



Ratio, Proportion and Rates of Change

Age 14+ Level ★★ Worksheet 1

1. Antifreeze

A large container holds 14 litres of a solution that is 25% antifreeze, the remainder being water. How many litres of antifreeze must be added to the container to make a solution that is 30% antifreeze?

2. Platinum Puzzle

Platinum is a very rare metal, even rarer than gold. Its density is 21.5 g/cm^3 . Assuming that the world production has been about 110 tonnes for each of the past 50 years, and negligible before that, which of the following has a comparable volume to that of the total amount of platinum ever produced?

A: a shoe box, B: a cupboard, C: a house, D: Buckingham Palace, E: the Grand Canyon

3. Hillwalking

Andrew starts his walk along a flat path at an average speed of 4km/h. Then he climbs a hill at an average speed of 3km/h. On reaching the top, he comes straight back down at a speed of 6km/h and then goes back on the flat path at a speed of 4km/h again.

The walk takes him 2 hours altogether.
What is the total distance he walks?

4. Travelator

At the airport, there is a moving walkway 500m long, which moves at a speed of 4km/h. Andrew and Bill step onto the walkway at the same time. Andrew walks with a steady speed of 6km/h on the walkway, whilst Bill stands still.

When Andrew arrives at the end of the walkway, how far is he ahead of Bill?

5. Travelling by Train

Stephen leaves Middlesbrough by train at 09:00. The train travels the first 27 km at 96 km per hour. It then stops at Darlington for 3 minutes, before travelling the remaining 29 km to Durham at the same speed.

At what time does Stephen arrive in Durham?

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



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Age 14+ Level ★★ Worksheet 2

1. Crude Calculation

When Louise had her first car, 50 litres of petrol cost £40. When she filled up the other day, she noticed that 40 litres of petrol cost £50. By what percentage has the cost of petrol increased over this time?

2. Pond Runners

Katherine and James are jogging in the same direction around a pond.

They start at the same time and from the same place and each jogs at a constant speed.

Katherine, the faster jogger, takes 3 minutes to complete one lap, and first overtakes James 8 minutes after starting.

How many seconds does it take James to complete one lap?

3. Walking in the Mountains

Heidi and Peter went for a mountain walk from Obersee to Salzbau. They left Obersee at 12 noon and the sign there said that Salzbau was 2 hours and 55 minutes away.

At one o'clock they sat down for lunch under another sign which said that Salzbau was now only 1 hour and 15 minutes away.

After stopping for 15 minutes for lunch, they continued their walk at the same speed as before without any further breaks.

At what time did they reach Salzbau?

4. Shepherd's Flock

Joseph's flock has 55% more sheep than goats. What is the ratio of goats to sheep in the flock?

5. Overtake

Tom left a motorway service station and travelled towards Glasgow at a steady speed of 60 mph. Tim left the same service station 10 minutes after Tom and travelled in the same direction at a steady speed, overtaking Tom after a further 1 hour 40 minutes.

At what speed did Tim travel?

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Age 14+ Level ★★ Worksheet 3

1. Bike Shop

I walk to the bike shop at 3 miles per hour and cycle back along the same route at 12 miles per hour.

What is my average speed, in miles per hour, for the time I am travelling?

2. Very Long Line

If the line on the right were 0.2mm thick, how long would it need to be to cover an area of one square metre?



3. Inches and Barleycorns

Yards, furlongs, inches, cubits, chains and barleycorns are all imperial measures of length.

There are 220 yards in a furlong and 36 inches in a yard. There are 44 cubits in a chain and 54 barleycorns in a cubit. 1 furlong is the same as 10 chains.

How many barleycorns are the same length as 1 inch?

4. Ratio Riddle

The ratio $a : b = 2 : 3$ and the ratio $a : c = 3 : 4$.
What is the ratio $b : c$?

5. Tyneside Average Speed

A van travels from Newcastle to South Shields at an average speed of 30 mph and returns by the same route at an average speed of 40 mph. What is the van's average speed for the whole journey?

6. Dolly Dolphin

Dolly Dolphin swims at a constant speed. When she swims against a current of 2m/s, she travels at 6 m/s.

Dolly swims upstream in this current for 2 minutes, then turns round and swims back to her starting point. What is her average speed?

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