Exercise walk-through

3.1.2 Scale Drawings

AQA · GCSE · Mathematics

Scale, similarity and rates of change

- **Scale drawings.** A map **scale** of $1 : 25\,000$ means 1 cm on the map is 25 000 cm in real life.
- A 4 cm line on the map is $4 \times 25\,000 = 100\,000$ cm, which is 1 km.
- **Length, area and volume.** If two shapes are similar with a length **scale** factor of k, the **area scale factor** is k^2 and the volume scale factor is k^3.
- A square with sides 3 times as long has 9 times the area.

Growth and decay

- **Simple interest** pays the same amount every year. **Compound interest** pays interest on the interest too, so the amount is multiplied by the same number every year:
- where P is the starting amount, r the percentage rate and n the number of years.
- For decay, such as a car losing value, use $1 - \frac{r}{100}$.
- **Worked example 13.** 1000 yuan is saved at 10% a year for 4 years.

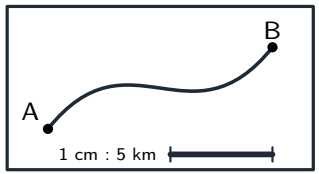
$$A = P\left(1 + \frac{r}{100}\right)^n$$

Sources for this lesson

- AQA, *GCSE Mathematics (8300) specification*, subject content section 3.3 (Ratio, proportion and rates of change).
- NASA, *Mars Climate Orbiter Mishap Investigation Board Phase I Report* (10 November 1999).
- AQA, *GCSE Mathematics* Higher Paper 2 (June 2024), the reverse-percentage and house-price questions, adapted.

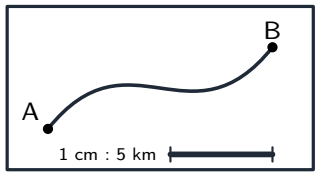
Exercise 2.1

2.1 A scale drawing uses 1 cm to 2 m. A room is 6.5 cm long on the drawing. How long is the real room? [1]



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2.1

- $6.5 \times 2 = \mathbf{13}$ m

Setup for exercise 2.2

2.2 A map has scale 1 : 50 000. Two towns are 6 cm apart on the map. Work out the real distance in km. [2]



Exercise 2.2

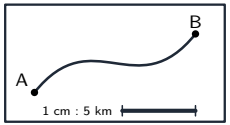
2.3 On a map with scale 1 : 200 000, a lake is 18 km long. How long is it on the map? [2]



2.4 A model car is built to a scale of 1 : 40. The real car is 4.2 m long. How long is the model, in cm? [2]



2.5 A map shows 3 km as 12 cm. Write the scale of the map in the form 1 : n. [2]



Exercise 2.2

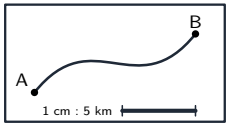
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2.2

- $6 \times 50\,000 = 300\,000$ cm

Full solution on next slide

Full solution 2.2

2.2

- $6 \times 50\,000 = 300\,000$ cm
- $300\,000$ cm $= 3000$ m $=$ **3** km

2.3

- 18 km $= 1\,800\,000$ cm
- $1\,800\,000 \div 200\,000 =$ **9** cm

2.4

- 4.2 m $= 420$ cm
- $420 \div 40 =$ **10.5** cm

2.5

- 3 km $= 300\,000$ cm, so $12 : 300\,000$
- divide by 12: **1** : **25 000**

Exercise 3.1

3.1 Kim says that on a map with scale $1 : 100\,000$, 5 cm represents 500 km. Explain her mistake and give the correct distance. [2]



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3.1

- $5 \times 100\,000 = 500\,000$ **cm**, not km: she forgot to convert units
- $500\,000$ cm $=$ **5** km

Setup for exercise 3.2

3.2 A garden plan uses a scale of 1 : 50. A path is 7.2 m long. Work out its length on the plan. [2]



3.3 On a map of scale 1 : 25 000, a footpath measures 9.6 cm. Mo walks it at 4 km/h. How many minutes does the walk take? [3]

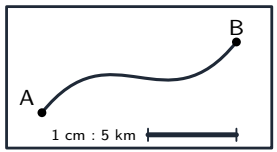


Exercise 3.2

3.4 A field is shown as a rectangle 4 cm by 3 cm on a map of scale 1 : 5000. Work out the real area of the field in m^2. [3]



3.5 A ship sails 12 km on a bearing of 090° and then 9 km on a bearing of 180°. On a scale drawing of 1 : 300 000, how far is the ship from its start, in cm? [3]

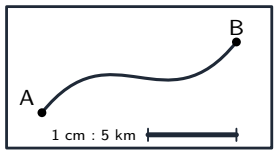


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3.2

- $7.2\text{ m} = 720\text{ cm}$

Full solution on next slide

Full solution 3.2

3.2

- $7.2\ \text{m} = 720\ \text{cm}$
- $720 \div 50 = \mathbf{14.4}\ \text{cm}$

3.3

- $\text{real length} = 9.6 \times 25\,000 = 240\,000\ \text{cm} = 2.4\ \text{km}$
- $\text{time} = \dfrac{\text{distance}}{\text{speed}} = \dfrac{2.4\ \text{km}}{4\ \text{km/h}} = 0.6\ \text{h}$
- $0.6 \times 60 = \mathbf{36}\ \text{minutes}$

3.4

- $\text{real sides: } 4 \times 5000 = 20\,000\ \text{cm} = 200\ \text{m} \text{ and } 3 \times 5000 = 15\,000\ \text{cm} = 150\ \text{m}$
- $\text{area} = 200 \times 150 = \mathbf{30\,000}\ \text{m}^2$

3.5

- $\text{the two legs are at right angles: distance} = \sqrt{12^2 + 9^2} = \sqrt{225} = 15\ \text{km}$
- $15\ \text{km} = 1\,500\,000\ \text{cm}$
- $1\,500\,000 \div 300\,000 = \mathbf{5}\ \text{cm}$