Exercise walk-through

3.2.1 Percent

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.

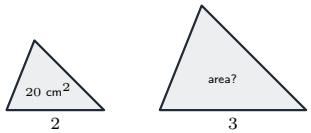
$$A = P\left(1 + \frac{r}{100}\right)^n$$

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.

Exercises 2.1·2.2

2.1 The two triangles are similar. The lengths are in the ratio 2 : 3. The small triangle has an area of 20 cm^2. Work out the area of the large triangle. [2]

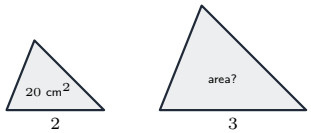


2.2 A car costs £12 000. Its value falls by 15% each year. Work out its value after 2 years. [2]



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2.1

- area factor $\frac{9}{4}$
- $20 \times \frac{9}{4} = \mathbf{45}$ cm^2

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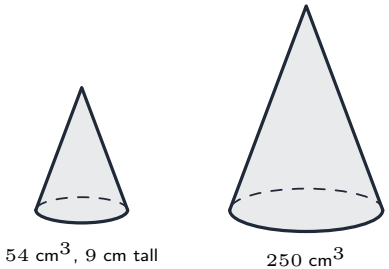


2.2

- $12\,000 \times 0.85^2$
- £**8670**

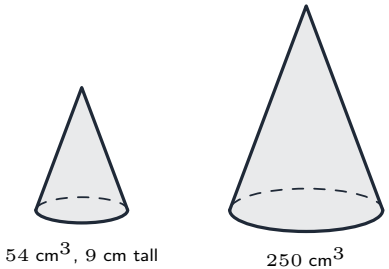
Exercise 3.1

3.1 *(H)* Two cones are similar. Their volumes are 54 cm^3 and 250 cm^3. The small cone is 9 cm tall. Work out the height of the large cone. [3]



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3.1

- volume factor $\frac{250}{54} = \frac{125}{27}$
- $k = \frac{5}{3}$
- $9 \times \frac{5}{3} = \mathbf{15}$ cm

Exercise 3.2 (a)

3.2 A museum has a model of a church. The scale of the model is $1 : 50$.

(a) The tower of the model is 0.6 m tall. Work out the height of the real tower. [2]

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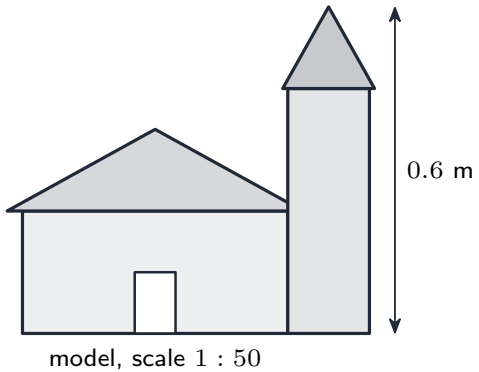
(a) The tower of the model is 0.6 m tall. Work out the height of the real tower. [2]

(a) $0.6 \times 50 = \mathbf{30}$ m

Exercise 3.2 (b)

3.2 A museum has a model of a church. The scale of the model is 1 : 50.

(b) The real roof has an area of 400 m^2. Work out the area of the model roof in cm^2. [3]

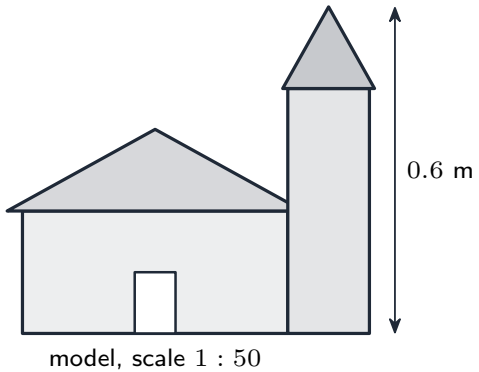


model, scale 1 : 50

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model, scale 1 : 50

(b) area factor $50^2 = 2500$; $400 \div 2500 = 0.16$ m^2; **1600** cm^2

Exercise 3.2 (c)

3.2 A museum has a model of a church. The scale of the model is 1 : 50.

(c) The inside of the model has a volume of 0.05 m^3. Work out the volume inside the real church. One heater can heat 250 m^3. How many heaters does the church need? [4]

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3.2 A museum has a model of a church. The scale of the model is $1 : 50$.

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(c) volume factor $50^3 = 125\,000$; $0.05 \times 125\,000 = \mathbf{6250}\ \text{m}^3$; $6250 \div 250 = \mathbf{25}$ heaters

Exercise 3.2 (d)

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(d) 8000 people visited the church in 2024. The number of visitors goes up by 6% each year. How many visitors will there be in 2027? In which year will the number of visitors first be more than 10 000? [5]

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(d) $8000 \times 1.06^3 = \mathbf{9528}$; $8000 \times 1.06^4 = 10\,100$; 2028