Chapter 7

Ratio and Proportion

Year 6 – Ratio & proportion

National Curriculum

Pupils should be taught to: solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts

solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and the use of percentages for comparison

solve problems involving similar shapes where the scale factor is known or can be found

solve problems' involving unequal sharing and grouping using knowledge of fractions and multiples

Notes and guidance (non-statutory)

Pupils recognise proportionality in contexts when the relations between quantities are in the same ratio (for example, similar shapes and recipes).

Pupils link percentages or 360° to calculating angles of pie charts.

Pupils should consolidate their understanding of ratio when comparing quantities, sizes and scale drawings by solving a variety of problems. They might use the notation a:b to record their work.

Pupils solve problems involving unequal quantities, for example, 'for every egg you need three spoonfulls of flour', 'of the class are boys'. These problems are the foundation for later formal approaches to ratio and proportion.

Key vocab: for every, to every, in every, as many as, ratio, proportion

Key concepts

Ratio is a way of comparing the relative sizes of two quantities or sets of items.

A given ratio does not indicate the actual sizes of the quantities involved.

A comparison model can be drawn to represent the two quantities given the ratio.

Ratios are parts of a whole.

Ratios compare two or more parts.

The whole number of parts can be found by adding the ratio.

Ratios can be equivalent.

Ratios can be reduced to lowest terms.

Proportion compares a part to the whole where ratio compares a part to a part.

Proportion uses the language '1 in every 5' where ratio uses '1 to 4' or '1 for every 4'.

Learning objectives (see overleaf for exemplification)

To use ratio to compare two things

To find equivalent ratios

To compare three quantities using ratios

To follow simple recipes involving basic proportions

To read a simple scale on a map e.g. 1cm = 100cm , 250:1 means 1cm = 2.5m.

To solve problems involving missing values. (using integer multiplication and division facts).

To solve problems involving percentages

To use percentages for comparison

To use the scale factor to solve problems involving shapes

To use knowledge of fractions and multiples to solve problems involving unequal sharing

Potential barriers

Pupils will often confuse the terms 'ratio' and 'proportion' and need a clear understanding of when each is appropriate.

Fraction and percentage work may be introduced too early, before the pupils have a clear understanding of the meaning of the terms.

Pupils may need to have it highlighted to them that a given ratio may not always indicate the actual size of the quantities involved (i.e. number of items in each set).

Pupils may not know that when comparing quantities the information stated first is the first part of the ratio e.g. when making purple I used red and blue paints at a ratio of 3:2, the red is the 3 and the blue the 2.

Example Questions

Two letters have a total weight of 120 grams. One letter weighs twice as much as the other. Write the weight of the heavier letter.
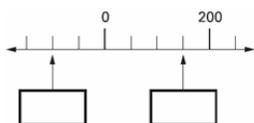
Jenny is going to make some cordial. The finished drink should be 1⁄3 cordial and 2⁄3 water.

Jenny puts 100ml of cordial in a glass. How much water should she put with it?

Two rulers cost eighty pence. How much do three rulers cost?

In a country dance there are 3 boys and 2 girls in every line. 42 boys take part in the dance. How many girls take part?

Here is part of a number line. Write the missing numbers in the boxes.

To make some dough, Gemma mixes 5 cups of flour with every 3 cups of water.

A)   Find the ration of the amount of flour used to the amount of water used.

B)   If Gemma wants to make 5 times the amount of dough as above, how many cups of water and how many cups of flour does she need?

C)   If she used 21 cups of water, how many cups of flour are needed to make the same amount of dough.

Mental Maths

To discuss and complete statements linked to ratio and proportion:

-In every week I spend 5 days at school. In every 2 weeks I spend X days at school and in every 3 weeks I spend Y days at school.

- For every 2 bags of crisps you buy you get one sticker. How many stickers do you get for 6 bags?

- John has 1 stamp for every 2 that Mark has. What other statement s can you make?

Solve simple problems involving 'in every' or 'for every':

- Chicken must be cooked for 50 mins for every kg. How long does it take to cook a 3kg chicken?

- At the gym there are 2 boys for every 3 girls. There are 15 girls at the club. How many boys are there? If there are twelve boys at the club how many girls are there now?

- Zara uses 3 tomatoes for every 1/2 litre of sauce. How much sauce does she make from 15 tomatoes? How many tomatoes does she need for 1 litre of sauce?

- A mother seal is fed 5 fish for every 2 fish given to her baby. Alice fed the seal 15 fish. How many fish did her baby get? Alice fed the baby seal 8 fish. How many fish did its mother get?

- For every 50p coin Mum gives to Dad, he gives her five 10p coins. Dad gave mum twenty-five 10p coins. How many 50p coins did mum give him?

Use multiplicative reasoning to solve simple ratio and proportion questions:

- Kate shares out 12 sweets. She gives Jim 1 sweet for every 3 sweets she takes. How many sweets does Jim get?

-Dee mixes 1 tin of red paint with 2 tins of white. She needs 9 tins altogether. How many tins of red paint does she need?

Year 6 - Progression (a combination of these models and images can be used for every objective)

To use ratio to compare two things	To find equivalent ratios	To compare three quantities using ratios

To use ratio to compare two things

There is 1 chocolate muffin and 2 cherry cakes.

The ratio of chocolate muffins to cherry cakes is 1:2.

Standard eggs

Free range eggs

The ratio of standard eggs to free range eggs is 2:1. One carton has 10 eggs. The ratio does not give the number of eggs!

To find equivalent ratios

The ratio is 6 pencils to 12 pins.

6:12

This can be simplified to 3 groups of pencils to 6 groups of pins

3:6

In its simplified form this would be 1 group of pencils to 2 groups of pins:

1:2 (these are all equivalent ratios)

6 : 12
÷3   ÷3
= 1:2

To compare three quantities using ratios

The ratio of bananas to strawberries to oranges is:
4 : 8 : 6

2 is a common factor: ÷2

2 : 4 : 3 in its simplest form.

To solve word problems involving ratio.	To follow simple recipes involving basic proportions / To read a simple scale on a map e.g. 1cm = 100cm , 250:1 means 1cm = 2.5m.	To solve problems involving missing values. (using integer multiplication and division facts).

To solve word problems involving ratio.

A safari park has 96 big cats altogether. 60 of them are Lions. What is the ratio of the number of Lions to the number of Tigers?   60

Lions   96
Tigers

Number of tigers = 96—60 = 36
60:36 = common factor 12 = 5:3

The ratio of the number of Lions to the number of tigers is 5:3.

To follow simple recipes involving basic proportions

1 part sugar
2 parts fat
3 parts flour

2cm = 1km
You can measure the distance in cm
Try to be exact!
(Each extra mm = .1)
Then … divide by 2 to change to km

To solve problems involving missing values.

Find the missing value(s) in the ratio table. Then write the equivalent ratios.

6.
| Boys | 1 | |
| Girls | 5 | 10 |

7.
| Violins | 8 | 24 |
| Cellos | 3 | |

8.
| Taxis | 6 | | 36 |
| Buses | 5 | 15 | |

9.
| Burgers | 3 | | 9 |
| Hot Dogs | 5 | 10 | |

10.
| Towels | 14 | 7 | |
| Blankets | 8 | | 16 |

11.
| Forks | 16 | 8 |
| Spoons | 10 | | 30 |

To solve problems involving percentages / To use percentages for comparison	To use the scale factor to solve problems involving shapes	To use knowledge of fractions and multiples to solve problems involving unequal sharing

To solve problems involving percentages

When Jonny was 10 years old his mass was 36kg. Two years later, his mass had increased by 30%. Find Jonny's mass when he was 12 years old.

                    ?%   ?%
10 years old   ? kg
12 years old

100% = 36kg
1% = 36 ÷ 100 = ? Kg

? % = ? X ? = ? Kg

Jimmy's mass when he was 12 years old was ? Kg.

To use the scale factor to solve problems involving shapes

The sides of a triangle are in the ratio 2:3:4. The sum of all the sides of the triangle is 162cm. Find the length of the longest side of the triangle.   The sum of the 3 sides = 9 units

2 units   3 units

9 units = 162 cm
1 unit = 162 ÷ 9 =1
4 units = 4 x 18 = 72 cm
The length of the longest side = 72cm

To use knowledge of fractions and multiples to solve problems involving unequal sharing

£360

£ ?