Exercise walk-through

2.4.7
Context Graphs

AQA · GCSE · Mathematics

Solving equations

- **Linear equations.** Collect the letters on one side and the numbers on the other. **Worked example 8.** $7x - 22 = 4x + 29$.
- Subtract $4x$: $3x - 22 = 29$.
- Add 22: $3x = 51$, so $x = 17$.
- **Quadratic equations by factorising.** Make one side zero and factorise.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Inequalities

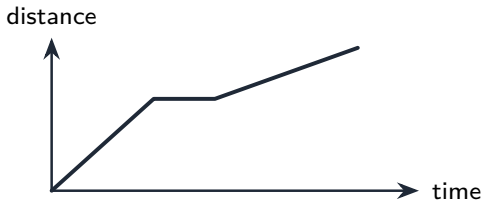
- Solve a linear inequality like an equation, but if you multiply or divide by a negative number, turn the sign round: from $-2x < 6$ you get $x > -3$.
- On a number line, an open circle means the end value is not included ($<$ or $>$) and a filled circle means it is ($\leq$ or $\geq$).
- **Worked example 15.** Find the integers n with $-3 < 2n + 1 \leq 9$.
- Subtract 1: $-4 < 2n \leq 8$.

Sequences

- A sequence is a list of numbers that follows a rule.
- A term-to-term rule says how to get the next term; a position-to-term rule, the **nth term** , gives any term from its position n.
- You should know the square numbers (1, 4, 9, 16, ...), cube numbers (1, 8, 27, ...), triangular numbers (1, 3, 6, 10, ...) and Fibonacci-type sequences, where each term is the sum of the two before.
- **Arithmetic sequences.** An **arithmetic progression** adds the same number each time.

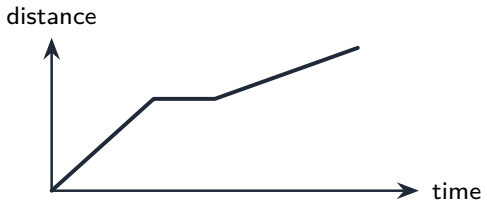
Exercise 2.1

2.1 On a distance–time graph, what does a horizontal line show? [1]



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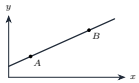
- the object is **not moving**: its distance stays the same

Exercise 2.2

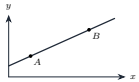
2.2 Ana walks 1.2 km in 15 minutes. Work out her speed in km/h. [2]



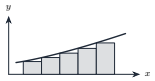
2.3 A plumber's charge is shown by a straight line through $(0, 40)$ and $(3, 190)$, where x is hours and y is yuan. Write down the fixed charge and work out the cost per hour. [2]



2.4 A conversion graph is a straight line through $(0, 0)$ and $(50, 400)$, converting pounds (£) to yuan. How many yuan is £20? [2]



2.5 Water is poured at a steady rate into a tall straight-sided glass. Describe the graph of water depth against time. [1]

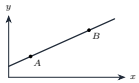


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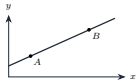
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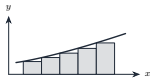
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2.2

- 15 minutes $= 0.25$ h
- speed $= \dfrac{\text{distance}}{\text{time}} = \dfrac{1.2 \text{ km}}{0.25 \text{ h}} = \mathbf{4.8}$ km/h

2.3

Full solution on next slide

Full solution 2.2

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2.3

- fixed charge **¥40**
- cost per hour $= \dfrac{190 - 40}{3 - 0} =$ **¥50**

2.4

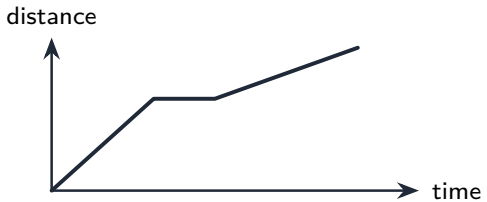
- rate: $400 \div 50 = 8$ yuan per pound
- $20 \times 8 =$ **¥160**

2.5

- a **straight line** sloping upwards from the origin: the depth rises at a constant rate

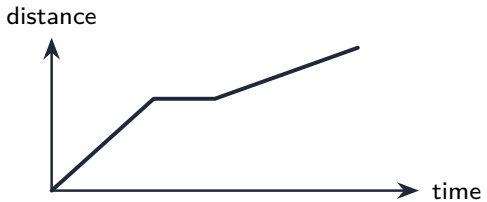
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3.1 Kai says the steepest section of a distance–time graph is where he was slowest. Is he correct? Give a reason. [1]



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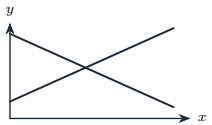
- **No**: the steepest section has the biggest gradient, which is the **fastest** speed

Setup for exercise 3.2

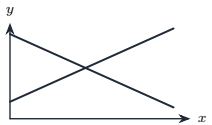
3.2 Lin cycles 12 km from home in 40 minutes, rests for 20 minutes, then cycles home in 30 minutes. Work out her speed in km/h on the way home, and her average speed for the whole trip. [3]



3.3 Phone plan A costs ¥30 a month plus ¥0.10 per minute. Plan B costs ¥0.25 per minute with no monthly charge. Find the number of minutes for which both plans cost the same, and say which plan is cheaper for 300 minutes. [3]

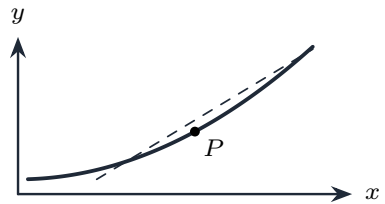


3.4 A taxi fare is a fixed charge plus a rate per km. A 4 km ride costs ¥22 and a 10 km ride costs ¥40. Find the fixed charge and the rate per km. [3]



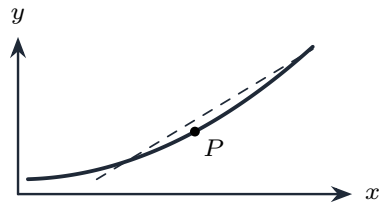
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3.5 A tank holds 600 litres. It empties at a constant rate and is empty after 25 minutes. Find the gradient of its volume–time graph and explain what the gradient means. [2]



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- home: 30 minutes $= 0.5$ h; speed $= \dfrac{12 \text{ km}}{0.5 \text{ h}} = \mathbf{24}$ km/h
- total distance 24 km; total time $40 + 20 + 30 = 90$ min $= 1.5$ h
- average speed $= \dfrac{24 \text{ km}}{1.5 \text{ h}} = \mathbf{16}$ km/h

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- $30 + 0.10m = 0.25m$, so $30 = 0.15m$ and $m = \mathbf{200}$ minutes
- 300 minutes: A costs $30 + 30 =$ ¥60, B costs $0.25 \times 300 =$ ¥75, so **plan A** is cheaper

3.4

- rate $= \dfrac{40 - 22}{10 - 4} = \dfrac{18}{6} = \mathbf{¥3 \text{ per km}}$
- fixed charge: $22 - 4 \times 3 = \mathbf{¥10}$

3.5

- gradient $= \dfrac{(0 - 600) \text{ L}}{25 \text{ min}} = \mathbf{-24}$ L/min
- the tank loses 24 litres every minute