Question Number	Scheme	Marks
1.	$\int \left(3x^2-2\right)\left(\frac{2}{x^2}+4\right)\mathrm{d}x$ $\left(3x^2-2\right)\left(\frac{2}{x^2}+4\right)=6+12x^2-4x^{-2}-8$	M1, A1
	$\int \left(3x^2-2\right)\left(\frac{2}{x^2}+4\right)\mathrm{d}x=\int \left(12x^2-4x^{-2}-2\right)\mathrm{d}x=4x^3+\frac{4}{x}-2x+c$	M1, A1ft, A1 **(5 marks)**

Note: Attempts to integrate by parts send to review

M1: Attempts to multiply out and achieves the correct form of $Ax^2+\frac{B}{x^2}+\text{constant}\quad A,B\neq 0$, Condone slips and it may be left unsimplified but with the powers correctly processed. May be implied by further work.

A1: For $12x^2-4x^{-2}-2$ but allow this unsimplified with the terms uncollected. May be implied by further work.

M1: For an attempt to integrate scored for $\int x^n\mathrm{d}x\to x^{n+1},\ n\neq -1,$ on any term in x following an attempt to expand. The index must be processed, i.e. $x^2\to x^3$ and not x^{2+1}.

A1ft: Correct follow through on any **two terms** from $ax^2\to\frac{ax^3}{3}\qquad b\to bx\qquad cx^{-2}\to -cx^{-1}$.

The terms **do not have to be collected** but the coefficient for each term must be simplified so $-4\times\frac{x^{-1}}{-1}$ would not be one of the valid terms for this mark.
Accept e.g. $"-2"x^1$ for $"-2"x$
Does not need to be an expression for this mark i.e. terms may be on separate lines.
Ignore other incorrect terms for this mark.

A1: $4x^3+\frac{4}{x}-2x+c$ or exact simplified equivalent **including the + *c***. So accept $\frac{4}{x}\leftrightarrow 4x^{-1}$
Accept e.g. $-2x^1$
Condone spurious notation such as an integral sign at the start or a dx at the end.
Do not ISW if candidates proceed say to multiply by x to get rid of the fractional terms.

Question Number	Scheme	Marks
2.(a)	Uses $t = 2, H = 2.7 \Rightarrow \dfrac{2a+b}{6} = 2.7$ $t = 7, H = 4.5 \Rightarrow \dfrac{7a+b}{11} = 4.5$ (may be seen as $2a + b = 16.2$ AND $7a + b = 49.5$)	M1A1
	Solves $7a + b = 49.5$, $2a + b = 16.2 \Rightarrow a = 6.66$ OR $b = 2.88$	dM1
	$H = \dfrac{6.66t + 2.88}{t + 4}$	A1 **(4)**
(b)	Sets $t = 0, H = \dfrac{2.88}{4} = 0.72$ m	M1, A1ft **(2)**
		(6 marks)

Mark (a) and (b) together

(a)

M1: Attempts to use $t = 2, H = 2.7$ **OR** $t = 7, H = 4.5$ in the given model. Does not need to be simplified.

A1: Achieves two correct simultaneous equations in a and b
$2a + b = 16.2$ oe **AND** $7a + b = 49.5$ oe

They do not need to be simplified i.e. $\dfrac{2a+b}{6} = 2.7$ and $\dfrac{7a+b}{11} = 4.5$ scores M1A1

Look out for attempts where one correct equation is formed and they use the other information to directly substitute into this equation which can imply this mark.

e.g. $\dfrac{2a + (49.5 - 7a)}{6} = 2.7$ would score M1A1

dM1: Solves their simultaneous equations leading to values of a and b. It is dependent on the previous method mark.

Allow a solution via a calculator – you do not need to check this but **do not** allow

$\dfrac{2a+b}{6} = 2.7, \dfrac{7a+b}{11} = 4.5 \Rightarrow a = ..., b = ...$ without rearranging to simultaneous equations of the form $Pa + Qb = r$ first.

Note they can proceed from an equation in one variable $\dfrac{2a + (49.5 - 7a)}{6} = 2.7 \Rightarrow a = ..., b = ...$

A1: $H = \dfrac{6.66t + 2.88}{t + 4}$ Condone a and b to be written as fractions e.g. $H = \dfrac{\frac{333}{50}t + \frac{72}{25}}{t + 4}$.

Can only be scored provided all previous marks have been scored.

(b)

M1: Sets $t = 0$ leading to a value for H. You may need to check this if just a value is stated. i.e. $\dfrac{"2.88"}{4}$

A1ft: States 0.72m or 72 cm **including units** (condone a correct fraction for 0.72)
Follow through on their b provided $0 < H < 2.7$