Exercise walk-through

# 3.1.99

# Independent transfer: Foundation then Higher

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.

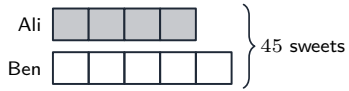
$$A = P\left(1 + \frac{r}{100}\right)^n$$

# 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** Share 45 sweets between Ali and Ben in the ratio 4 : 5. [2]



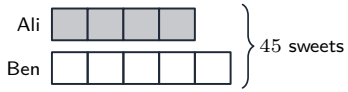

**2.2** Which pack of cans is the better buy? Show how you decide. [2]



6 cans: £3.30 4 cans: £2.40

# Exercises 2.1·2.2

**2.1** Share 45 sweets between Ali and Ben in the ratio 4 : 5. [2]




**2.1**

- one part $45 \div 9 = 5$
- Ali **20**, Ben **25**

**2.2** Which pack of cans is the better buy? Show how you decide. [2]

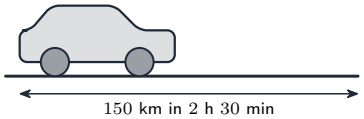



**2.2**

- 55p and 60p a can
- the **6-pack** is the better buy

# Exercises 2.3·2.4

**2.3** A car travels 150 km in 2 hours 30 minutes. Work out its average speed. How long does it take to travel 210 km at the same speed? [2]

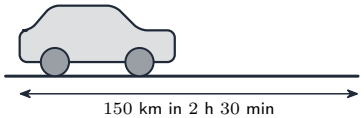



**2.4** A jacket costs £80. In a sale the price is reduced by 15%. Work out the sale price. After the sale it goes back to £80. Work out the percentage increase. [2]



# Exercises 2.3·2.4

**2.3** A car travels 150 km in 2 hours 30 minutes. Work out its average speed. How long does it take to travel 210 km at the same speed? [2]




**2.3**

- $150 \div 2.5 = \mathbf{60}$ km/h
- $210 \div 60 = 3.5$: $\mathbf{3}$ h $\mathbf{30}$ min

**2.4** A jacket costs £80. In a sale the price is reduced by 15%. Work out the sale price. After the sale it goes back to £80. Work out the percentage increase. [2]




**2.4**

- £**68**
- $\frac{12}{68} \times 100 = \mathbf{17.6}\%$

exercises.lol exercises.com.cn

# Exercise 3.1

**3.1** A recipe for 4 people uses 300 g of flour and 2 eggs. Work out the flour and eggs for 10 people. Sam has 600 g of flour and plenty of eggs. What is the largest number of people Sam can make it for? [3]

**Pancakes** (serves 4)
300 g flour
2 eggs

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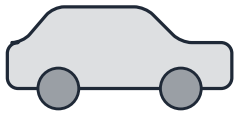
### 3.1

- **750** g of flour
- **5** eggs
- $600 \div 75 = \mathbf{8}$ people

# Exercise 3.2 (a)

**3.2** Mia buys a car for £18 000. It loses 15% of its value each year.

(a) Work out the value of the car after 1 year. [2]



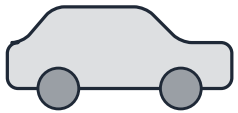
£18 000: loses 15% a year

240 km; 6.5 litres per 100 km; £1.45 a litre

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£18 000: loses 15% a year

240 km; 6.5 litres per 100 km; £1.45 a litre

(a) $18\,000 \times 0.85 = \textbf{£15 300}$

# Exercise 3.2 (b)

**3.2** Mia buys a car for £18 000. It loses 15% of its value each year.

(b) Work out the value after 3 years, and the percentage of the original value lost. [3]

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(b) $18\,000 \times 0.85^3 = \mathbf{£11\,054.25}$; $\mathbf{38.6}\%$ lost

# Exercise 3.2 (c)

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(c) Mia drives 240 km. The car uses 6.5 litres of fuel for every 100 km. Fuel costs £1.45 a litre. Work out the cost of the fuel. [4]

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(c) Mia drives 240 km. The car uses 6.5 litres of fuel for every 100 km. Fuel costs £1.45 a litre. Work out the cost of the fuel. [4]

(c) $240 \div 100 \times 6.5 = 15.6$ litres; $15.6 \times 1.45 =$ £**22.62**

# Exercise 3.2 (d)

**3.2** Mia buys a car for £18 000. It loses 15% of its value each year.

(d) *(H)* The time $T$ hours for the 240 km is inversely proportional to the speed $v$ km/h. At 80 km/h it takes 3 hours. Find a formula for $T$ and the time at 96 km/h. A wheel part has a mass of 2.4 kg and is made of aluminium of density 2.7 g/cm$^3$. Work out its volume. [5]

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(d) $T = \frac{k}{v}$, $k = 240$; $T = \mathbf{\frac{240}{v}}$; **2.5** hours; $2400 \div 2.7 = \mathbf{889}$ cm$^3$