Past-paper walk-through

Solving Related Rates Problems ▪ 4.5

eXercise

Questions in this set

- 2025 Q6
- 2024 Q5
- 2023 Q6
- 2022 Q2
- 2022 Q4
- 2019 Q4
- 2018 Q4
- 2017 Q1
- 2016 Q5
- 2014 Q4

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 6

2025 ▪ Q6

Consider the curve G defined by the equation $y^3 - y^2 - y + \frac{1}{4}x^2 = 0$.

(a) Show that $\dfrac{dy}{dx} = \dfrac{-x}{2(3y^2 - 2y - 1)}$.

Question 6

2025 ▪ Q6

Consider the curve G defined by the equation $y^3 - y^2 - y + \frac{1}{4}x^2 = 0$.

(b) There is a point P on the curve G near $(2, -1)$ with x-coordinate 1.6. Use the line tangent to the curve at $(2, -1)$ to approximate the y-coordinate of point P.

Question 6

2025 ▪ Q6

Consider the curve G defined by the equation $y^3 - y^2 - y + \frac{1}{4}x^2 = 0$.

(c) For $x > 0$ and $y > 0$, there is a point S on the curve G at which the line tangent to the curve at that point is vertical. Find the y-coordinate of point S. Show the work that leads to your answer.

Question 6

2025 ▪ Q6

Consider the curve G defined by the equation $y^3 - y^2 - y + \frac{1}{4}x^2 = 0$.

(d) A particle moves along the curve H defined by the equation $2xy + \ln y = 8$. At the instant when the particle is at the point $(4, 1)$, $\frac{dx}{dt} = 3$. Find $\frac{dy}{dt}$ at that instant. Show the work that leads to your answer.

Solution 6

(a) Mark scheme

- Differentiate $y^3 - y^2 - y + \frac{1}{4}x^2 = 0$ implicitly with respect to x:
  $3y^2\frac{dy}{dx} - 2y\frac{dy}{dx} - \frac{dy}{dx} + \frac{x}{2} = 0 \Rightarrow \left(3y^2 - 2y - 1\right)\frac{dy}{dx} = -\frac{x}{2} \Rightarrow \frac{dy}{dx} = \frac{-x}{2(3y^2 - 2y - 1)}$.
  Point 1: correct implicit differentiation of the given equation (may use y' in place of $\frac{dy}{dx}$). Point 2: correctly verifies/derives the given result $\frac{dy}{dx} = \frac{-x}{2(3y^2 - 2y - 1)}$ (it suffices to present $(3y^2 - 2y - 1)\frac{dy}{dx} = -\frac{x}{2}$ with no subsequent errors); requires Point 1.

Solution 6

(b) Mark scheme

- Slope of the tangent line at $(2, -1)$: $\left.\frac{dy}{dx}\right|_{(2,-1)} = \frac{-2}{2(3(-1)^2 - 2(-1) - 1)} = \frac{-2}{2(3+2-1)} = \frac{-2}{8} = -\frac{1}{4}$. Tangent line approximation: $y \approx -1 + \left(-\frac{1}{4}\right)(1.6 - 2) = -1 - \frac{1}{4}(-0.4) = -1 + 0.1 = -0.9$. Point 3: correct slope of the tangent line at $(2, -1)$, i.e. $\left.\frac{dy}{dx}\right|_{(x,y)=(2,-1)} = -\frac{1}{4}$ (or equivalent statement, e.g. "slope is $-\frac{1}{4}$"). Point 4: correct tangent-line approximation $y \approx -0.9$, using $x = 1.6$; requires clearly demonstrated use of the

Solution 6

tangent line at $x = 1.6$ (does not require the tangent line equation to be explicitly presented).

Solution 6

(c) Mark scheme

- The curve has a vertical tangent where the denominator of $\dfrac{dy}{dx}$ is zero: $2(3y^2 - 2y - 1) = 0 \Rightarrow 2(3y+1)(y-1) = 0 \Rightarrow y = -\dfrac{1}{3}$ or $y = 1$. Since $y > 0$ is required, $y = 1$ is the y-coordinate of point S. Point 5: sets the denominator $2(3y^2 - 2y - 1) = 0$ (or an equivalent factored/unfactored form, e.g. $3y^2 - 2y - 1 = 0$ or $(3y \pm 1)(y \pm 1) = 0$; the numerator need not be considered). Point 6: correct answer $y = 1$, with correct algebraic work clearly identifying it as the only solution satisfying $y > 0$ (stating both $y = -\frac{1}{3}$ and $y = 1$ without identifying $y = 1$ as the answer to the prompt does not earn this point); requires Point 5.

Solution 6

(d) Mark scheme

- Differentiate $2xy + \ln y = 8$ implicitly with respect to t: $2\dfrac{dx}{dt}y + 2x\dfrac{dy}{dt} + \dfrac{1}{y}\dfrac{dy}{dt} = 0.$
  At $(x, y) = (4, 1)$ with $\dfrac{dx}{dt} = 3$:
  $2(3)(1) + 2(4)\dfrac{dy}{dt} + \dfrac{1}{1}\dfrac{dy}{dt} = 0 \Rightarrow 6 + 9\dfrac{dy}{dt} = 0 \Rightarrow \dfrac{dy}{dt} = -\dfrac{2}{3}$. Point 7: attempts implicit differentiation of $2xy + \ln y = 8$ with respect to t (at most one error; alternatively, differentiating with respect to x first is acceptable as long as $\dfrac{dy}{dx}$ is eventually correctly linked to $\dfrac{dy}{dt}$ via the chain rule). Point 8: correct equation

Solution 6

$2\frac{dx}{dt}y + 2x\frac{dy}{dt} + \frac{1}{y}\frac{dy}{dt} = 0$ (or equivalent); requires Point 7 with no errors in the implicit differentiation. Point 9: correct answer $\frac{dy}{dt} = -\frac{2}{3}$; requires Points 7 and 8.

Question 5

2024 ▪ Q5

Consider the curve defined by the equation $x^2 + 3y + 2y^2 = 48$. It can be shown that $\dfrac{dy}{dx} = \dfrac{-2x}{3+4y}$.

(a) There is a point on the curve near $(2,4)$ with x-coordinate 3. Use the line tangent to the curve at $(2,4)$ to approximate the y-coordinate of this point.

(b) Is the horizontal line $y = 1$ tangent to the curve? Give a reason for your answer.

(c) The curve intersects the positive x-axis at the point $(\sqrt{48}, 0)$. Is the line tangent to the curve at this point vertical? Give a reason for your answer.

(d) For time $t \geq 0$, a particle is moving along another curve defined by the equation $y^3 + 2xy = 24$. At the instant the particle is at the point $(4,2)$, the y-coordinate of the particle's position is decreasing at a rate of 2 units per second. At that instant, what is the rate of change of the x-coordinate of the particle's position with respect to time?

Solution 5

(a) Mark scheme

- $\left.\dfrac{dy}{dx}\right|_{(2,4)} = \dfrac{-2(2)}{3+4(4)} = -\dfrac{4}{19}$. Tangent line approximation: $y \approx 4 - \dfrac{4}{19}(3-2) = \dfrac{72}{19}$. 1 point for the correct slope $-4/19$ at $(2,4)$, 1 point for the correct approximation using that slope evaluated at $x = 3$ through the point $(2,4)$.

Solution 5

(b) Mark scheme

- $\dfrac{dy}{dx} = \dfrac{-2x}{3+4y} = 0 \Rightarrow x = 0$, so if $y = 1$ were tangent, the point of tangency would have to be $(0,1)$. But $(0,1)$ is not on the curve, because $0^2 + 3(1) + 2(1)^2 = 5 \neq 48$. Therefore the horizontal line $y = 1$ is NOT tangent to the curve. 1 point for considering $dy/dx = 0$ (equivalently $x = 0$, or identifying the point $(0,1)$), 1 point for the answer 'not tangent' with a valid reason (merely stating '(0,1) is not on the curve' without explanation is insufficient; must show why).

Solution 5

(c) Mark scheme

- At $(\sqrt{48}, 0)$, $\dfrac{dy}{dx} = \dfrac{-2\sqrt{48}}{3+4(0)} = \dfrac{-2\sqrt{48}}{3}$. Since the denominator $3+4(0) = 3 \neq 0$, the slope is defined (finite), so the tangent line at this point is NOT vertical. The single point requires clearly showing the slope of the tangent at $(\sqrt{48}, 0)$ is defined and answering 'no' (considering only that the denominator is nonzero is sufficient).

Solution 5

(d) Mark scheme

- Curve: $y^3 + 2xy = 24$. Implicit differentiation with respect to t: $3y^2\dfrac{dy}{dt} + 2x\dfrac{dy}{dt} + 2y\dfrac{dx}{dt} = 0$. At $(4, 2)$ with $\dfrac{dy}{dt} = -2$: $3(2)^2(-2) + 2(4)(-2) + 2(2)\dfrac{dx}{dt} = 0 \Rightarrow -24 - 16 + 4\dfrac{dx}{dt} = 0 \Rightarrow \dfrac{dx}{dt} = \dfrac{40}{4} = 10.$ The rate of change of the x-coordinate is 10 units per second. 1 point for attempting implicit differentiation of $y^3 + 2xy = 24$ with respect to t (at most one error), 1 point for the fully correct differentiated equation $3y^2\frac{dy}{dt} + 2x\frac{dy}{dt} + 2y\frac{dx}{dt} = 0$, 1 point for correctly using $dy/dt = -2$ (the y-coordinate is decreasing), 1 point (only earnable with the prior three, no arithmetic mistakes) for the final answer 10.

Question 6

2023 ▪ Q6

Consider the curve given by the equation $6xy = 2 + y^3$.

(a) Show that $\dfrac{dy}{dx} = \dfrac{2y}{y^2 - 2x}$.

Question 6

2023 ▪ Q6

Consider the curve given by the equation $6xy = 2 + y^3$.

(b) Find the coordinates of a point on the curve at which the line tangent to the curve is horizontal, or explain why no such point exists.

Question 6

2023 ▪ Q6

Consider the curve given by the equation $6xy = 2 + y^3$.

(c) Find the coordinates of a point on the curve at which the line tangent to the curve is vertical, or explain why no such point exists.

Question 6

2023 ▪ Q6

Consider the curve given by the equation $6xy = 2 + y^3$.

(d) A particle is moving along the curve. At the instant when the particle is at the point $\left(\frac{1}{2}, -2\right)$, its horizontal position is increasing at a rate of $\frac{dx}{dt} = \frac{2}{3}$ unit per second. What is the value of $\frac{dy}{dt}$, the rate of change of the particle's vertical position, at that instant?

Solution 6

(a) Mark scheme

- Differentiate implicitly: $\frac{d}{dx}(6xy) = \frac{d}{dx}(2 + y^3) \Rightarrow 6y + 6x\frac{dy}{dx} = 3y^2\frac{dy}{dx}$ (1 pt: correct implicit differentiation of $6xy = 2 + y^3$). Solve for dy/dx: $2y = \frac{dy}{dx}(y^2 - 2x) \Rightarrow \frac{dy}{dx} = \frac{2y}{y^2 - 2x}$ (1 pt: verification, i.e. correctly isolating dy/dx to match the given expression, with no subsequent errors).

Solution 6

(b)

Mark scheme

- For the tangent line to be horizontal, it is necessary that $2y = 0$ (so y=0) and $y^2 - 2x \neq 0$ (1 pt: sets 2y=0, equivalently y=0, dy/dx=0, or dy=0). Substituting y=0 into $6xy = 2 + y^3$ yields $6x \cdot 0 = 2$, i.e. $0 = 2$, which has no solution; therefore there is no point on the curve at which the tangent line is horizontal (1 pt: answer with reason).

Solution 6

(c)

Mark scheme

- For the tangent line to be vertical, it is necessary that $2y \neq 0$ and $y^2 - 2x = 0$ (so $x = y^2/2$, equivalently $y = \sqrt{2x}$) (1 pt: sets $y^2 - 2x = 0$). Substituting $x = y^2/2$ into $6xy = 2 + y^3$: $3y^2 \cdot y = 2 + y^3 \Rightarrow 2y^3 = 2 \Rightarrow y = 1$ (1 pt: substitutes correctly and solves). Substituting y=1 into $6xy = 2 + y^3$ gives $6x = 3$, so $x = \dfrac{1}{2}$; the tangent line is vertical at the point $\left(\dfrac{1}{2}, 1\right)$ (1 pt: answer — both coordinates must be presented, and the point verified to lie on the curve).

Solution 6

(d) Mark scheme

- Differentiate $6xy = 2 + y^3$ implicitly with respect to t: $6y\dfrac{dx}{dt} + 6x\dfrac{dy}{dt} = 3y^2\dfrac{dy}{dt}$ (1 pt: implicit differentiation with respect to t, presenting at least one of the terms $6y\,dx/dt$, $6x\,dy/dt$, or $3y^2\,dy/dt$). At the point $(x, y) = \left(\dfrac{1}{2}, -2\right)$ with $\dfrac{dx}{dt} = \dfrac{2}{3}$: $6(-2)\left(\dfrac{2}{3}\right) + 6\left(\dfrac{1}{2}\right)\dfrac{dy}{dt} = 3(-2)^2\dfrac{dy}{dt} \Rightarrow -8 + 3\dfrac{dy}{dt} = 12\dfrac{dy}{dt} \Rightarrow \dfrac{dy}{dt} = -\dfrac{8}{9}$ unit per second (1 pt: answer, an unsupported value of -8/9 alone earns no points).

Question 2

2022 ▪ Q2

[Graph: a coordinate plane with x-axis from -2 to 1 and y-axis from -1 to 1 (tick marks labeled -1 on y-axis, 1 on y-axis; -2, -1, O, 1 on x-axis). A curve labeled implicitly by the two functions below starts at $(-2, 0)$, dips down to a minimum below the x-axis between $x = -1$ and $x = 0$, rises back up crossing near the origin, and continues upward, ending with a marked point just above and to the right of $(1, 1)$.]

Let f and g be the functions defined by $f(x) = \ln(x + 3)$ and $g(x) = x^4 + 2x^3$. The graphs of f and g, shown in the figure above, intersect at $x = -2$ and $x = B$, where $B > 0$.

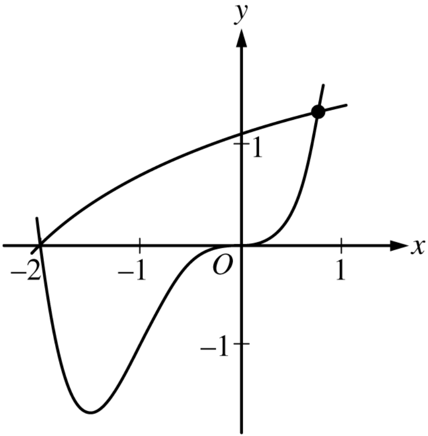
(a) Find the area of the region enclosed by the graphs of f and g.

(b) For $-2 \leq x \leq B$, let $h(x)$ be the vertical distance between the graphs of f and g. Is h increasing or decreasing at $x = -0.5$? Give a reason for your answer.

Question 2

(c) The region enclosed by the graphs of f and g is the base of a solid. Cross sections of the solid taken perpendicular to the x-axis are squares. Find the volume of the solid.
(d) A vertical line in the xy-plane travels from left to right along the base of the solid described in part (c). The vertical line is moving at a constant rate of 7 units per second. Find the rate of change of the area of the cross section above the vertical line with respect to time when the vertical line is at position $x = -0.5$.

Question 2



Solution 2

(a)

Mark scheme

- $\ln(x+3) = x^4 + 2x^3 \Rightarrow x = -2,\ x = B = 0.781975$. Area $= \int_{-2}^{B}(f(x) - g(x))\,dx = \int_{-2}^{B}\left(\ln(x+3) - (x^4 + 2x^3)\right)dx = 3.603548$. The area of the region is 3.604 (or 3.603). Points: (1) correct integrand $f(x) - g(x)$ (or an equivalent form such as $|f(x) - g(x)|$ or $g(x) - f(x)$); (2) correct limits of integration, -2 to B; (3) correct answer.

Solution 2

(b)

Mark scheme

- $h(x) = f(x) - g(x)$, so $h'(x) = f'(x) - g'(x)$. $h'(-0.5) = f'(-0.5) - g'(-0.5) = -0.6$ (or -0.599). Since $h'(-0.5) < 0$, h is decreasing at $x = -0.5$. Points: (1) considers $h'(-0.5)$ (or equivalently $f'(-0.5) - g'(-0.5)$); (2) correct answer (decreasing) with reason.

Solution 2

(c)

Mark scheme

- Volume $= \int_{-2}^{B}(f(x) - g(x))^2\,dx = 5.340102$. The volume of the solid is 5.340. Points: (1) correct integrand $k(f(x) - g(x))^2$ with $k = 1$ in a definite integral; (2) correct answer.

Solution 2

(d) Mark scheme

- The cross section has area $A(x) = (f(x) - g(x))^2$. By the chain rule, $\dfrac{d}{dt}[A(x)] = \dfrac{dA}{dx} \cdot \dfrac{dx}{dt}$. At $x = -0.5$: $\dfrac{d}{dt}[A(x)]\Big|_{x=-0.5} = A'(-0.5) \cdot 7 = -9.271842$. At $x = -0.5$, the area of the cross section is changing at a rate of about -9.272 (or -9.271) square units per second. Points: (1) correct chain-rule expression $\frac{dA}{dx} \cdot \frac{dx}{dt}$ (equivalently $A'(x) \cdot dx/dt$); (2) correct answer.

Question 4

2022 ▪ Q4

t (days)	0	3	7	10	12
$r'(t)$ (centimeters per day)	-6.1	-5.0	-4.4	-3.8	-3.5

An ice sculpture melts in such a way that it can be modeled as a cone that maintains a conical shape as it decreases in size. The radius of the base of the cone is given by a twice-differentiable function r, where $r(t)$ is measured in centimeters and t is measured in days. The table above gives selected values of $r'(t)$, the rate of change of the radius, over the time interval $0 \leq t \leq 12$.

(a) Approximate $r''(8.5)$ using the average rate of change of r' over the interval $7 \leq t \leq 10$. Show the computations that lead to your answer, and indicate units of measure.

(b) Is there a time t, $0 \leq t \leq 3$, for which $r'(t) = -6$? Justify your answer.

Question 4

(c) Use a right Riemann sum with the four subintervals indicated in the table to approximate the value of

$$\int_0^{12} r'(t)\,dt.$$

(d) The height of the cone decreases at a rate of 2 centimeters per day. At time $t = 3$ days, the radius is 100 centimeters and the height is 50 centimeters. Find the rate of change of the volume of the cone with respect to time, in cubic centimeters per day, at time $t = 3$ days. (The volume V of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.)

Question 4

t (days)	0	3	7	10	12
$r'(t)$ (centimeters per day)	-6.1	-5.0	-4.4	-3.8	-3.5

Solution 4

(a)

Mark scheme

- $r''(8.5) \approx \dfrac{r'(10) - r'(7)}{10 - 7} = \dfrac{-3.8 - (-4.4)}{3} = \dfrac{0.6}{3} = 0.2$ centimeters per day per day. Points: (1) correct difference-quotient setup (a difference over a quotient) with supporting work; (2) correct units (cm/day^2, or an equivalent form).

Solution 4

(b)

Mark scheme

- r is twice differentiable, so r' is differentiable and therefore continuous. $r'(0) = -6.1 < -6 < -5.0 = r'(3)$. By the Intermediate Value Theorem, there is a time t, $0 < t < 3$, such that $r'(t) = -6$. Points: (1) establishes that -6 is between $r'(0) = -6.1$ and $r'(3) = -5.0$; (2) correct conclusion invoking the Intermediate Value Theorem (or equivalent reasoning), noting that r' is continuous because r is twice differentiable.

Solution 4

(c)

Mark scheme

- $\int_0^{12} r'(t)\,dt \approx 3r'(3) + 4r'(7) + 3r'(10) + 2r'(12) = 3(-5.0) + 4(-4.4) + 3(-3.8) + 2(-3.5) = -51$. Points: (1) correct form of the right Riemann sum (subinterval widths 3, 4, 3, 2 paired with the right endpoints $r'(3), r'(7), r'(10), r'(12)$); (2) correct answer, -51.

Solution 4

(d) Mark scheme

- $V = \frac{1}{3}\pi r^2 h \Rightarrow \dfrac{dV}{dt} = \dfrac{2}{3}\pi rh\dfrac{dr}{dt} + \dfrac{1}{3}\pi r^2\dfrac{dh}{dt}$. At $t = 3$: $r = 100$, $h = 50$, $\frac{dr}{dt} = r'(3) = -5$ (from the table in part (a)), $\frac{dh}{dt} = -2$ (height decreases at 2 cm/day). $\dfrac{dV}{dt}\Big|_{t=3} = \dfrac{2}{3}\pi(100)(50)(-5) + \dfrac{1}{3}\pi(100)^2(-2) = -\dfrac{70{,}000\pi}{3}$ cubic centimeters per day. Points: (1) correct product-rule term; (2) correct chain-rule term (both differentials present); (3) correct final answer.

Question 4

2019 ▪ Q4

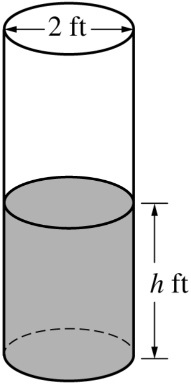
A cylindrical barrel with a diameter of 2 feet contains collected rainwater, as shown in the figure below. The water drains out through a valve (not shown) at the bottom of the barrel. The rate of change of the height h of the water in the barrel with respect to time t is modeled by $\frac{dh}{dt} = -\frac{1}{10}\sqrt{h}$, where h is measured in feet and t is measured in seconds. (The volume V of a cylinder with radius r and height h is $V = \pi r^2 h$.)
[Diagram of a cylindrical barrel with diameter labeled "2 ft" at the top opening; the barrel is partially filled with shaded (gray) water up to a level, with a vertical double-arrow labeled "h ft" marking the height of the water from the bottom of the barrel to the water's surface.]
(a) Find the rate of change of the volume of water in the barrel with respect to time when the height of the water is 4 feet. Indicate units of measure.

Question 4

(b) When the height of the water is 3 feet, is the rate of change of the height of the water with respect to time increasing or decreasing? Explain your reasoning.

(c) At time $t = 0$ seconds, the height of the water is 5 feet. Use separation of variables to find an expression for h in terms of t.

Question 4



Solution 4

(a) Mark scheme

- $V = \pi r^2 h = \pi(1)^2 h = \pi h$ (radius fixed at 1 ft), so $\dfrac{dV}{dt} = \pi \dfrac{dh}{dt}$. At $h = 4$, $\dfrac{dh}{dt}\Big|_{h=4} = -\frac{1}{10}\sqrt{4} = -\frac{1}{5}$. So $\dfrac{dV}{dt}\Big|_{h=4} = \pi\left(-\frac{1}{5}\right) = -\dfrac{\pi}{5}$ cubic feet per second.
  Points: 1 for $\frac{dV}{dt} = \pi\frac{dh}{dt}$, 1 for the correct answer with units ($-\pi/5$ cubic feet per second).

Solution 4

(b) Mark scheme

- $\dfrac{d^2h}{dt^2} = \dfrac{d}{dh}\left(-\frac{1}{10}\sqrt{h}\right) \cdot \dfrac{dh}{dt} = -\dfrac{1}{20\sqrt{h}} \cdot \left(-\frac{1}{10}\sqrt{h}\right) = \dfrac{1}{200}$. Because $\dfrac{d^2h}{dt^2} = \frac{1}{200} > 0$ for $h > 0$, the rate of change of the height of the water is INCREASING when the height of the water is 3 feet. Points: 1 for $\frac{d}{dh}\left(-\frac{1}{10}\sqrt{h}\right) = -\frac{1}{20\sqrt{h}}$, 1 for the chain-rule setup $\frac{d^2h}{dt^2} = -\frac{1}{20\sqrt{h}} \cdot \frac{dh}{dt}$, 1 for the answer (increasing) with explanation, since $d^2h/dt^2 = 1/200 > 0$.

Solution 4

(c) Mark scheme

- Separating variables: $\dfrac{dh}{\sqrt{h}} = -\dfrac{1}{10}\,dt$. Integrating: $\displaystyle\int \frac{dh}{\sqrt{h}} = \int -\frac{1}{10}\,dt \Rightarrow 2\sqrt{h} = -\frac{1}{10}t + C$. Using the initial condition $h(0) = 5$: $2\sqrt{5} = -\frac{1}{10}(0) + C \Rightarrow C = 2\sqrt{5}$. So $2\sqrt{h} = -\dfrac{1}{10}t + 2\sqrt{5}$, and $h(t) = \left(-\dfrac{1}{20}t + \sqrt{5}\right)^2$. Points: 1 for separating variables, 1 for antiderivatives ($2\sqrt{h}$ and $-t/10$), 1 for the constant of integration AND correctly using the initial condition $h(0) = 5$, 1 for the final expression $h(t) = (-t/20 + \sqrt{5})^2$. Note:

Solution 4

score 0/4 if no separation of variables; max 2/4 (pattern 1-1-0-0) if no constant of integration.

Question 4

2018 ▪ Q4

t **(years)**	**2**	**3**	**5**	**7**	**10**
$H(t)$ (meters)	1.5	2	6	11	15

The height of a tree at time t is given by a twice-differentiable function H, where $H(t)$ is measured in meters and t is measured in years. Selected values of $H(t)$ are given in the table above.

Question 4

(a) Use the data in the table to estimate $H'(6)$. Using correct units, interpret the meaning of $H'(6)$ in the context of the problem.

Question 4

t (years)	2	3	5	7	10
$H(t)$ (meters)	1.5	2	6	11	15