Question	Scheme	Marks
1(a)	(i) There is a common difference (no common ratio) and so an arithmetic series should be used.	B1
	(ii) $(u_n) = 5 + (n-1)"d"$ or $(u_n) = 5 + n"d"$	M1
	$(u_n) = 5 + 0.25(n-1)$ oe	A1
		(3)
(b)	Need $S_n = \frac{n}{2}\left(2\times 5 + (n-1)\times 0.25\right) \geqslant 350$	M1A1
	$\Rightarrow 0.25n^2 + 9.75n \geqslant 700 \Rightarrow (n+19.5)^2 - 19.5^2 \geqslant 2800 \Rightarrow n = ...$	M1
	So 37 weeks.	A1
		(4)
		(7 marks)

Notes:

(a)(i)

B1: Identifies that there is a common difference (e.g. goes up in equal amounts) between first and second, and second and third terms, or that the ratio between first and second, and second and third is not the same, and states arithmetic series/sequence to be used.

M1: Attempts general term for A.S. with n or $n-1$ used and their d (which need not be correct).

A1: Correct expression for general term, accept equivalents, eg $4.75 + 0.25n$. May use another label than u_n or no label at all.

(b)

M1: Uses the sum formula for A.S. with their a and d and equates to, or sets inequality with, 350. Accept with any inequality symbol or equality between.

A1: Correct equation/inequality. Accept with any inequality symbol or equality between.

M1: Forms and solves a 3 term quadratic (need not be gathered to one side). Any valid method (including calculator – you may need to check).

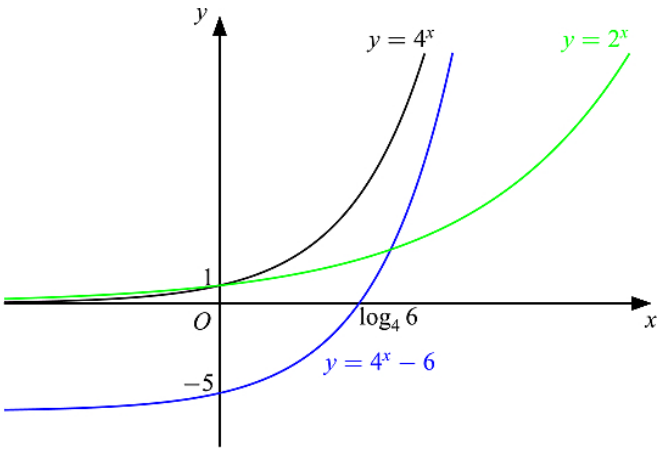
A1: 37 weeks selected as answer.

For attempts via listing, send to review.

For use of geometric series:

Case 1: If a student states arithmetic series but uses geometric series formulae, then only the B mark can be scored in (a), but in (b) allow M0A0M1A0 if a correct method is used to solve their equation $\frac{5("r"^n - 1)}{"r" - 1} \geqslant 350$ (or with "=" or "<" etc) to find n (so $n = \log_{"r"}(70("r" - 1) + 1)$ oe)

Case 2: If a student states a geometric series and gives a common ratio, then allow B0M1A0 in (a) for $(u_n) = 5"r"^k$ with $k = n$ or $n-1$ and in (b) allow M1A0 for $\frac{5("r"^n - 1)}{"r" - 1} \geqslant 350$ and then M1A0 for a correct method to solve this equation.

Question	Scheme		Marks
2(a)		(i) Correct shape and position for $y = 2^x$ Crosses y axis with same intersection as $y = 4^x$ but with gentler slope.	**B1**
		(ii) Graph of same shape as $y = 4^x$ but translated down	**B1**
		y intercept at -5	**B1**
		x intercept at $\log_4 6$	**B1**
			(4)
(b)	$2^x = 4^x - 6$ or $y = (2^x)^2 - 6 = y^2 - 6$		**M1**
	$\Rightarrow 2^{2x} - 2^x - 6 = 0 \Rightarrow (2^x - 3)(2^x + 2) = 0 \Rightarrow 2^x = \ldots$ or $(y-3)(y+2) = 0 \Rightarrow y = \ldots$		**M1**
	$y = 2^x = 3$		**A1**
	$x = \log_2 3$ oe		**A1**
			(4)
			(8 marks)

Notes:

(a)(i)

Note: Be tolerant of "wobbles" in the graph if it is clear the correct shapes are meant, but the graph must not clearly bend away from the asymptotes.

B1: Correct sketch for $y = 2^x$. This should be correct shape, but shallower gradient – look for crossing at same y intercept as $y = 4^x$, above $y = 4^x$ to the left of the y axis and below $y = 4^x$ to the right of the y axis.

(ii)

B1: Graph of $y = 4^x$ translated down by 6 units. Look for the same shape, always below $y = 4^x$ though be tolerant as the graph increases (accept if the graphs don't "narrow" as shown).

B1: Correct y intercepts of -5

B1: Correct x intercept of $\log_4 6$. Accept equivalents such as $\log 6 / \log 4$ or awrt 1.29

Ignore any references to asymptotes for these marks.

(b)

M1: Sets the equations equal to form an equation in x only, or writes 4^x in terms of 2^x and substitutes to achieve an equation in y only.

M1: Solves the equation to find a value for 2^x or y

A1: Correct y (or 2^x) value of intersection. (May have second solution)

A1: Correct x value of intersection. Must have rejected second "solution". Accept exact equivalents, such as $\log 3 / \log 2$ or $2\log_4 3$