

GCSE Maths: Areas under graphs (Higher): answers

GCSE Maths - Functions and Advanced Graphs - Higher - Lesson 25.9

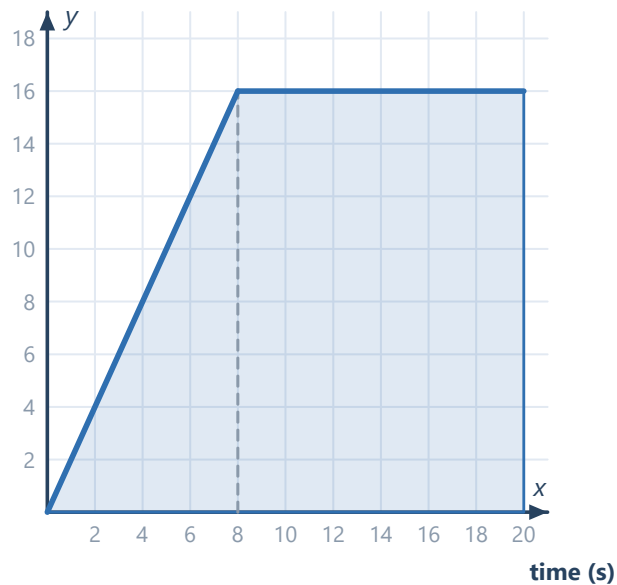
Answers. Final answers to the worksheet questions. Full step-by-step solutions for every question are free at websink.site/gcse/maths/ch25-functions-advanced-graphs/higher/areas-under-graphs/

Exercise 25I Areas under graphs Calculator allowed

- 1 Each graph shows speed (m/s) against time (s). Work out the distance travelled.

(a)

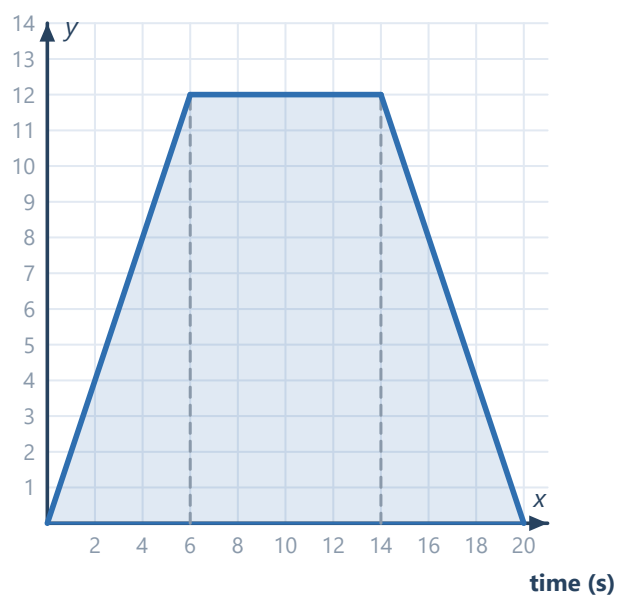
speed (m/s)



Answer: 256 m

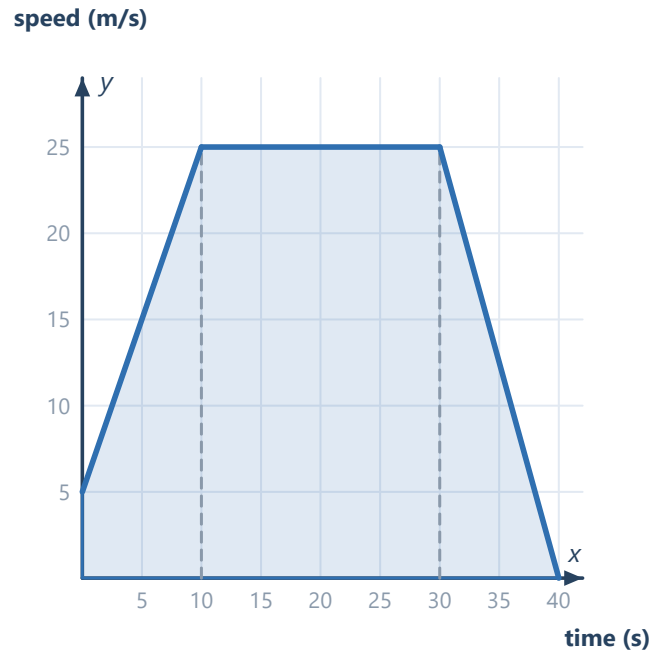
(b)

speed (m/s)



Answer: 168 m

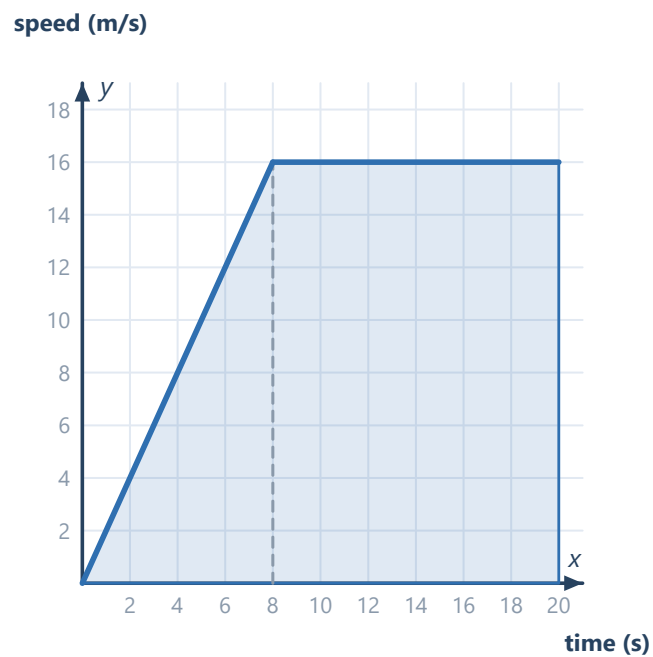
(c)



Answer: 775 m

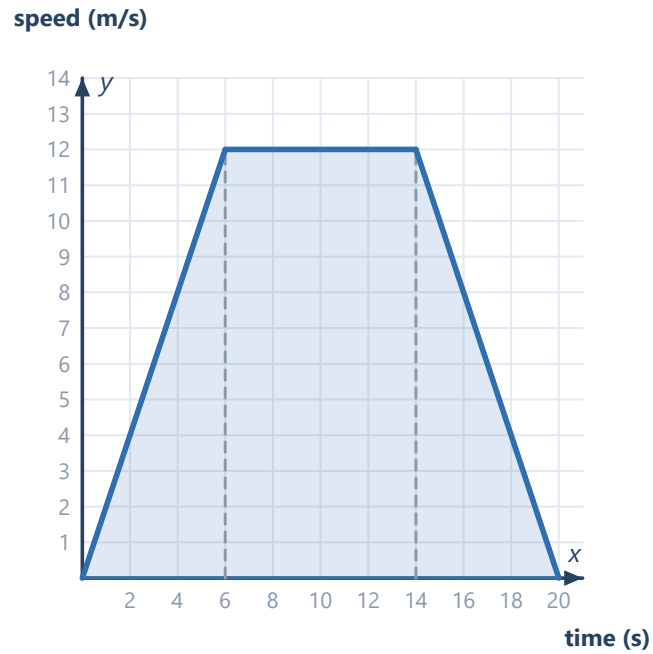
2 Work out the average speed for the journeys shown on the graphs above (the same three graphs).

(a)



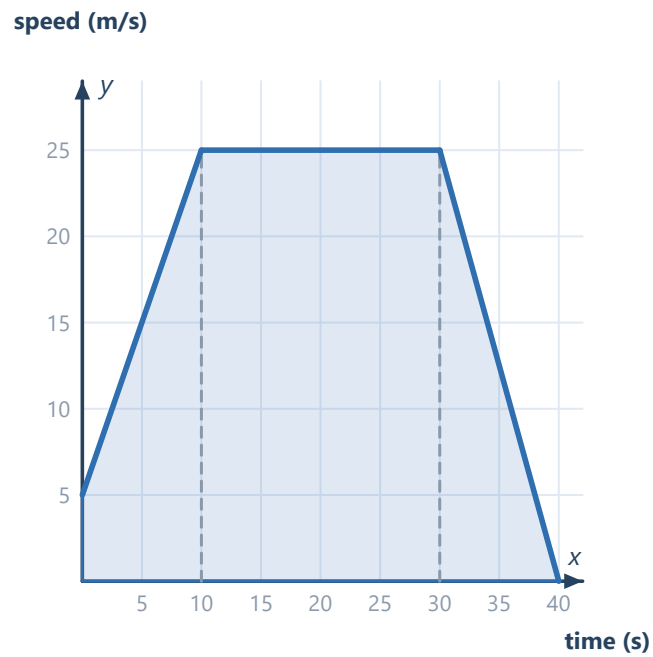
Answer: 12.8 m/s

(b)



Answer: 8.4 m/s

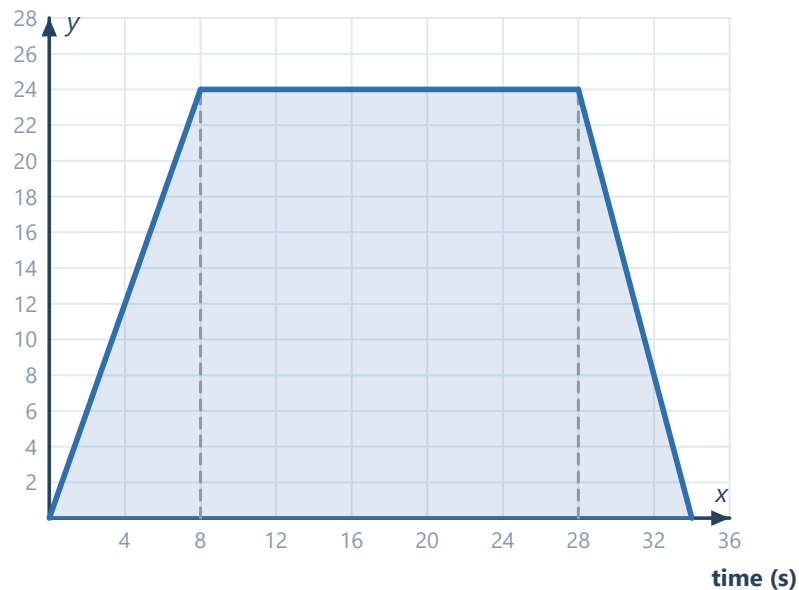
(c)



Answer: 19.375 m/s

- 3 A car accelerates uniformly from rest to 24 m/s in 8 s, then travels at a constant 24 m/s for 20 s, and finally slows uniformly to rest in 6 s.

speed (m/s)



- (a) Work out the acceleration during the first 8 seconds.

Answer: 3 m/s^2

- (b) Work out the total distance travelled.

Answer: 648 m

- (c) Work out the average speed for the whole journey.

Answer: $\frac{324}{17} \approx 19.06 \text{ m/s}$

4 Use strips of equal width and the trapezium method to estimate the area under each curve.

- (a) $y = \frac{x^2}{2} + 2$ from $x = 0$ to $x = 6$, using 3 strips

Answer: 50 m

- (b) $y = x^2 + 1$ from $x = 0$ to $x = 4$, using 4 strips

Answer: 26 m

- (c) $y = -x^2 + 16$ from $x = 0$ to $x = 4$, using 4 strips

Answer: 42 m

5 Use rectangles to estimate the area under $y = x^2/2 + 2$ between $x = 0$ and $x = 6$ with 3 strips, and decide if it is an over- or under-estimate.

- (a) Left-hand rectangles

Answer: 32 m

- (b) Right-hand rectangles

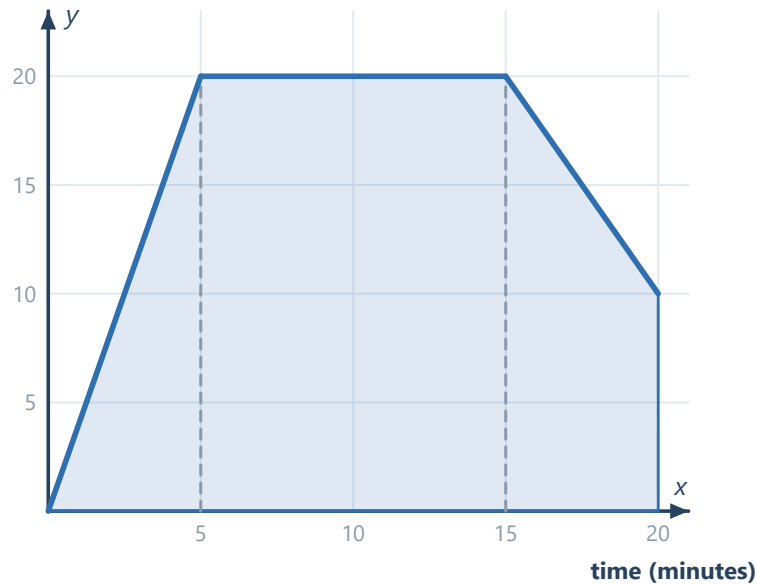
Answer: 68 m

- (c) Left-hand rectangles for $y = 16 - x^2$ from 0 to 4 with 4 strips

Answer: 50 m

- 6 Petrol is pumped into a tank. The flow rate rises steadily from 0 to 20 litres per minute in 5 minutes, stays at 20 litres per minute for 10 minutes and then falls steadily to 10 litres per minute over the next 5 minutes. How many litres are pumped in the 20 minutes?

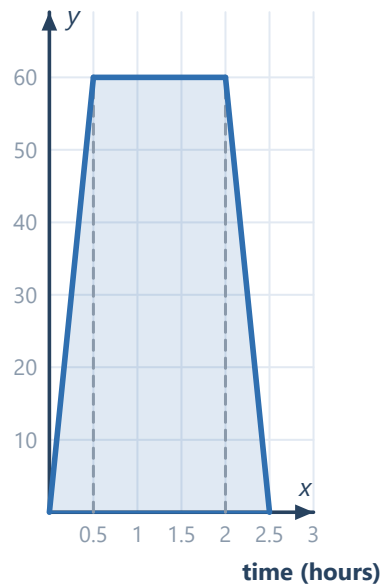
flow rate (litres/min)



Answer: 325 litres

- 7 A coach starts from rest, speeds up to 60 km/h in half an hour, travels at 60 km/h for 1.5 hours and stops in the next half hour. Work out the distance travelled in kilometres.

speed (km/h)



Answer: 120 km

- 8 A graph shows a constant rate. Work out the area under the graph for the time given and say what the area represents.

- (a) Power 3 kW for 4 hours

Answer: 12 kWh (kilowatt-hours of energy used)

(b) Flow 8 litres/s for 15 s

Answer: 120 litres (volume of water)

(c) Pay rate £12.50 per hour for 6 hours

Answer: £75 (total pay)

(d) Speed 15 m/s for 40 s

Answer: 600 m (distance)

9 The speed of a runner (m/s) at 2-second intervals is given by $v = 0.35t^2$. Use the trapezium method with 5 strips to estimate how far she runs in the first 10 seconds.

Answer: 119 m

10 The graph of $y = 16 - x^2$ bends downwards between $x = 0$ and $x = 4$. Explain whether the trapezium method gives an over-estimate or an under-estimate of the area, and show that using more strips changes the answer. (The exact area is 42.67 to 2 d.p.)

Answer: Under-estimate: 32, 40 and 42 are all below 42.67

11 Ben says: "The area under a distance–time graph is the distance travelled." Explain why Ben is wrong, and say what the area under a speed–time graph represents.

Answer: Distance $\times$ time has no useful meaning; speed $\times$ time = distance

12 The straight line $y = kx$ is drawn for x from 0 to 6. The area between the line and the x -axis is 54. Find k .

Answer: $k = 3$