

GCSE MATHS

Graphs in context

Worked Solutions

Q1

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$$d = 300 \text{ m}$$

Read up from 5 minutes to the graph, then across to the distance axis.

Q2

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(a) $10 - 6 = 4 \text{ min}$

The horizontal section runs from 6 to 10 minutes.

(b) $d = 200 \text{ m}$

Read the final point.

Q3

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$$v = \frac{720 - 240}{10 - 4} = 80 \text{ m/min}$$

Divide the change in distance by the change in time.

Q4

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$$v = \frac{900 - 100}{20 - 12} = 100 \text{ m/min}$$

Find the speed towards home.

$$d = 900 - 100(18 - 12) = 300 \text{ m}$$

Subtract the distance walked in six minutes.

Q5

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(a) $d = 600 + (600 - 300) + (900 - 300) = 1500 \text{ m}$

Add the distance travelled on each moving section.

(b) Average speed $= 1500/20 = 75 \text{ m/min}$

Divide by the whole journey time.

Q6

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$$d = 400 + 200 + 600 = 1200 \text{ m}$$

Add the distances covered, including the return journey.

$$v = 1200/24 = 50 \text{ m/min}$$

Use the full 24 minutes.

Q7

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$$a = \frac{16 - 4}{4} = 3 \text{ m/s}^2$$

Divide the increase in speed by the time.

Q8

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$$d = (9 - 3) \times 8 = 48 \text{ m}$$

Use the area of the rectangle.

Q9

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$$\text{Deceleration} = \frac{24 - 6}{8 - 2} = 3 \text{ m/s}^2$$

Divide the decrease in speed by the time taken.

Q10

$$d = \frac{1}{2}(4)(12) + \frac{1}{2}(12 + 6)(4) + \frac{1}{2}(4)(6)$$

Split the area into a triangle, a trapezium and a triangle.

$$d = 24 + 36 + 12 = 72 \text{ m}$$

Add the three areas.

Q11

$$d = \frac{1}{2}(4 + 8)(4) + 8(6) + \frac{1}{2}(8)(6) = 96 \text{ m}$$

Find the total area under the graph.

$$v = 96/16 = 6 \text{ m/s}$$

Divide the total distance by the time.

Q12

$$d_1 = \frac{1}{2}(6)(6) = 18 \text{ m}$$

Find the distance travelled in the first six seconds.

$$t = 6 + \frac{54 - 18}{6} = 12 \text{ s}$$

Divide the remaining distance by the constant speed, then add six seconds.

Q13

$$v \approx (8 - 0)/(3 - 1) = 4 \text{ m/s}$$

Use two points on the tangent, not a chord of the curve.

Q14

$$v \approx \frac{22 - 6}{6 - 2} = 4 \text{ m/s}$$

Find the gradient of the tangent.

Q15

$$d \approx \frac{1}{2}(0 + 1) + \frac{1}{2}(1 + 4) + \frac{1}{2}(4 + 9) + \frac{1}{2}(9 + 16)$$

Add four trapezium areas.

$$d \approx 22 \text{ m}$$

Calculate the total.

Q16

$$d \approx \frac{1}{2}(2 + 6)(2) + \frac{1}{2}(6 + 14)(2) = 28 \text{ m}$$

Add the areas of the two trapeziums.

Q17

Trapezium area > area under curve

Each top edge lies above the curve.

Q18

$$\bar{v} \approx 22/4 = 5.5 \text{ m/s}$$

Divide estimated distance by elapsed time.

Q19

$$V = 20 + 5t$$

Add the initial volume to five litres for every minute.

Q20

$$\text{Rate} = \frac{72 - 36}{16 - 4} = 3 \text{ litres/min}$$

Find the rate of draining.

$$t = 4 + 72/3 = 28 \text{ min}$$

Add the draining time to four minutes.

Q21

$$s = 4(3) + (-2)(4) = 4 \text{ m}$$

Subtract the distance travelled back from the distance travelled forwards.

Q22

$$d = 5(4) + 3(2) = 26 \text{ m}$$

Add the distances travelled in each direction.

Q23

$$\frac{1}{2}(3)v + 6v + \frac{1}{2}(3)v = 126$$

Total distance equals the area.

$$9v = 126 \Rightarrow v = 14 \text{ m/s}$$

Collect the terms and divide.

Q24

$$200t = 300(t - 5)$$

Both cyclists have travelled the same distance at the catch.

$$100t = 1500 \Rightarrow t = 15 \text{ min}$$

Expand and solve.