Exercise walk-through

3.2.2
Percentage Growth

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.

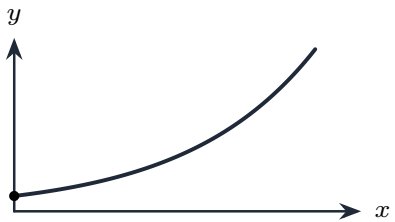
$$A = P\left(1 + \frac{r}{100}\right)^n$$

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.

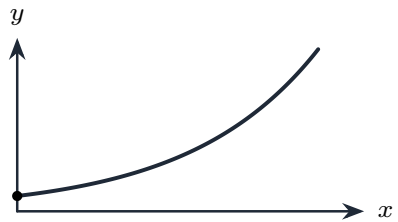
Exercise 2.1

2.1 Increase ¥240 by 15%. [2]



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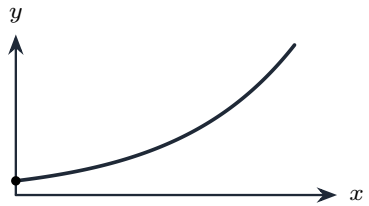


2.1

- multiplier 1.15
- $240 \times 1.15 = \mathbf{¥276}$

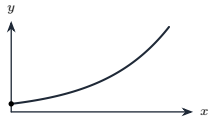
Setup for exercise 2.2

2.2 A coat costs ¥450. In a sale it is reduced by 30%. Work out the sale price. [2]

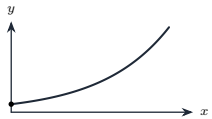


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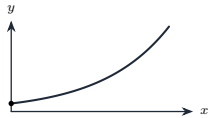
2.3 A price rises from ¥80 to ¥92. Work out the percentage increase. [2]



2.4 Work out the simple interest on ¥2500 at 4% a year for 3 years. [2]

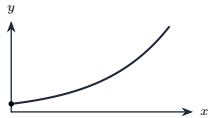


2.5 A phone costs ¥1380 after a 15% increase. What did it cost before? [2]

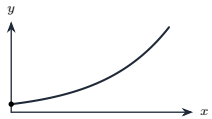


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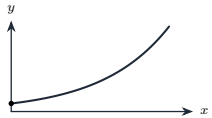
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2.2

- multiplier $1 - 0.30 = 0.7$
- $450 \times 0.7 =$ **¥315**

Full solution on next slide

Full solution 2.2

2.2

- multiplier $1 - 0.30 = 0.7$
- $450 \times 0.7 = \mathbf{¥315}$

2.3

- change $= 92 - 80 = 12$
- percentage change $= \dfrac{\text{change}}{\text{original}} \times 100 = \dfrac{12}{80} \times 100 = \mathbf{15}\%$

2.4

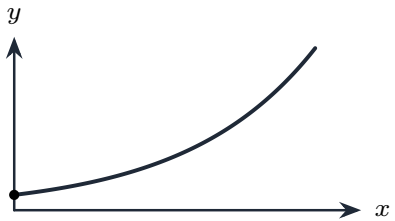
- one year: 4% of $2500 = ¥100$
- 3 years: $3 \times 100 = \mathbf{¥300}$

2.5

- original $\times 1.15 = 1380$
- original $= 1380 \div 1.15 = \mathbf{¥1200}$

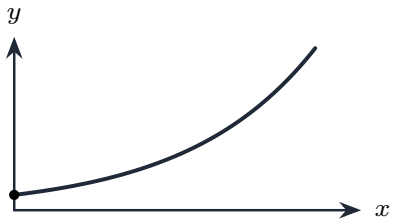
Exercise 3.1

3.1 Nina says a 20% increase followed by a 20% decrease brings a price back to where it started. Use ¥100 to show she is wrong. [2]



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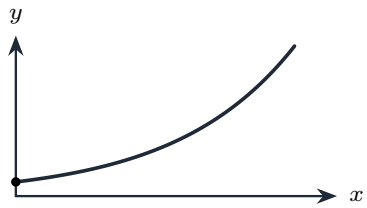


3.1

- $100 \times 1.2 = 120$, then $120 \times 0.8 = 96$
- ¥96 is not ¥100: the 20% decrease is taken from the larger amount

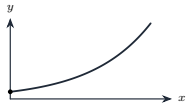
Setup for exercise 3.2

3.2 ¥5000 is invested at 3% compound interest a year. Work out its value after 4 years, to the nearest yuan. [2]

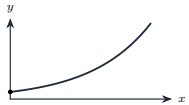


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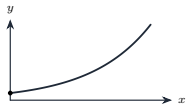
3.3 A car bought for ¥90 000 loses 12% of its value each year. Work out its value after 3 years. [2]



3.4 In a sale everything is 35% off. A bag costs ¥195 in the sale. Work out its price before the sale. [2]

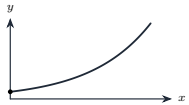


3.5 A house's value rises by 3% one year and 8% the next, reaching ¥100 116. Work out its value before the two rises. [3]

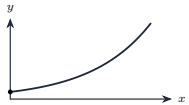


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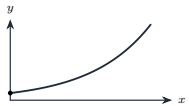
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3.2

- $A = P\left(1 + \frac{r}{100}\right)^n = 5000 \times 1.03^4 = 5627.54\ldots \approx$ **¥5628**

3.3

Full solution on next slide

Full solution 3.2

3.2

- $A = P\left(1 + \frac{r}{100}\right)^n = 5000 \times 1.03^4 = 5627.54\ldots \approx$ **¥5628**

3.3

- multiplier 0.88 for 3 years: $90\,000 \times 0.88^3 =$ **¥61 332.48**

3.4

- sale price is 65%: original $\times 0.65 = 195$
- original $= 195 \div 0.65 =$ **¥300**

3.5

- overall multiplier $1.03 \times 1.08 = 1.1124$
- original $\times 1.1124 = 100\,116$
- original $= 100\,116 \div 1.1124 =$ **¥90 000**