



Ratio, rates and repeated percentages

Grades 4–9 About 85 minutes Calculator allowed

83 marks

Name _____

Class _____

Date _____

A Before you start

Grades 4–5

You will need these in every question below.

A1 Write the ratio 18 : 45 in its simplest form.

[1 mark]

Answer _____

A2 Write down the multiplier for an increase of 7%.

[1 mark]

Answer _____

A3 Write 2 hours 15 minutes in hours, as a decimal.

[1 mark]

Answer _____

A4 Share £60 in the ratio 1 : 4.

[2 marks]

Answer _____

A5 Work out 12% of 350.

[1 mark]

Answer _____

Your teacher works through each example with you. Then try the one beside it on your own.

EXAMPLE 1

Share £720 in the ratio 3 : 5 : 7.

Hint Add the parts to find how many equal shares there are. Work out one share, then multiply.

B1 Share 840 g in the ratio 2 : 3 : 9. [2 marks]

Answer

EXAMPLE 2

A 400 g jar of coffee costs £2.36. A 650 g jar costs £3.77. Which jar is better value?

Hint Work out the cost of 1 g for each jar. The jar with the lower cost for each gram is better value.

B2 A 250 ml bottle of shampoo costs £1.45. A 750 ml bottle costs £4.20. Which bottle is better value? You must show your working. [3 marks]

Answer

EXAMPLE 3

A cyclist rides 42 km in 1 hour 45 minutes. Work out her average speed in km/h.

Hint Write the time in hours first: 45 minutes is $\frac{45}{60} = 0.75$ of an hour. Then speed = distance $\div$ time.

B3 A runner covers 21 km in 1 hour 24 minutes. Work out his average speed in km/h. [2 marks]

Answer

EXAMPLE 4

£4500 is invested for 4 years at 3.5% compound interest per year. Work out the value of the investment after 4 years.

Hint The multiplier for an increase of 3.5% is 1.035. Multiplying by it once for each year is the same as multiplying by 1.035^4 .

B4 A car is worth £18 000. Its value [3 marks]
falls by 12% each year. Work out
its value after 3 years.

Answer

C Practice

Grades 5–7

Each question asks for something different. Show your working.

C1 6 pens cost £4.86. Work out the cost of 11 of the same pens. [2 marks]

Answer

C2 The density of gold is 19.3 g/cm^3 .

(a) Work out the mass of a gold bar with a volume of 12 cm^3 . [2 marks]

Answer

(b) Work out the volume of 500 g of gold. Give your answer to 3 significant figures. [2 marks]

Answer

Total for C2: 4 marks

- C3** A box has a weight of 360 N. It rests on a face that measures 0.8 m by 0.6 m. Work out the pressure on the floor, in N/m^2 . [2 marks]

Answer

- C4** In a sale, all prices are reduced by 15%. A jacket costs £71.40 in the sale. Work out the price of the jacket before the sale. [3 marks]

Answer

- C5** Amy and Ben share some money in the ratio 3 : 10. Ben gets £63 more than Amy. How much money do they share altogether? [3 marks]

Answer

- C6** A train travels at 72 km/h. Write this speed in metres per second. [2 marks]

Answer

- C7** The number of birds in a colony is 8000. The number falls by 6% each year. After how many whole years will the number first be below 6000? [3 marks]

Answer

C8 A recipe for 6 people uses 450 g of flour. How much flour is needed for 14 people? [2 marks]

Answer

C9 A bag holds 65 counters. The ratio of red counters to blue counters is 4 : 9.

(a) What fraction of the counters are red? [1 mark]

Answer

(b) How many of the counters are blue? [1 mark]

Answer

Total for C9: 2 marks

D Exam-style questions

Grades 6–9

Answer every question in the space given. Show your working: most of the marks are for method.

D1 Mo says, "If a price goes up by 20% and then goes down by 20%, it ends up back where it started." [2 marks]

Explain why Mo is wrong.

D2 Lena drives 120 km at an average speed of 80 km/h. She then drives 90 km at an average speed of 60 km/h. [4 marks]

Work out her average speed for the whole journey.

Answer

- D3** An alloy is made by melting together 300 cm^3 of metal A and 200 cm^3 of metal B. Metal A has density 8.9 g/cm^3 . Metal B has density 2.7 g/cm^3 . [4 marks]

Work out the density of the alloy.

Answer

- D4** Priya has £6000 to invest for 4 years. [6 marks]

Account A pays 3.8% compound interest each year.

Account B pays 5% interest in the first year, then 3% compound interest in each year after that.

Which account gives Priya more money after 4 years, and by how much? You must show your working.

Answer

- D5** Some money is invested at 4% compound interest per year. After 3 years the investment is worth £4049.51. How much money was invested? [3 marks]

Answer

- D6** A force acts on an area of 0.5 m^2 and makes a pressure of 240 N/m^2 . The same force acts on an area of 0.3 m^2 . Work out the new pressure. [3 marks]

Answer

- D7** In a club, the ratio of boys to girls is $5 : 3$. Then 12 more girls join the club, and no one leaves. The ratio of boys to girls is now $5 : 4$. [4 marks]
How many boys are in the club?

Answer

- D8** Shop A sells a pack of 6 cans of drink for £3.54. Shop B sells a pack of 15 of the same cans for £9.60, and takes 10% off the price. [3 marks]
Which shop gives the better value? You must show your working.

Answer

- D9** A train leaves at 09:47. It travels 228 km at an average speed of 95 km/h. At what time does it arrive? [3 marks]

Answer

- D10** Water flows into an empty tank at 12 litres per minute. The tank is a cuboid 80 cm long, 60 cm wide and 50 cm high. How many minutes does it take to fill the tank? (1 litre = 1000 cm³.) [3 marks]

Answer

E Extension

Grade 9 and beyond

No route is given. Spend five minutes on a problem before you look at a hint. The hints are on the last page of the worksheet, and you can use one at a time.

- E1** Ann, Bob and Cal share £1400. The ratio of Ann's share to Bob's share is 2 : 3. The ratio of Bob's share to Cal's share is 4 : 5. [3 marks]

How much does each person get?

Answer

- E2** The value of a house goes up by the same percentage each year. After 2 years its value has gone up by 21% altogether. [3 marks]

What is the percentage increase each year?

Answer

E3 If Jo walks to school at 5 km/h, she arrives 6 minutes late. If she walks at 6 km/h, she arrives 2 minutes early. [3 marks]

How far is it from Jo's home to school?

Answer

F How did it go?

Colour one circle on each line.

	Not yet	Nearly	Yes
I can share an amount in a ratio and use the unitary method.	☐	☐	☐
I can compare best buys by working out the cost of one unit.	☐	☐	☐
I can use speed, density and pressure, and change between units of speed.	☐	☐	☐
I can work out repeated percentage change with a multiplier and power.	☐	☐	☐
I can find the original amount after a percentage change.	☐	☐	☐

Extension hints

Use one hint at a time. Cover the ones below it with a sheet of paper.

- E1**
- Hint 1** Bob is in both ratios. Make his number of parts the same in both.
- Hint 2** $2 : 3 = 8 : 12$ and $4 : 5 = 12 : 15$, so Ann : Bob : Cal = 8 : 12 : 15.
- Hint 3** That is 35 parts, so one part is $1400 \div 35 = 40$. Ann gets £320, Bob £480 and Cal £600.
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- E2**
- Hint 1** Call the yearly multiplier m . Two years of growth multiply the value by m^2 .
- Hint 2** A rise of 21% altogether means $m^2 = 1.21$.
- Hint 3** $m = \sqrt{1.21} = 1.1$, so the value goes up by 10% each year.
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- E3**
- Hint 1** Call the distance d km. Write each journey time in hours, in terms of d .
- Hint 2** The two times differ by 8 minutes, which is $\frac{8}{60}$ of an hour: $\frac{d}{5} - \frac{d}{6} = \frac{8}{60}$.
- Hint 3** $\frac{d}{30} = \frac{8}{60}$, so $d = 4$. The distance is 4 km.