



Ratio, Proportion and Rates of Change

Age 11+ Level ★★ Worksheet 1

1. Don't Be Late

Mary drove to Birmingham Airport at 45 miles per hour for the first two hours and then at 70 miles per hour for the remainder of the journey. Her average speed for the entire journey was 60 miles per hour. How long did Mary's journey to Birmingham Airport take?

2. Decimal Clock

In the late 18th century, a decimal clock was proposed, in which there were 100 'minutes' in one 'hour' and 10 'hours' in one day. Assuming that such a clock started from 0:00 at midnight, what time would it show when an ordinary clock showed 6am?

3. Sharing Sweets

Maria and Lucy spun a coin 30 times. Whenever the coin showed heads, Maria gave 2 sweets to Lucy. Whenever the coin showed tails, Lucy gave 3 sweets to Maria.

After all 30 spins, both Maria and Lucy had the same number of sweets that they started with. How many times was tails spun?

4. Leg It

Amina and Bhavi are both training for a 100 metre race. Amina's average time to run 100 metres is 12 seconds, and Bhavi's is 15 seconds. To make their training sessions more competitive, they want to run 'fair' races against each other - so that if they ran at their average speeds, they would finish at the same time.

a) If Amina starts 100 metres from the finish line, how many metres in front of her should Bhavi start to make the race 'fair'?

b) If Bhavi starts 100 metres from the finish line, how many metres behind her should Amina start to make the race 'fair'?

5. How Many Swimmers?

A swimming club has three categories of member: junior, senior and veteran. The ratio of junior to senior members is 3:2, and the ratio of senior to veteran members is 5:2. What is the least possible number of members of the swimming club?

These problems are adapted from UKMT (ukmt.org.uk) and SEAMC (seamc.asia) problems.



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Age 11+ Level ★★ Worksheet 2

1. Musical Maths

The musical *Rent* contains a song which starts 'Five hundred and twenty five thousand six hundred minutes'.

Is this closest to a week, a month, a year, a decade or a century?

2. Ratio Swap

In a group of 48 people, the ratio of adults to children is 3 : 5.

How many adults need to join the group to make the ratio of adults to children 5 : 3?

3. Out of Sync

Albert Einstein was standing on the station platform thinking about relativity when he noticed that he could see two station clocks. Each clock was digital, showing only hours and minutes.

He observed that the display on one clock changed to the next minute 10 seconds before the correct time, whereas the display on the other clock changed to the next minute 10 seconds after the correct time.

For what fraction of the day did the clocks show the same time?

4. Fruit Basket Ratio

My fruit basket contains apples and oranges.

The ratio of apples to oranges in the basket is 3 : 8.

When I remove one apple the ratio changes to 1 : 3.

How many oranges are in the basket?

5. Stair Climb

Boris, Spike and Percival are going to race up the 99 steps that lead from the beach to the car park at the top of the cliff. Boris can run up five steps in the same time as Spike can run up four steps, which is the same time as Percival can run up three steps. It is agreed that Boris starts from the bottom, Spike starts 21 steps up and Percival 38 steps up. If they all start at the same time, in what order will they reach the top?

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Age 11+ Level ★★ Worksheet 3

1. Tyre Wear

A car with 5 tyres (four road tyres and a spare) travelled 30000km. All 5 tyres were used equally. How many kilometres' wear did each tyre receive?

2. Millennium Leap

Leap years normally occur every four years. However, years at the turn of a century are leap years only if they are multiples of 400. Therefore, 2000 was a leap year but the year 1900 was not. How many leap years will there be between 2001 and 3001?

3. Off the Cuff

A long-sleeve shirt has 8 front buttons and 2 cuff buttons.
A short-sleeve shirt has 6 front buttons and no cuff buttons.
The factory which makes 'Slimboy Shirts' uses 10 times as many front buttons as cuff buttons.

What is the ratio of long-sleeve shirts to short-sleeve shirts produced by the factory?

4. A Leg to Stand On

In the *Soft Boulder Cafe* each table has 3 legs, each chair has 4 legs and all the customers and the three members of staff have two legs each. There are four chairs at each table.

At a certain time, three-quarters of the chairs are occupied by customers and there are 206 legs altogether in the cafe.
How many *chairs* does the cafe have?

5. The Elephant Diet

One of the elephants in the zoo is on a special diet. Every day, the elephant eats the same amount of carrots that the rabbit eats in 1 year (365 days).

The rabbit eats the same amount of carrots every day.

Together, in one day, the elephant and rabbit eat 122 kilograms of carrots.

How many kilograms of carrots does the rabbit eat in one day?

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