Contents

1. Introduction

A **Ratio** is a way of comparing two or more quantities with each other**.** The quantities are separated by the colon sign (:)

- It is written in the form "a : b", where "a" and "b" represent two quantities (e.g., 2:3.)
- Ratios can compare anything that can be counted or measured, such as people, objects, or amounts.

Example: Mike has **2 red balls,** and James has 3 **blue balls** in a box. What is the ratio of red balls to blue balls?

The number of **red** balls Mike has **:** The number of **blue** balls James has

Answer: 2:3

Exercise 12.1: Write the ratio for the quantities:

1. The school has 5 boys and 15 girls. _____ : _____

2. William has £8 and Adam has £11.

3. Antony has 6 apples and Adam has 5.

4. Lucy has 2cm of ribbon and Jo has 9cm.

5. Aaron has 5 cakes and Adam has 11 cakes.

2. Lowest Terms (Simplifying Ratios):

Ratios should always be written in their lowest terms.

A. When ratio contains only whole numbers

To write the ratios in their lowest terms (simplify) divide all the numbers by the **Highest Common Factor (HCF)** of them.

Example: Write the ratio 8 : 12 : 20 in its lowest terms

We know that HCF (8, 12, 20) = 4

So, divide all the numbers by 4. Then the ratio in its lowest terms is 2 : 3 : 5

Exercise 12.2: Write the ratios correctly in their lowest terms

SNo	Ratio (a:b)	Ratio (a:b:c)
1	24 : 36 =	18 : 24 : 30 =
2	16 : 24 =	20 : 30 : 40 =

3	42 : 56 =	32 : 48 : 64 =
4	18 : 54 =	12 : 24 : 36 =
5	27 : 36 =	9 : 18 : 27 =
6	50 : 75 =	20 : 40 : 60 =
7	45 : 60 =	30 : 45 : 60 =
8	30 : 45 =	12 : 18 : 24 =
9	36 : 48 =	9 : 18 : 27 =
10	60 : 90 =	24 : 36 : 48 =

B. When ratio contains decimal numbers

Ratios should always be expressed as **WHOLE NUMBERS**.

Step-by-step process:

1. **Convert to whole numbers**: If any numbers in the ratio have decimals, multiply the entire ratio by an appropriate power of 10 (10, 100, 1000 etc) to eliminate the decimals.
2. **Find the HCF**: Identify the highest common factor of the numbers.
3. **Simplify the ratio**: Divide all parts of the ratio by the HCF to express the ratio in its lowest terms.

Example: Write the ratio 0.6 : 1.2 in its lowest terms

- **Step 1 (Convert to whole numbers)**: Multiply both numbers by **10** to get rid of the decimals:
  - **0.6 × 10 = 6**, and **1.2 × 10 = 12**.
  - The ratio becomes **6 : 12**.
- **Step 2 (Find the HCF)**: The HCF of 6 and 12 is **6**.

- **Step 3 (Simplify the ratio)**: Divide both numbers by the HCF (6):
  - **6 ÷ 6 = 1**, and **12 ÷ 6 = 2**.
  - The ratio in its lowest terms is **1 : 2**.

Exercise 12.3: Write the ratios correctly as whole numbers in their lowest terms

SNo	Ratio (a:b)	Ratio (a:b:c)
1	0.6 : 1.2 =	1.5 : 2.5 : 3.5 =
2	1.25 : 2.5 =	3.5 : 4.5 : 5.5 =
3	0.4 : 0.8 =	2.3 : 3.4 : 4.5 =
4	0.75 : 1.5 =	1.5 : 2.25 : 3 =
5	0.2 : 0.4 =	3.5 : 5.5 : 7.5 =

C. When ratio contains fractions

Ratios should always be expressed as **WHOLE NUMBERS**.

Step-by-step process:

1. **Find the LCM** of the denominators: Determine the lowest common multiple (LCM) of the denominators of any fractions in the ratio.
2. **Multiply through by the LCM**: Multiply every term in the ratio by the LCM of the denominators.
3. **Simplify**: Once you have whole numbers, simplify the ratio to its lowest terms by finding and dividing by the **Highest Common Factor (HCF)** of the numbers.

Example: Write the ratio 01/4 : 1/8 in its lowest terms

- **Step 1 (LCM of denominators)**: The denominators are 4 and 8. The LCM of 4 and 8 is **8**.
- **Step 2 (Multiply by LCM)**:
  - 1/4 × 8 = 2
  - 1/2 × 8 = 4
- **Step 3 (Simplify if necessary)**: The ratio becomes **2 : 4**.

  HCF (2, 4) = 2 so to write in its lowest terms divide all numbers by **2**
  - The ratio in its lowest terms is **1 : 2**.

Exercise 12.4: Write the ratios contains fractions as whole numbers in their lowest terms

SNo	Ratio(a:b)	Ratio(a:b:c)
1	5 ½ : 4 ½ =	1/5 : 2 2/3 : 1 4/5 =
2	2 3/5 : 4 1/5 =	4/9 : ½ : 2/3 =
3	1 1/3 : 2 ½ =	3/5 : 1/10 : 7/2 =
4	7 ½ : 9 2/7 =	2/3 : ½ : 4/9 =
5	3 ¼ : 4 2/3 =	½ : 2/3 : 4/3 =

3. Proportion (Scaling Ratios):

Key Points:

The two ratios are equivalent if they represent the same relationship between two quantities. To find equivalent ratios, multiply or divide both parts of the ratio by the same number. This is often done to adjust the ratio to match a specific value, such as increasing or decreasing the quantities in a recipe, mixing ingredients etc.

1. Scaling the Ratio Up or Down

- **Scaling up** means increasing the quantities in the ratio. To scale up multiply both parts of the ratio by the same scaling factor.
- **Scaling down** means decreasing the quantities in the ratio. To scale up divide both parts of the ratio by the same scaling factor.

2. Example of Scaling Up a Ratio:

- **Original Ratio**: 3 : 4 (3 red balls and 4 blue balls)
- **Scaling Factor**: 5 (you want to have 5 times the number of red and blue balls)
- **Scaling Up**: Multiply both parts by 5:
    - Red balls: 3 × 5 = 15
    - Blue balls: 4 × 5 = 20
- **Scaled Ratio**: 15 : 20

Red balls	Blue balls	Proportion (Scaled Up)	Result
3	4	multiply both numbers by 5	15 : 20
6	9	multiply both numbers by 3	18 : 27

3. Example of Scaling Down a Ratio:

- **Original Ratio**: 12 : 18 (12 apples and 18 oranges)
- **Scaling Factor**: 6 (you want to scale down by 6)
- **Scaling Down**: Divide both parts by 6:
    - Apples: 12 ÷ 6=2
    - Oranges: 18 ÷ 6=3
- **Scaled Ratio**: 2 : 3

Red balls	Blue balls	Proportion (Scale Down)	Result
3	9	divide both numbers by 3	1 : 3
8	12	divide both numbers by 4	2 : 3

4. Key Rule: Maintain Proportions

- When you scale a ratio, it's important to maintain the proportional relationship between the two parts. If you multiply one part by a certain number, you must multiply the other part by the same number to keep the ratio correct.

Exercise 12.5: Correct the ratios which are not in proportion.

SNo	Ratio	Is this ratio in Proportion?
1	1 : 2 and 3 : 6	
2	2 : 5 and 3 : 10	
3	7 : 3 and 14 : 4	
4	6 :2 and 24 : 9	
5	5 : 7 and 10 : 3	
6	16 : 2 and 8 : 2	

4. Revision questions:

1. Calculate the value of below questions

   a. 3.6 ÷ 0.12 =
   b). 45.6 x 3.2 =
   c. 567.6 ÷ 2.4 =
   c). 123.45 x 6.3 =
   d. 804.9 ÷ 9.5 =
   d). 92.7 x 8.6 =
   e. 999.9 ÷ 11.1 =
   f). 1.074 x 10 =
   f. 0.9382 x 100 =
   g). 42.070 x 1000 =
   g. 0.1 x 0.02 =
   h). 714 x 0.01 =

2. LCM (8, 12) =

3. A recipe requires 3/4 of a cup of sugar. If you are making only half of the recipe, how much sugar will you need?

4. What is the next number in below sequence?

   h. 4, 8, 12, 16, 20, _____
   b). 3, 9, 27, 81, _____
   i. 2, 5, 10, 17, 26, _____
   d). 1, 4, 9, 16, 25, _____
   j. 1, 8, 27, 64, _____
   e).1, 4, 9, 16, 25, _____

5. Calculate the value of below

   a. 7 + (4 × 3) – 6 ÷ 2 =
   b). 42 + 6 ÷ 3 × 2 =

b. (3 + 5) × 42 – 6 ÷ 2 =

d). 5 × 32 – (8 + 2) =

6. Write the missing operation

a. 3 ◯ 2 ◯ 4 = 14

b). 15 ◯ 5 ◯ 2 = 5

b. 12 ◯ 4 ◯ 3 = 21

d). 2 ◯ 3 ◯ 5 = 14

7. Write the missing number in below equivalent fractions

a. 4 / n = 8 / 12 =

b. 9/14 = n/28

8. Write the missing number in below addition and subtractions

a. 324 + n = 587 what is value of n?

b. 4 ☐ 3 + 2 ☐ 7 = 7 5 ☐

c. 6 ☐ 8 + 2 ☐ 9 = 9 3 ☐

d. 5 ☐ 8 - 2 ☐ 3 = 2 4 ☐

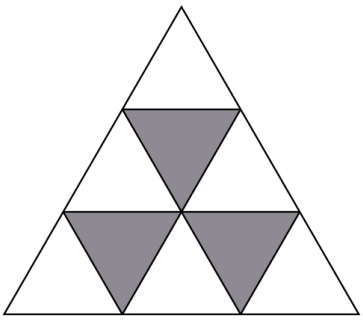
e. 6 ☐ 4 + 1 ☐ 9 = 3 5 ☐

9. Round to nearest place as given below

Decimal Value	Nearest Whole Number	Two Decimal Places	Thousandth Places
3.276			
0.9368			
1.01478			

5. Past paper questions

1. What fraction of the whole shape is shaded?



2. Matthew thinks of a number. He multiplies his number by 2. Then he subtracts 4. What number did Matthew first think of?

3. A train left at 10.20. It arrived at 11.15. How long did the journey take, in minutes?

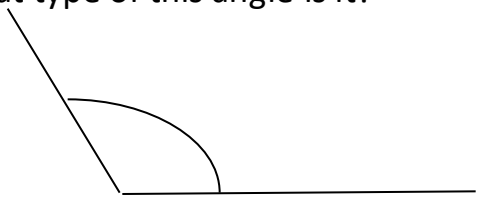
4. Join Tennies Club today! Take advantage of this great offer now.

Type of membership	Normal price	Offer price
Individual member	£47.90	£35.63
Joint membership (2 adults)	£79.50	£59.63
Family group £82.00 £61.50 (2 adults and children under 18)	£82.00	£61.50
Family one adult £62.00 £46.50 (1 adult and children under 18)	£62.00	£46.50
Young person – aged 13–25	£21.50	£16.13

a. Emily, aged 8, wanted to join Tennies Club with her parents. How much must she pay?

b. Mrs. Ward wants to join the Tennies Club with her three children, aged 10, 12 and 15. How much must she pay?

5. a. What type of this angle is it? b. Is the angle > 90 or < 90



6. A ship travels 528 nautical miles in one day. How many nautical miles does it travel in 15 days?

7. There were 27 children in the class. There were twice as many boys as girls. How many boys were there?

8. Zac starts with the number 5. Which of these instructions does not give him an answer of 17?

A. Halve your value, add six, then double.

B. Multiply by four, then subtract three.

C. Triple your value, then add two.

D. Add three and double.

E. Multiply by ten, subtract sixteen, then halve.

9. This chart shows the weather for 12 hours on one day.

10. To make brown paint, you mix 2 parts red, 17 parts yellow and 1 part blue. How much red paint is needed to make 40 litres of brown paint?