Question Number	Scheme	Marks
6. (i)	$2\log_2(4-x) = 3+\log_2\left(\dfrac{x+11}{2}\right)$	
	One correct law applied – examples (not exhaustive):	
	$2\log_2(4-x) = \log_2(4-x)^2$, $\log_2\left(\dfrac{x+11}{2}\right) = \log_2(x+11) - \log_2 2$	B1
	$3 = \log_2 8$	
	Correctly combines two original terms e.g. $2\log_2(4-x) = \log_2(4x+44)$	M1
	Correct equation not involving logs $(4-x)^2 = 4x+44$	A1
	$x^2 - 12x - 28 = 0 \Rightarrow (x-14)(x+2) = 0 \Rightarrow x = ...$	dM1
	$\Rightarrow x = -2$ only	A1
		(5)
(ii)	Combines $y = 6\times 3^x$ and $y = 3^{2x+1} \Rightarrow 3^{2x+1} = 6\times 3^x$	M1
	$\Rightarrow 3^x \times 3 = 6$	
	$\Rightarrow 3^x = 2 \Rightarrow x = \log_3 2$	dM1, A1
	$y = 6\times 3^{\log_3 "2"} = 6\times "2"$	ddM1
	coordinates of P are: $\left(\log_3 2,\ 12\right)$	A1
		(5)
		(10 marks)

(i)

B1: Sight of one correct log law applied. See scheme. There will be other equivalent examples e.g. $\log_2\left(\dfrac{x+11}{2}\right) = \log_2(x+11) - 1$. This mark can still be awarded if they have made errors before applying the law and do not withhold this mark for any subsequent errors.

M1: Correctly combines two of the three original terms of the equation. e.g. $\log_2\left(\dfrac{2(4-x)^2}{x+11}\right) = 3$

May be implied by a correct equation in any form not involving logs provided it has not come from incorrect log work. e.g. $\dfrac{\log_2(4-x)^2}{\log_2\left(\dfrac{x+11}{2}\right)} = 3 \Rightarrow \dfrac{(4-x)^2}{\dfrac{x+11}{2}} = 8$ is M0

A1: Correct equation in any form not involving logs which has not come from incorrect log work.

dM1: Solves a quadratic equation via factorisation, the formula or completing the square (usual rules apply). They are not allowed to just state the roots. Dependent on the previous method mark.

A1: $x = -2$ only (the 14 if found must be rejected or not included in their final answer)

(ii) Note that if logarithms are written as decimals instead of keeping their values exact then
- if they find *x* first the maximum score is M1dM0A0ddM0A0
- if they find *y* first the maximum score is M1dM1A1ddM0A0

M1: Sets up a correct equation in *x* or *y*. Most likely in *x* but it is possible to form an equation in *y*

e.g. $y = 3^{2x+1} = 3\times\left(3^{x}\right)^{2} = 3\times\left(\frac{y}{6}\right)^{2}$

dM1: A correct method of solving the equation in *x* (or *y*) to find either
- an unsimplified expression or value for *x* in terms of logs, or
- an expression or value for *y* not involving logs

It is dependent on the previous method mark. Condone arithmetical slips but any log/index work must be correct.

There may be some alternative approaches here to solving:
e.g. taking logarithms of base 3:
$\log_3(3^{2x+1}) = \log_3(6\times 3^{x}) \Rightarrow 2x+1 = \log_3 6 + \log_3 3^{x} \Rightarrow 2x+1 = 1+\log_3 2 + x \Rightarrow x = ...$
e.g. forming a quadratic in 3^{x} (or another variable)
$3\times 3^{2x} - 6\times 3^{x} = 0 \Rightarrow 3^{x}(3^{x}-2) = 0 \Rightarrow 3^{x} = 2 \Rightarrow x = ...$
If solving an equation in *y* then e.g. $y = 3\times\left(\frac{y}{6}\right)^{2} \Rightarrow \cancel{y} = 3\times\frac{\cancel{y}^{2}}{36} \Rightarrow y =$

A1: Correct *x* coordinate ($\log_3 2$ or equivalent expressions such as $\log_3 6 - 1$ or $\frac{\log 2}{\log 3}$ o.e.) **or** *y* coordinate which must be 12

ddM1: Uses a correct method to find values for both *x* **and** *y*. Condone arithmetical slips but any log/index work must be correct.
It is dependent on the previous two method marks.
May be implied by a correct coordinate for their *x* or *y*. Do not allow logarithms to be written as decimals.

A1: $\left(\log_3 2, 12\right)$ Accept if written separately e.g. $x = \log_3 2,\ y = 12$. isw if they incorrectly state the values of *a* and *b* after correct coordinates are seen.
Condone missing brackets but do not allow the coordinates to be the wrong way round.

Question Number	Scheme	Marks
7. (i)	$10+8+6.4+...$	
(a)	Attempts $S_\infty = \frac{a}{1-r}$ with $a=10, r=\frac{8}{10}$	M1
	$S_\infty = 50$	A1 **(2)**
(b)	Sets $10\times 0.8^{k-1} < 0.0005 \Rightarrow 0.8^{k-1} < 0.00005$ e.g.	M1
	$\Rightarrow k-1 > \frac{\log(0.00005)}{\log(0.8)}$ or e.g. $k-1 > \log_{0.8} 0.00005$ (see notes)	M1
	$\Rightarrow k-1 > 44.38 \Rightarrow (k=)\ 46$	A1 **(3)**
(ii)	Sets $850+(n-1)\times -7 = 0 \Rightarrow n = 122.4$	M1
	States or implies that $n=122$	A1
	$S = \frac{122}{2}\{2\times 850 + 121\times -7\} = 52033$	dM1, A1 **(4)**
		(9 marks)

(i) (a)

M1: Attempts $S_\infty = \frac{a}{1-r}$ with $a=10, r=\frac{8}{10}$ but condone slips on an incorrectly evaluated "r" provided the method to finding it is correct and $-1<r<1$. The expression with the values substituted in is sufficient.

A1: $(S_\infty =)\ 50$

(b) Note that candidates may misread the number of 0s in 0.0005 but can still score M1M1A0

M1: Sets $10\times "0.8"^{k-1} < 0.0005$ and proceeds to $"0.8"^{k-1} < 0.00005$ (or they may manipulate correctly to $"0.8"^{k} < 0.00005\times 0.8$). If they take logs before this stage then they will need to proceed to e.g. $\log "0.8"^{k-1} < \log 0.0005 - \log 10$
Condone other signs being used e.g. = or >

M1: Uses a correct method to solve an equation or inequality of the type $p^k ... q$ or $p^{k-1} ... q$
It cannot be for just stating the value for *k*. They only need to proceed as far as $k-1$ on one side of an equation or inequality. Evidence of using logs is required which cannot be e.g. 44.38… otherwise M0A0
Do not be concerned with the direction of inequalities, if used, in their solution for this mark.

A1: $(k=)\ 46$ from correct working.
If inequalities are used in their method then the direction must be correct.