



Show equations, substitutions, units, and vector directions. Explain your reasoning. Use sensible rounding.

Constants	1 km = 1000 m 1 h = 3600 s
Equations	$\Delta x = x_f - x_i$ $v_{\text{avg}} = \Delta x / \Delta t$ average speed = distance / Δt $a = (v_f - v_i) / t$ $v_f = v_i + at$ $\Delta x = v_i t + \frac{1}{2}at^2$ $v_f^2 = v_i^2 + 2a\Delta x$ $\Delta x = \frac{1}{2}(v_i + v_f)t$

Use constant-acceleration equations only when acceleration is constant.

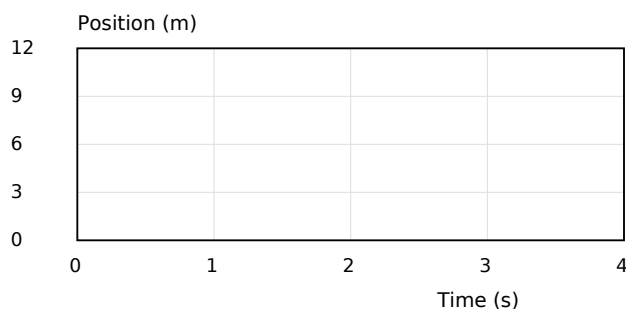
1.1 Graphing Relationships

1. A student changes the time a cart rolls and measures its position. Identify the independent and dependent variables, their graph axes, and two conditions to keep constant.

2. The data below describe a cart. Plot position versus time on the grid. Draw a best-fit line. Find its slope and equation, then predict the position at 7.0 s. Explain the assumption in that prediction.

t (s)	0	1	2	3	4
x (m)	3	5	7	9	11

Use the grid to plot the data.



1.2 Distance and Displacement

3. A student starts at $x = +2.0$ m, walks to $+14.0$ m, then returns to -4.0 m. Find the total distance and displacement. Classify each quantity as scalar or vector.

1.3 Speed and Velocity

4. The walk in Question 3 takes 12.0 s. Find average speed and average velocity. Explain how a moving person can have a nonzero average speed but zero average velocity.

1.4 Position-Time Graphs

5. Use the position-time graph. Find the velocity during each interval: 0–2 s, 2–4 s, and 4–6 s. When is the object at rest? Find its total distance and displacement.

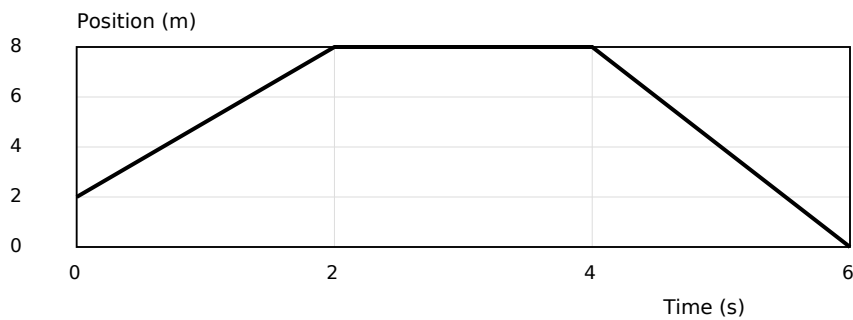
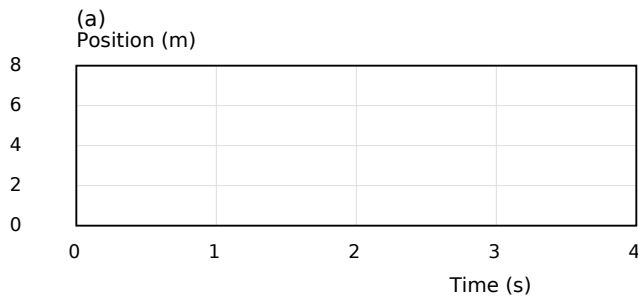
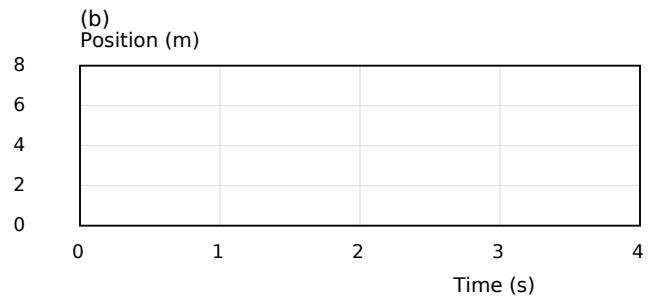


Diagram not to physical scale.

6. Sketch position-time graphs for (a) constant negative velocity and (b) motion in the positive direction that speeds up. Label both axes. Explain how each graph shows the motion.



1.5 Acceleration

7. A cyclist moving east slows from 18.0 m/s to 6.0 m/s in 4.0 s. Take east as positive. Calculate acceleration and explain why its sign differs from the velocity sign.

8. For each pair of signs, state whether speed increases or decreases: (a) v positive, a positive, (b) v positive, a negative, (c) v negative, a positive, (d) v negative, a negative.

1.6 Velocity-Time Graphs

9. Use the velocity-time graph. Calculate the acceleration in each interval and the total displacement from 0 to 6 s.

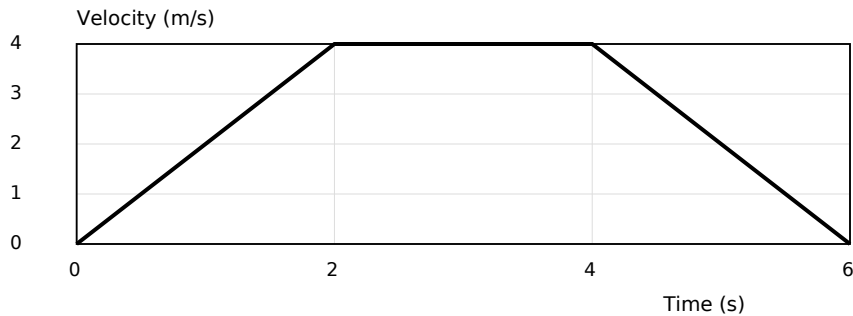
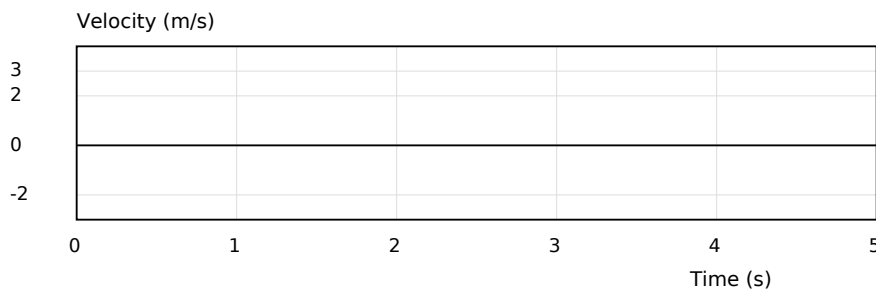


Diagram not to physical scale.

10. A cart travels at $+3.0 \text{ m/s}$ for 2.0 s , then at -2.0 m/s for 3.0 s . Treat the reversal as instantaneous. Sketch its velocity-time graph. Find displacement and distance using areas.



1.7 Kinematic Equations

11. A cart starts from rest and accelerates at $+2.4 \text{ m/s}^2$ for 5.0 s . Find its final velocity and displacement. Show an equation for each result.

12. A car moving at $+24.0 \text{ m/s}$ brakes with constant acceleration -4.0 m/s^2 . Find its stopping time and stopping distance.

Unit 1 Review

13. A train increases its velocity from $+8.0 \text{ m/s}$ to $+20.0 \text{ m/s}$ over 84 m with constant acceleration. Find its acceleration and elapsed time.

14. A car moves at 72 km/h . Convert this speed to m/s . Find the distance it travels at this speed in 15 s .

15. Correct each claim: (a) A horizontal line always means an object is at rest. (b) Negative acceleration always means slowing down. (c) The area under a position-time graph gives displacement.

16. A runner starts from rest, accelerates uniformly to 6.0 m/s in 3.0 s , then maintains that speed for 5.0 s . Find total distance and average speed over all 8.0 s .