Question Number	Scheme	Marks
2.	$\cancel{\left(\frac{dy}{dx}\right)} = 8x - 2y\frac{dy}{dx} + 2x\frac{dy}{dx} + 2y = 0$	M1 B1 A1
	Sets $\frac{dy}{dx} = 2, \Rightarrow 8x - 4y + 4x + 2y = 0 \Rightarrow y - 6x = 0$	M1
	Sub "$y = 6x$" into $4x^2 - y^2 + 2xy + 5 = 0$ $\Rightarrow 4x^2 - 36x^2 + 12x^2 + 5 = 0 \Rightarrow x^2 = \frac{1}{4} \Rightarrow x = \pm\frac{1}{2}$	dM1, A1
	$\left(\frac{1}{2}, 3\right)$ $\left(-\frac{1}{2}, -3\right)$	A1 **(7)** **(7 marks)**

M1: Differentiates $4x^2 - y^2 + 5$ wrt x to obtain $Ax + By\frac{dy}{dx}$ (inc. $5 \to 0$) Condone $\frac{dy}{dx} = ...$ at start

B1: Sight of $\frac{d}{dx}(2xy) = 2x\frac{dy}{dx} + 2y$ oe e.g. $2\left(y + x\frac{dy}{dx}\right)$

A1: $8x - 2y\frac{dy}{dx} + 2x\frac{dy}{dx} + 2y = 0$ oe e.g. $\frac{dy}{dx} = \frac{-8x - 2y}{2x - 2y}$ oe The =0 may be implied by further work

M1: Sets $\frac{dy}{dx} = 2$ in their differentiated function in x and y and proceeds to a linear equation in x and y.
Brackets do not need to be multiplied out. Condone arithmetical slips in their rearrangement.
There must have been some attempt at implicit differentiation so look for at least a $...y\frac{dy}{dx}$ or $...x\frac{dy}{dx}$ term in their differentiated function – not just e.g. $\frac{dy}{dx} = 8x - 2y + 2$

Note: $\boldsymbol{\frac{dy}{dx} = 0 \Rightarrow y = -4x \Rightarrow 20x^2 = 5 \Rightarrow x = \pm\frac{1}{2}}$ **scores M0dM0A0A0**

dM1: Dependent on the previous method mark only. For this mark:

- substitutes their $y = 6x$ or $x = \frac{y}{6}$ into the equation of curve C to form an equation in one variable
- reaches a **two-term quadratic** $Ax^2 = B$ oe or $Ay^2 = B$ oe for any values of A or B where $A \times B > 0$:

  e.g. $(4x^2 - 36x^2 + 12x^2 + 5 = 0 \Rightarrow)$ $20x^2 = 5$

  e.g. $\left(4\left(\frac{y}{6}\right)^2 - y^2 + \frac{y^2}{3} + 5 = 0 \Rightarrow\right)$ $\frac{5}{9}y^2 = 5$

  but condone slips in the working. Also allow if both terms are on one side of an equation. The = 0 may be implied by further work.
- solves their **two term quadratic** to find a value for x or y (you do not need to be check this)

  It cannot be implied by a correct value for x or y.

A1: Either **one correct pair** of coordinates **or both *x* or both *y* values**. It must follow evidence of a two term quadratic. If it is a pair of coordinates, condone the omission of brackets.

A1: **Both** $\left(\frac{1}{2},3\right)$ and $\left(-\frac{1}{2},-3\right)$ (two answers correct following a correct quadratic in x or y only can score dM1A1A1) Any extra solutions (obtained by substituting the variable found first into the quadratic, instead of the linear equation for example) result in A0.

Unsimplified answers lose the final A mark e.g. $\left(\frac{\sqrt{5}}{\sqrt{20}},3\right)$ and $\left(-\frac{\sqrt{5}}{\sqrt{20}},-3\right)$

Allow (0.5, 3) and $(-0.5,\ -3)$ and condone without brackets.

Coordinates may be written separately if pairing is clear but a wrong pairing or just stating the x coordinates together and the y coordinates together is A0.

i.e. $x=\frac{1}{2}, y=3$ and $x=-\frac{1}{2}, y=-3$ is acceptable but $x=\pm\frac{1}{2}, y=\pm 3$ is not sufficient

Question Number	Scheme	Marks
3	$\dfrac{\mathrm{d}h}{\mathrm{d}t} = \dfrac{2h^{\frac{3}{2}}}{5t^2}$	
(a)	$\displaystyle\int \frac{1}{2h^{\frac{3}{2}}}\,\mathrm{d}h = \int \frac{1}{5t^2}\,\mathrm{d}t$	B1
	$-h^{-\frac{1}{2}} = -\dfrac{1}{5}t^{-1}(+c)$ oe	M1, A1
	$-(1)^{-\frac{1}{2}} = -\dfrac{1}{5}(1)^{-1} + c \Rightarrow c = \ldots \left(\text{e.g.} = -\dfrac{4}{5}\right)$	M1
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	e.g. $-h^{-\frac{1}{2}} = -\dfrac{1}{5}t^{-1} - \dfrac{4}{5} \Rightarrow \dfrac{1}{\sqrt{h}} = \dfrac{1}{5t} + \dfrac{4}{5} = \dfrac{1+4t}{5t} \Rightarrow \sqrt{h} = \dfrac{5t}{1+4t} \Rightarrow h = \ldots$ or $\dfrac{1}{\sqrt{h}} = \dfrac{1}{5t} + \dfrac{4}{5} \Rightarrow 5t = \sqrt{h}(1+4t) \Rightarrow h = \ldots$	M1

	$h = \dfrac{25t^2}{(1+4t)^2} \quad (a = 25,\ b = 4)$	A1
		(6)
(b)	Max $h = \dfrac{25}{16}$ or 1.5625 (m)	M1, A1ft
		(2)
		Total 8

(a)

B1: Correct separation of variables (allow equivalent forms) There is no need to see the integral signs but the dh and dt must be present and in the correct positions or may be implied by further work.

M1: Reaches $\alpha h^{-\frac{1}{2}} = \beta t^{-1}(+c)$ oe

A1: Correct integration with or without +c Accept other correct equivalent forms of $-h^{-\frac{1}{2}} = -\dfrac{1}{5}t^{-1}(+c)$

e.g. $-10h^{-\frac{1}{2}} = -2t^{-1}(+c)$

Note that if they do not have a constant of integration then no further marks can be scored

M1: Uses given conditions at an appropriate point in their integrated form (however poor) to find a constant of integration for their equation in h and t. Alternatively uses $\left[-h^{-\frac{1}{2}}\right]_1^h = \left[-\dfrac{1}{5}t^{-1} + c\right]_1^t$

Allow stating $h = 1,\ t = 1 \Rightarrow c = \ldots$ or equivalent but if a value for c is stated without any method seen then you will need to check this on your calculator.