Past-paper walk-through

Straight-Line Motion: Connecting Position, Velocity, and Acceleration ▪ 4.2

eXercise

Questions in this set

- 2026 Q5
- 2025 Q5
- 2024 Q2
- 2023 Q2
- 2022 Q6
- 2021 Q2
- 2018 Q2
- 2017 Q5
- 2016 Q2
- 2015 Q3

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

Question 5

2026 ▪ Q5

A remote-controlled toy car moves back and forth along a straight path so that its velocity at time t is given by the function v, where $v(t)$ is measured in feet per second and t is measured in seconds.

$$v(t) = \begin{cases} t^4 - 8t^3 + 16t^2 & \text{for } 0 \le t \le 4 \\ 0 & \text{for } 4 < t < 6 \\ 10\cos\left(\frac{\pi}{3}t\right) - 10 & \text{for } 6 \le t \le 12 \end{cases}$$

The graph of $v(t)$ is shown.
[Graph of $v(t)$: t-axis from 0 to 12 in increments of 2 (labels at 2,4,6,8,10,12); v-axis unlabeled (vertical). The curve starts at the origin $(0,0)$, rises to a local maximum

Question 5

somewhere between $t = 2$ and $t = 4$, returns to and touches the t-axis at $t = 4$, stays at $v = 0$ (flat on the t-axis) from $t = 4$ to $t = 6$, then dips below the axis into a trough with minimum between $t = 8$ and $t = 10$, and rises back up to touch the t-axis at $t = 12$.]

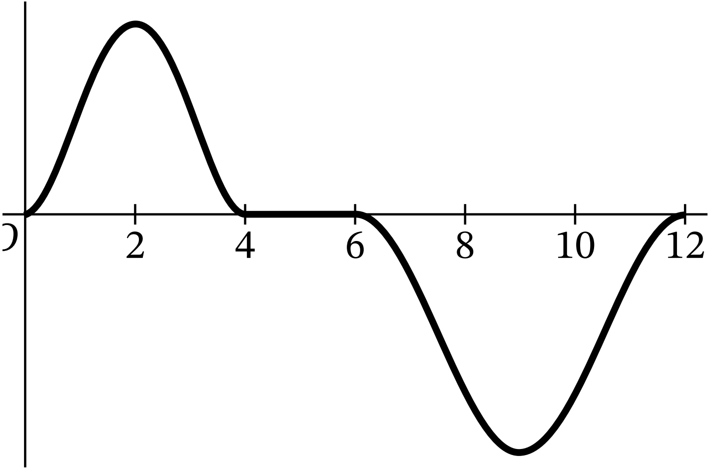
(a) Find the acceleration of the car at time $t = 1$ second. Show the work that leads to your answer.

(b) Is the car speeding up or slowing down at time $t = 1$ second? Give a reason for your answer.

(c) Find the distance, in feet, that the car traveled over the time interval $0 \leq t \leq 4$ seconds. Show the work that leads to your answer.

(d) Find the average velocity of the car over the time interval $6 \leq t \leq 12$ seconds. Show the work that leads to your answer.

Question 5



Question 5

2025 ▪ Q5

Two particles, H and J, are moving along the x-axis. For $0 \le t \le 5$, the position of particle H at time t is given by $x_H(t) = e^{t^2-4t}$ and the velocity of particle J at time t is given by $v_J(t) = 2t(t^2-1)^3$.

(a) Find the velocity of particle H at time $t = 1$. Show the work that leads to your answer.

(b) During what open intervals of time t, for $0 < t < 5$, are particles H and J moving in opposite directions? Give a reason for your answer.

(c) It can be shown that $v_J'(2) > 0$. Is the speed of particle J increasing, decreasing, or neither at time $t = 2$? Give a reason for your answer.

(d) Particle J is at position $x = 7$ at time $t = 0$. Find the position of particle J at time $t = 2$. Show the work that leads to your answer.

Solution 5

(a)

Mark scheme

- $x_H'(t) = v_H(t) = (2t-4)e^{t^2-4t}$. At $t=1$: $x_H'(1) = (2-4)e^{1-4} = -2e^{-3}$. Point 1: considers/presents $x_H'(t)$ (or $v_H(t)$, $x'(t)$, $x'(1)$, $(2t-4)e^{t^2-4t}$, or the unsimplified value at $t=1$, e.g. $(2\cdot 1-4)e^{1^2-4\cdot 1}$). Point 2: correct answer $-2e^{-3}$ (an unsupported answer of $-2e^{-3}$ alone earns this point but not Point 1).

Solution 5

(b) Mark scheme

- $x_H'(t) = (2t-4)e^{t^2-4t} = 0 \Rightarrow t = 2$ (only critical point on $0 < t < 5$); $x_H'(t) < 0$ for $0 < t < 2$ and $x_H'(t) > 0$ for $2 < t < 5$, so H moves left then right. $v_J(t) = 2t(t^2-1)^3 = 0$ for $0 < t < 5 \Rightarrow t = 1$; $v_J(t) < 0$ for $0 < t < 1$ and $v_J(t) > 0$ for $1 < t < 5$, so J moves left then right. H and J move in opposite directions exactly where their directions differ: for $1 < t < 2$ (H moving left, J moving right). Point 3: considers the sign of $x_H'(t)$ or $v_J(t)$ (sets it/the expression equal to 0, or correctly identifies its critical time $t = 2$ for H or $t = 1$ for J with no other values in $0 < t < 5$, or identifies the interval $1 < t < 2$). Point 4: correct direction-of-motion analysis on $0 < t < 5$ for one particle (H or J). Point 5:

Solution 5

correct answer $1 < t < 2$ with reasoning; requires correct analysis for BOTH particles on $0 < t < 5$.

Solution 5

(c)

Mark scheme

- $v_J(2) = 2(2)((2)^2 - 1)^3 = 108 > 0$, and $v_J'(2) > 0$ is given. Because $v_J(2)$ and $v_J'(2)$ have the same sign, the speed of particle J is increasing at $t = 2$. Point 6: correct answer (increasing) with correct reasoning that $v_J(2)$ and $v_J'(2)$ have the same sign (an explicit numeric evaluation of $v_J(2)$ is not required, but if given must be correct: $v_J(2) = 108$; the sign analysis for $v_J(t) > 0$ on $1 < t < 5$ from part B may be reused without restating $v_J(2) > 0$).

Solution 5

(d)

Mark scheme

- $x_J(2) = x_J(0) + \int_0^2 v_J(t)\,dt = 7 + \int_0^2 2t(t^2-1)^3\,dt = 7 + \left[\frac{1}{4}(t^2-1)^4\right]_0^2 = 7 + \frac{1}{4}\left((3)^4 - (-1)^4\right) = 7 + \frac{1}{4}(80) = 7 + 20 = 27$. Point 7: presents an integral (indefinite or definite) with integrand $v_J(t)$ or $2t(t^2-1)^3$ (with or without the differential dt). Point 8: correct antiderivative of the form $k(t^2-1)^4$ with $k = \frac{1}{4}$ for $k > 0$ (a different nonzero k does not earn Point 9). Point 9: correct answer $x_J(2) = 27$; requires Point 8.

Question 2

2024 ▪ Q2

A particle moves along the x-axis so that its velocity at time $t \geq 0$ is given by $v(t) = \ln\left(t^2 - 4t + 5\right) - 0.2t$.

(a) There is one time, $t = t_R$, in the interval $0 < t < 2$ when the particle is at rest (not moving). Find t_R. For $0 < t < t_R$, is the particle moving to the right or to the left? Give a reason for your answer.

(b) Find the acceleration of the particle at time $t = 1.5$. Show the setup for your calculations. Is the speed of the particle increasing or decreasing at time $t = 1.5$? Explain your reasoning.

(c) The position of the particle at time t is $x(t)$, and its position at time $t = 1$ is $x(1) = -3$. Find the position of the particle at time $t = 4$. Show the setup for your calculations.

Question 2

(d) Find the total distance traveled by the particle over the interval $1 \leq t \leq 4$. Show the setup for your calculations.

Solution 2

(a)

Mark scheme

- Solve $v(t) = \ln(t^2 - 4t + 5) - 0.2t = 0$ on $0 < t < 2$: $t_R = 1.425610 \approx 1.426$ (or 1.425). For $0 < t < t_R$, $v(t) > 0$, so the particle is moving to the right. 1 point for the correct value of t_R (particle at rest requires $v(t) = 0$), 1 point for the direction (right) with a reason based on the sign of $v(t)$ on that interval.

Solution 2

(b)

Mark scheme

- $a(1.5) = v'(1.5) = -1$ (or -0.999), using $a = v'$. $v(1.5) = -0.076856 < 0$; because $a(1.5)$ and $v(1.5)$ have the same sign, the speed of the particle is increasing at $t = 1.5$. 1 point for declaring the acceleration value via $v'(1.5)$, 1 point for the correct increasing/decreasing conclusion with reasoning consistent with the signs of $v(1.5)$ and $a(1.5)$.

Solution 2

(c)

Mark scheme

- $x(4) = x(1) + \int_1^4 v(t)\,dt = -3 + 0.197117 = -2.802883 \approx -2.803$ (or -2.802). 1 point for the definite integral of $v(t)$ with correct limits 1 to 4, 1 point for adding the initial condition $x(1) = -3$, 1 point for the final numeric answer with supporting work shown (an answer alone with no work earns no points).

Solution 2

(d)

Mark scheme

- Total distance $= \int_1^4 |v(t)|\, dt = 0.9581 \approx 0.958$ (0.958, 0.959, or 0.96 all accepted due to calculator variation). 1 point for setting up the integral of $|v(t)|$ (equivalently, splitting into signed pieces at the sign changes of v near $t \approx 1.425$ and $t \approx 2.883$), 1 point for the correct numeric answer.

Question 2

2023 ▪ Q2

Stephen swims back and forth along a straight path in a 50-meter-long pool for 90 seconds. Stephen's velocity is modeled by $v(t) = 2.38e^{-0.02t}\sin\left(\frac{\pi}{56}t\right)$, where t is measured in seconds and $v(t)$ is measured in meters per second.

(a) Find all times t in the interval $0 < t < 90$ at which Stephen changes direction. Give a reason for your answer.

(b) Find Stephen's acceleration at time $t = 60$ seconds. Show the setup for your calculations, and indicate units of measure. Is Stephen speeding up or slowing down at time $t = 60$ seconds? Give a reason for your answer.

(c) Find the distance between Stephen's position at time $t = 20$ seconds and his position at time $t = 80$ seconds. Show the setup for your calculations.

Question 2

(d) Find the total distance Stephen swims over the time interval $0 \leq t \leq 90$ seconds. Show the setup for your calculations.

Solution 2

(a)

Mark scheme

- For $0 < t < 90$, $v(t) = 0 \Rightarrow t = 56$ (1 pt: considers the sign of v(t)). Stephen changes direction when his velocity changes sign; this occurs at t=56 seconds (1 pt: answer with reason — must include t=56, unsupported t=56 alone earns nothing).

Solution 2

(b)

Mark scheme

- $v'(60) = a(60) \approx -0.0360162 \approx -0.036$ (1 pt: a(60) with setup, e.g. explicitly showing v'(60)=a(60)); the units of acceleration are meters per second per second (1 pt: units). Since $v(60) \approx -0.1595124 < 0$, Stephen is speeding up at t=60 seconds because his velocity and acceleration are both negative at that time (1 pt: speeding-up conclusion with reason — the presented sign of a(60) must be negative and consistent with a negative v(60)).

Solution 2

(c)

Mark scheme

- Distance $= \displaystyle\int_{20}^{80} v(t)\,dt$ (1 pt: integral setup). Evaluating, $\int_{20}^{80} v(t)\,dt = 23.383997 \approx 23.384$ (or 23.383) meters (1 pt: answer).

Solution 2

(d)

Mark scheme

- Total distance $= \displaystyle\int_0^{90} |v(t)|\, dt$ (1 pt: integral setup, or equivalently $\int_0^{56} v(t)\, dt - \int_{56}^{90} v(t)\, dt$). Evaluating, $\int_0^{90} |v(t)|\, dt = 62.164216 \approx 62.164$ meters (1 pt: answer).

Question 6

2022 ▪ Q6

Particle P moves along the x-axis such that, for time $t > 0$, its position is given by $x_P(t) = 6 - 4e^{-t}$.
Particle Q moves along the y-axis such that, for time $t > 0$, its velocity is given by $v_Q(t) = \frac{1}{t^2}$. At time $t = 1$, the position of particle Q is $y_Q(1) = 2$.

(a) Find $v_P(t)$, the velocity of particle P at time t.

(b) Find $a_Q(t)$, the acceleration of particle Q at time t. Find all times t, for $t > 0$, when the speed of particle Q is decreasing. Justify your answer.

(c) Find $y_Q(t)$, the position of particle Q at time t.

(d) As $t \to \infty$, which particle will eventually be farther from the origin? Give a reason for your answer.

Solution 6

(a)

Mark scheme

- $v_P(t) = x_P'(t) = 4e^{-t}$. 1 point for the correct answer (an unlabeled response still earns the point; a response that equates $x_P(t)$ with $v_P(t)$ does not).

Solution 6

(b) Mark scheme

- $a_Q(t) = v'_Q(t) = -\dfrac{2}{t^3}$. For $t > 0$, $a_Q(t) < 0$ and $v_Q(t) = \dfrac{1}{t^2} > 0$. Because the velocity and acceleration have opposite signs, the speed of particle Q is decreasing for all $t > 0$. Points: (1) correct expression $a_Q(t) = -2/t^3$; (2) considers/states the signs of $a_Q(t)$ and $v_Q(t)$ (consistent with the presented $a_Q(t)$); (3) correct answer (decreasing for all $t > 0$) with justification that velocity and acceleration have opposite signs.

Solution 6

(c)

Mark scheme

- $y_Q(t) = y_Q(1) + \int_1^t \frac{1}{s^2}\,ds = 2 - \left[\frac{1}{s}\right]_1^t = 2 - \frac{1}{t} + 1 = 3 - \frac{1}{t}$. Points: (1) correct integral expression; (2) uses the initial condition $y_Q(1) = 2$; (3) correct answer, $y_Q(t) = 3 - 1/t$.

Solution 6

(d)

Mark scheme

- For particle P: $\lim_{t\to\infty}(6-4e^{-t})=6$. For particle Q: $\lim_{t\to\infty}\left(3-\frac{1}{t}\right)=3$.
  Because $6>3$, particle P will eventually be farther from the origin. Points: (1) one correct limit; (2) correct answer with reason based on both limits.

Question 2

2021 ▪ Q2

A particle, P, is moving along the x-axis. The velocity of particle P at time t is given by $v_P(t) = \sin\left(t^{1.5}\right)$ for $0 \leq t \leq \pi$. At time $t = 0$, particle P is at position $x = 5$.
A second particle, Q, also moves along the x-axis. The velocity of particle Q at time t is given by $v_Q(t) = (t - 1.8) \cdot 1.25^t$ for $0 \leq t \leq \pi$. At time $t = 0$, particle Q is at position $x = 10$.

(a) Find the positions of particles P and Q at time $t = 1$.

(b) Are particles P and Q moving toward each other or away from each other at time $t = 1$? Explain your reasoning.

(c) Find the acceleration of particle Q at time $t = 1$. Is the speed of particle Q increasing or decreasing at time $t = 1$? Explain your reasoning.

(d) Find the total distance traveled by particle P over the time interval $0 \leq t \leq \pi$.

Solution 2

(a)

Mark scheme

- $x_P(1) = 5 + \displaystyle\int_0^1 v_P(t)\,dt = 5.370660$, so at $t = 1$ particle P is at $x = 5.371$ (or 5.370). $x_Q(1) = 10 + \displaystyle\int_0^1 v_Q(t)\,dt = 8.564355$, so particle Q is at $x = 8.564$.
  Point 1: explicit presentation of at least one definite integral ($\int_0^1 v_P(t)\,dt$ or $\int_0^1 v_Q(t)\,dt$) — required to be eligible for points 2 and 3. Point 2: correct position for P (adding the initial condition and evaluating). Point 3: correct position for Q.

Solution 2

(b)

Mark scheme

- $v_P(1) = \sin(1^{1.5}) = 0.841471 > 0$, so particle P is moving to the right. $v_Q(1) = (1 - 1.8) \cdot 1.25^1 = -1 < 0$, so particle Q is moving to the left. Since $x_P(1) < x_Q(1)$ (particle P is to the left of particle Q), the particles are moving TOWARD each other at $t = 1$. Point 1: uses the sign of $v_P(1)$ or $v_Q(1)$ to determine direction of motion for one particle (must reference a sign, an explicit value is not required). Point 2: answer with explanation based on the signs of both velocities and the relative positions of P and Q at $t = 1$ (may use imported positions from part (a)).

Solution 2

(c)

Mark scheme

- $a_Q(1) = v'_Q(1) = 1.026856$ (or 1.027), so the acceleration of particle Q at $t = 1$ is about 1.027. Since $v_Q(1) = -1 < 0$ and $a_Q(1) > 0$ (opposite signs), the speed of particle Q is DECREASING at $t = 1$. Point 1: acceleration explicitly connected to $v'_Q(1)$ (presenting only the numeric value without showing $v'_Q = a_Q$ does not earn it). Point 2: correct conclusion (speed decreasing) with the opposite-signs reasoning; may be earned independent of point 1.

Solution 2

(d)

Mark scheme

- Total distance traveled by $P = \displaystyle\int_0^{\pi} |v_P(t)|\,dt = 1.93148 \approx 1.931$. Point 1: the definite integral $\int_0^{\pi} |v_P(t)|\,dt$ (a split sum/difference of definite integrals using a verified sign-change point is also acceptable). Point 2: the correct final answer 1.931 (an unsupported numeric answer alone earns no points; using v_Q instead of v_P earns only point 1).

Question 2

2018 ▪ Q2

A particle moves along the x-axis with velocity given by $v(t) = \dfrac{10\sin\left(0.4t^2\right)}{t^2 - t + 3}$ for time $0 \le t \le 3.5$.

The particle is at position $x = -5$ at time $t = 0$.

(a) Find the acceleration of the particle at time $t = 3$.

(b) Find the position of the particle at time $t = 3$.

(c) Evaluate $\int_0^{3.5} v(t)\,dt$, and evaluate $\int_0^{3.5} |v(t)|\,dt$. Interpret the meaning of each integral in the context of the problem.

(d) A second particle moves along the x-axis with position given by $x_2(t) = t^2 - t$ for $0 \le t \le 3.5$. At what time t are the two particles moving with the same velocity?

Solution 2

(a)

Mark scheme

- $v'(3) = -2.118$. The acceleration of the particle at time $t = 3$ is -2.118. (1 pt: the answer.)

Solution 2

(b)

Mark scheme

- $x(3) = x(0) + \int_0^3 v(t)\,dt = -5 + \int_0^3 v(t)\,dt = -1.760213$. The position of the particle at $t = 3$ is -1.760. (1 pt: sets up $\int_0^3 v(t)\,dt$; 1 pt: uses the initial condition $x(0) = -5$; 1 pt: the answer -1.760.)

Solution 2

(c)

Mark scheme

- $\int_0^{3.5} v(t)\,dt = 2.844$ (or 2.843), and $\int_0^{3.5} |v(t)|\,dt = 3.737$. The integral $\int_0^{3.5} v(t)\,dt$ is the displacement of the particle over $0 \le t \le 3.5$. The integral $\int_0^{3.5} |v(t)|\,dt$ is the total distance traveled by the particle over $0 \le t \le 3.5$. (1 pt: both numeric answers; 2 pts: correct interpretations, 1 each for $\int v\,dt =$ displacement and $\int |v|\,dt =$ total distance.)

Solution 2

(d)

Mark scheme

- Set $v(t) = x_2'(t)$. Since $x_2(t) = t^2 - t$, $x_2'(t) = 2t - 1$, so $v(t) = 2t - 1 \Rightarrow t = 1.57054$. The two particles are moving with the same velocity at $t = 1.571$ (or 1.570). (1 pt: sets $v(t) = x_2'(t)$; 1 pt: the answer.)

Question 5

2017 ▪ Q5

Two particles move along the x-axis. For $0 \leq t \leq 8$, the position of particle P at time t is given by $x_P(t) = \ln\left(t^2 - 2t + 10\right)$, while the velocity of particle Q at time t is given by $v_Q(t) = t^2 - 8t + 15$.

Particle Q is at position $x = 5$ at time $t = 0$.

(a) For $0 \leq t \leq 8$, when is particle P moving to the left?

(b) For $0 \leq t \leq 8$, find all times t during which the two particles travel in the same direction.

(c) Find the acceleration of particle Q at time $t = 2$. Is the speed of particle Q increasing, decreasing, or neither at time $t = 2$? Explain your reasoning.

(d) Find the position of particle Q the first time it changes direction.

Question 2

2016 ▪ Q2

For $t \geq 0$, a particle moves along the x-axis. The velocity of the particle at time t is given by $v(t) = 1 + 2\sin\left(\frac{t^2}{2}\right)$. The particle is at position $x = 2$ at time $t = 4$.

(a) At time $t = 4$, is the particle speeding up or slowing down?

(b) Find all times t in the interval $0 < t < 3$ when the particle changes direction. Justify your answer.

(c) Find the position of the particle at time $t = 0$.

(d) Find the total distance the particle travels from time $t = 0$ to time $t = 3$.

Solution 2

(a)

Mark scheme

- v(4) $= 1+2\sin(4^2/2) = 1 + 2\sin(8) \approx 2.978716 > 0, anda(4) = \surd(4) \approx -1.164000 < 0. Sincevelocityandaccelerationhavedifferentsigns, theparticleisSLOWINGDOWNatt = 4. Points : 2(holistic)forthecorrectconclusion(slowingdown)withvalidreasonbasedonthesignsof$

Solution 2

(b)

Mark scheme

- v(t)=0 $\Rightarrow t = 2.707468(theonlysolutionin0 < t < 3).v(t)changesfrompositivetonegativeatt \approx 2.707, sotheparticlechangesdirectionatthistime(asignchangeinvelocityindicatesachangeindirec$
$1forthecorrecttimet = 2.707, 1forjustification(signchangeofvelocity).$

Solution 2

(c)

Mark scheme

- $x(0) = x(4) + \int_4^0 v(t)\,dt = 2 + (-5.815027) = -3.815, usingthegivenx(4) = 2andevaluating \int_4^0 v(t)\,dtnumerically.Points : 1forsettinguptheintegralofv(t), 1forusingtheinitialconditionx(4) = 2, 1forthecorrectfinalanswer(-3.815).$

Solution 2

(d)

Mark scheme

- Total distance $= \int_0^3 |v(t)|\, dt = 5.301, evaluatednumerically(accountingforthedirectionchange$
$1 forsettinguptheintegralof|v(t)|, 1 forthecorrectnumericalanswer(5.301).$

Question 3

2015 ▪ Q3

Johanna jogs along a straight path. For $0 \leq t \leq 40$, Johanna's velocity is given by a differentiable function v. Selected values of $v(t)$, where t is measured in minutes and $v(t)$ is measured in meters per minute, are given in the table above.

t (minutes)	0	12	20	24	40
$v(t)$ (meters per minute)	0	200	240	-220	150

(a) Use the data in the table to estimate the value of $v'(16)$.

(b) Using correct units, explain the meaning of the definite integral $\int_0^{40} |v(t)|\,dt$ in the context of the problem.

Approximate the value of $\int_0^{40} |v(t)|\,dt$ using a right Riemann sum with the four subintervals indicated in the table.

Question 3

(c) Bob is riding his bicycle along the same path. For $0 \leq t \leq 10$, Bob's velocity is modeled by $B(t) = t^3 - 6t^2 + 300$, where t is measured in minutes and $B(t)$ is measured in meters per minute.
Find Bob's acceleration at time $t = 5$.
(d) Based on the model B from part (c), find Bob's average velocity during the interval $0 \leq t \leq 10$.

Question 3

t (minutes)	0	12	20	24	40
$v(t)$ (meters per minute)	0	200	240	–220	150

Solution 3

(a)

Mark scheme

- $v'(16) \approx [v(20) - v(12)]\ /\ (20 - 12) = (240 - 200)/8 = 5$ meters/min^2. Points: 1 for a correct difference-quotient approximation using table values that straddle $t = 16$.

Solution 3

(b) Mark scheme

- $\int$ ^40 $|v(t)|$ dt is the total distance Johanna jogs, in meters, over the time interval $0 \leq t \leq 40$ minutes. Using a right Riemann sum with the four subintervals indicated in the table: $\int$ ^40 $|v(t)|$ dt $\approx 12 \cdot |v(12)| + 8 \cdot |v(20)| + 4 \cdot |v(24)| + 16 \cdot |v(40)| = 12(200) + 8(240) + 4(220) + 16(150) = 2400 + 1920 + 880 + 2400 = 7600$ meters. Points: 1 for the explanation (total distance traveled, in meters, over $0 \leq t \leq 40$), 1 for correctly setting up the right Riemann sum with the given subinterval widths (12, 8, 4, 16) and right endpoints, 1 for the correct numeric approximation 7600 meters.

Solution 3

(c)

Mark scheme

- Bob's velocity is $B(t) = t^3 - 6t^2 + 300$, so his acceleration is $B'(t) = 3t^2 - 12t$. $B'(5) = 3(25) - 12(5) = 75 - 60 = 15$ meters/min^2. Points: 1 for using $B'(t)$ (the correct derivative), 1 for the correct answer 15 meters/min^2.

Solution 3

(d)

Mark scheme

- Average velocity $= (1/10)\ \int\ \hat{}10\ (t^3 - 6t^2 + 300)\ dt = (1/10)\ [t\ /4 - 2t^3 + 300t]\ \hat{}10 = (1/10)\ [10000/4 - 2000 + 3000] = (1/10)(3500) = 350$ meters/min. Points: 1 for the correct average-value integral setup $(1/10)\int\ \hat{}10\ B(t)\ dt$, 1 for a correct antiderivative $t\ /4 - 2t^3 + 300t$, 1 for the correct final answer 350 meters/min.