The ratio of water to squash is 4:1

The ratio of water to squash is 1:5

The ratio of water to squash is 1:6

The ratio of water to squash is 3:1

Card set A3: Extension ratio cards




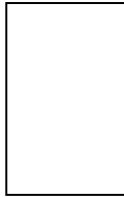




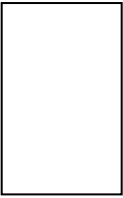


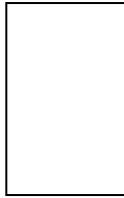







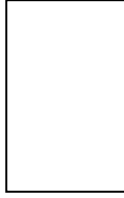




The ratio of water to squash is 3:2

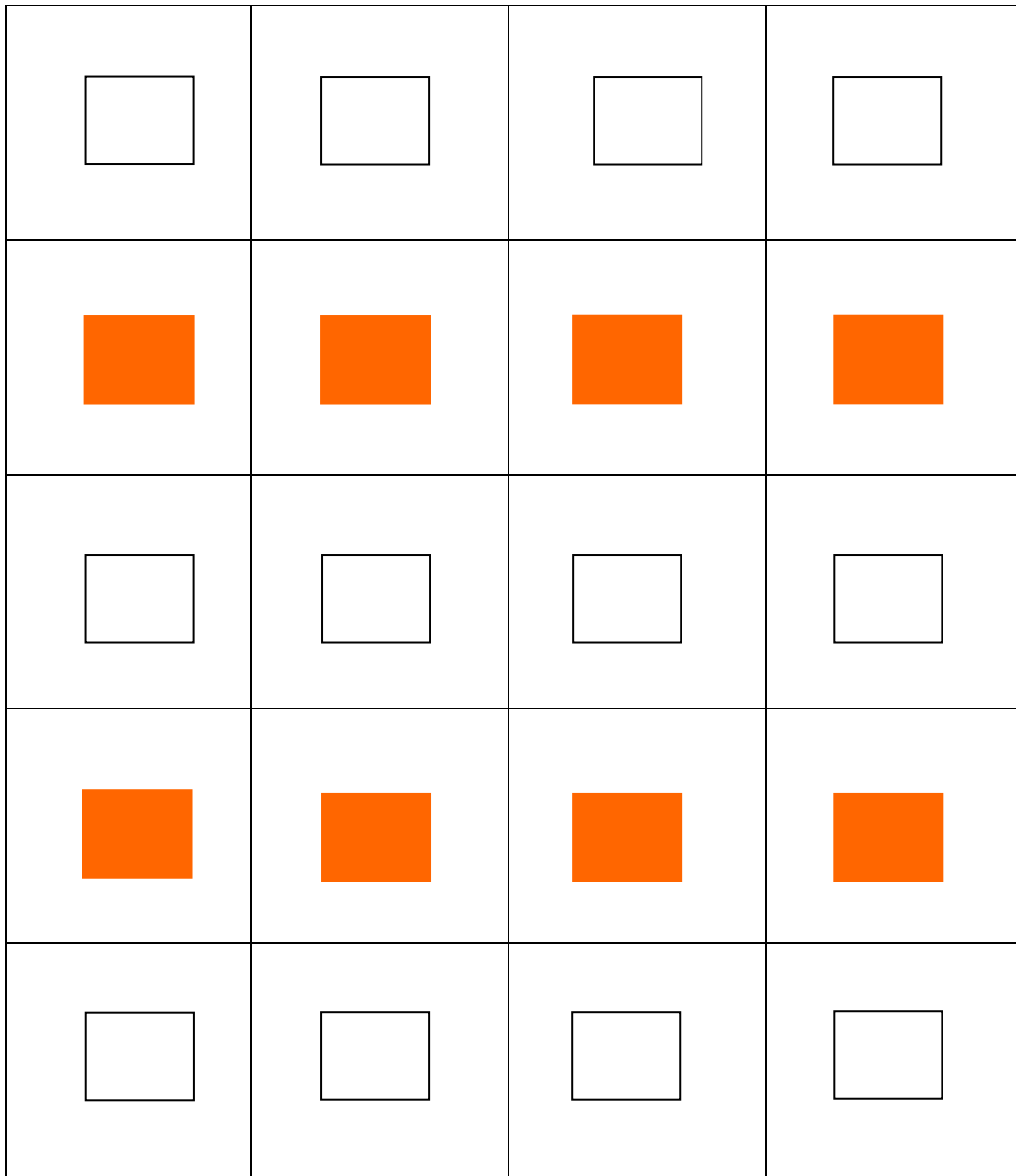
The ratio of water to squash is 4:3

The ratio of water to squash is 2:3

The ratio of water to squash is 7:2

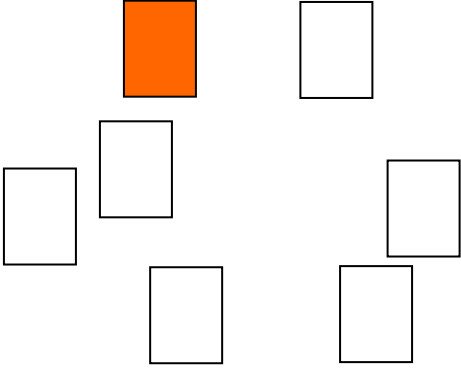
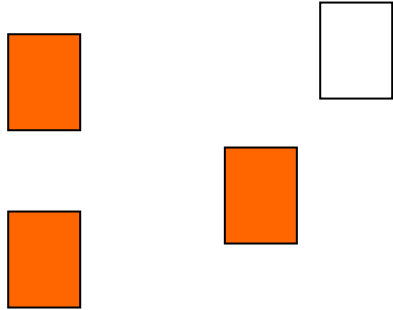
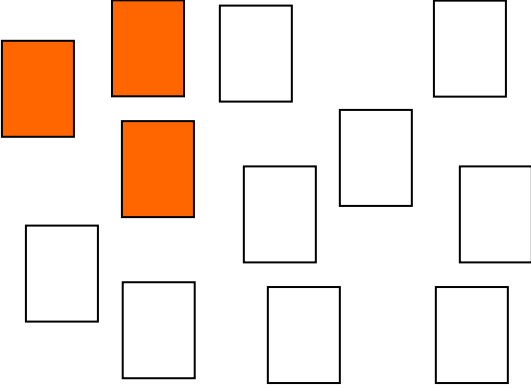
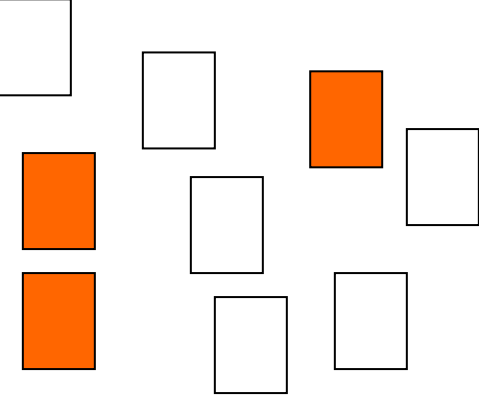
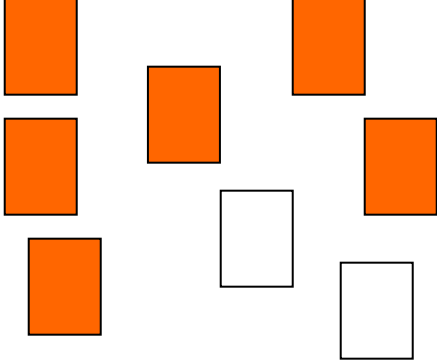
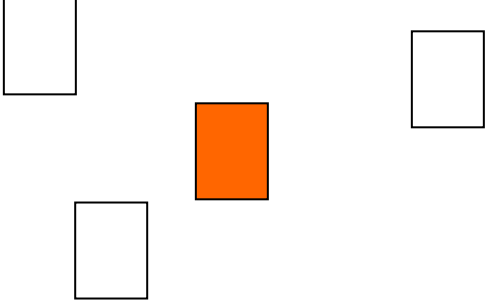
Card set B: Containers

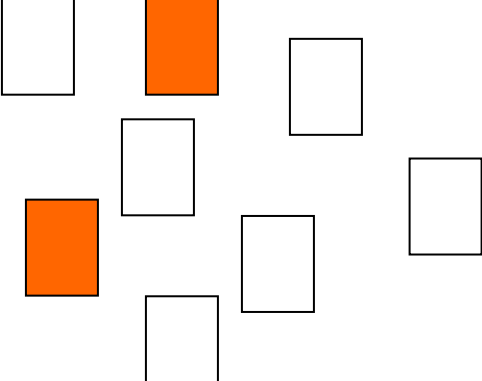
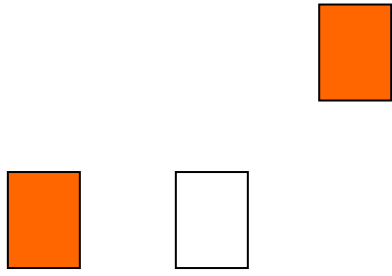
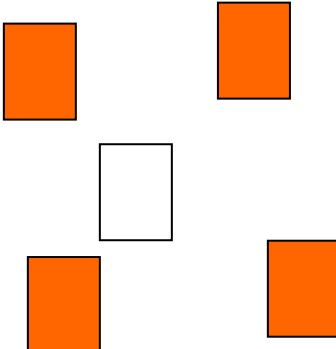
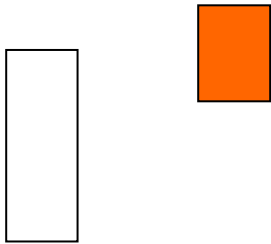
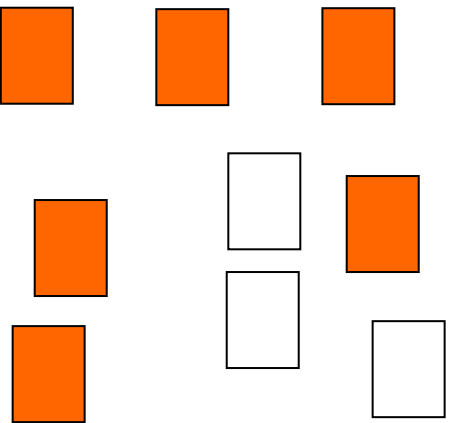
			
			
			
			
			
			



Card set C: Equivalent ratios

<p>1.</p>	<p>2.</p>
<p>3.</p>	<p>4.</p>
<p>5.</p>	<p>6.</p>

7. 	8. 
9. 	10. 
11. 	12. 

<p>13.</p> 	<p>14.</p> 
<p>15.</p> 	<p>16.</p> 
<p>17.</p> 	<p>18.</p> 