Velocity-Time and Distance-Time Graphs

GCSE Mathematics • **Higher Tier** • Grades 6–8 • Non-calculator

WORKED SOLUTIONS

Name: worked example Class: _____ Total: 52 / 52

Show all your working. Marks are given for correct method as well as the final answer.

1. On a velocity-time graph, write down what the GRADIENT represents. **[1 mark]**

change in velocity ÷ change in time

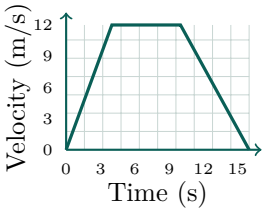
Answer: acceleration

2. On a velocity-time graph, write down what the AREA under the graph represents. **[1 mark]**

velocity × time = distance
this is the one students forget

Answer: distance

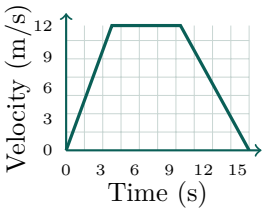
3. Write down the maximum velocity shown. **[1 mark]**



the height of the flat section

Answer: 12 **m/s**

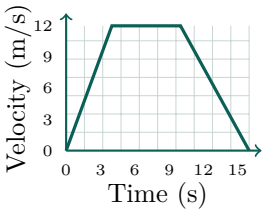
4. Work out the acceleration over the first 4 seconds. **[2 marks]**



gradient = 12 ÷ 4
= 3

Answer: 3 **m/s²**

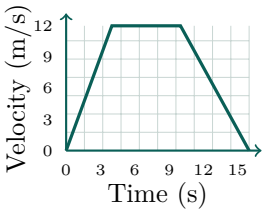
5. Work out the acceleration between 4 and 10 seconds. **[2 marks]**



the graph is flat
velocity is not changing

Answer: 0 m/s^2

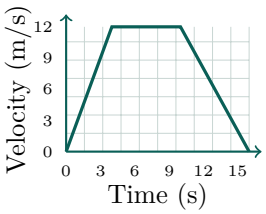
6. Work out the deceleration over the last 6 seconds. **[3 marks]**



velocity falls 12 in 6 seconds
gradient = −2
deceleration is quoted as a positive 2

Answer: 2 m/s^2

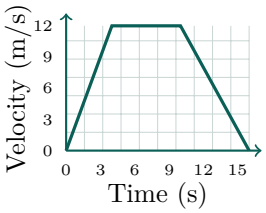
7. Work out the total distance travelled. **[4 marks]**



area of a trapezium
$\frac{1}{2}(a + b) \times h$
parallel sides 16 and 6, height 12
$\frac{1}{2}(16 + 6) \times 12$
$= 132$

Answer: 132 **m**

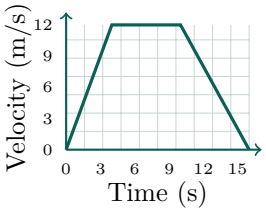
8. Work out the distance travelled in the first 4 seconds. **[3 marks]**



a triangle
$\frac{1}{2} \times 4 \times 12$
$= 24$

Answer: 24 **m**

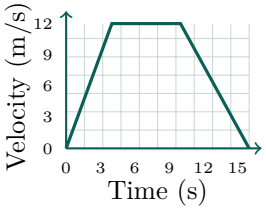
9. Work out the distance travelled between 4 and 10 seconds. **[2 marks]**



a rectangle
$6 \times 12 = 72$

Answer: 72 **m**

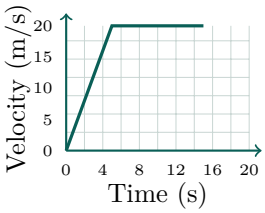
10. Work out the average speed for the whole journey, to 1 d.p. **[3 marks]**



total distance 132 m in 16 s
$132 \div 16 = 8.25$
$= 8.3$ m/s

Answer: 8.3 **m/s**

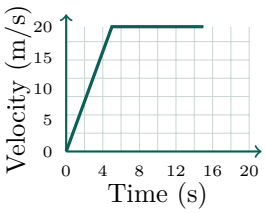
11. Work out the acceleration in the first 5 seconds. **[2 marks]**



$20 \div 5 = 4$

Answer: 4 **m/s²**

12. Work out the distance travelled in the 15 seconds shown. **[4 marks]**



triangle: $\frac{1}{2}(5)(20) = 50$
rectangle: $10 \times 20 = 200$
$50 + 200 = 250$

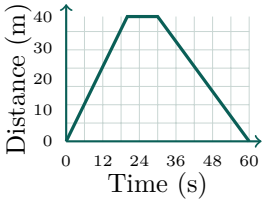
Answer: 250 **m**

13. On a DISTANCE-time graph, write down what the gradient represents. **[1 mark]**

distance ÷ time
on a VELOCITY-time graph it is acceleration

Answer: speed

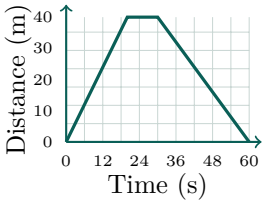
14. Work out the speed over the first 20 seconds. **[2 marks]**



40 m in 20 s
$40 \div 20 = 2$

Answer: 2 **m/s**

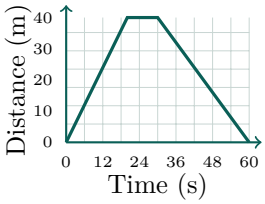
15. Write down what is happening between 20 and 30 seconds. **[2 marks]**



the graph is flat
distance is not changing, so it has stopped

Answer: _____ *stationary* _____

16. Work out the speed on the return journey. **[3 marks]**



40 m in 30 s
40 ÷ 30 = 1.333...
= 1.33 m/s

Answer: _____ *1.33* _____ **m/s**

17. Explain how a distance-time graph shows a journey BACK towards the start. **[2 marks]**

distance from the start is decreasing

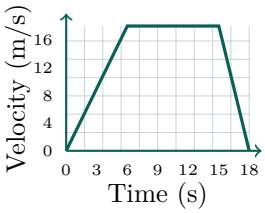
Answer: ____ *the line slopes downwards* ____

18. Explain why the area under a DISTANCE-time graph has no useful meaning. **[2 marks]**

that is not a quantity we use
only the velocity-time area gives distance

Answer: ____ *it would be distance × time* ____

19. A car accelerates from rest to 18 m/s in 6 seconds, holds that speed for 9 seconds, then stops in 3 seconds.



(a) Work out the acceleration in the first stage. **[2 marks]**

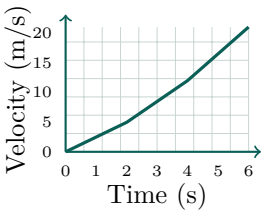
$18 \div 6$
$= 3\ m/s^2$

(b) Work out the total distance travelled. **[4 marks]**

triangle 1: $\frac{1}{2}(6)(18) = 54$
rectangle: $9 \times 18 = 162$
triangle 2: $\frac{1}{2}(3)(18) = 27$
$54 + 162 + 27 = 243$ m

Answer: 3 m/s² ; 243 m

20. The graph shows a journey with a curved section, so the distance must be ESTIMATED using trapezia.



(a) Estimate the distance using three trapezia of width 2. **[4 marks]**

$\frac{1}{2}(0 + 5)(2) = 5$
$\frac{1}{2}(5 + 12)(2) = 17$
$\frac{1}{2}(12 + 21)(2) = 33$
$5 + 17 + 33 = 55$ m

(b) Explain whether your estimate is too big or too small. **[2 marks]**

the curve bends upwards
the chords sit ABOVE it
so the estimate is too big

Answer: 55 m ; an overestimate

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