Question	Scheme	Marks	AOs
13 (i)	States that $S = a + (a+d) + ... + (a+(n-1)d)$	B1	1.1a
	$S = \quad a + \qquad . \qquad (a+d) + \qquad (a+(n-1)d)$ $S = (a+(n-1)d) + (a+(n-2)d) + ... + a$	M1	3.1a
	Reaches $2S = n\times(2a+(n-1)d)$ And so proves that $S = \frac{n}{2}[2a+(n-1)d]$ *	A1*	2.1
		(3)	
(ii)	(a) $S = 10 + 9.20 + 8.40 + ...$		
	$64 = \frac{n}{2}(20 - 0.8(n-1))$ o.e	M1	3.1b
	$128 = 20n - 0.8n^2 + 0.8n$ $0.8n^2 - 20.8n + 128 = 0$ $n^2 - 26n + 160 = 0$ *	A1*	2.1
		(2)	
	(b) $n = 10, 16$	B1	1.1b
		(1)	
	(c) 10 weeks with a minimal correct reason. E.g. • He has saved up the amount by 10 weeks so he would not save for another 6 weeks • You would choose the smaller number • He starts saving negative amounts (in week 14) so 16 does not make sense	B1	2.3
		(1)	
			(7 marks)
Notes:			

(i)

B1: Correctly writes down an expression for the key terms S or S_n including $S =$ or $S_n =$

Allow a minimum of 3 correct terms including the first and last terms, and no incorrect terms.

Score for S or $S_n = a + (a+d) + ... + (a+(n-1)d)$ with + signs, not commas

If the series contains extra terms that should not be there E.g

$S = a + (a+d) + ...(\boldsymbol{a+nd}) + (a+(n-1)d)$ score B0

M1: For the key step in reversing the terms and adding the two series.

Look for a minimum of two terms, including a and $a+(n-1)d$, the series reversed with evidence of adding, for example $2S =$ Condone the extra incorrect terms (see above) appearing.

Can be scored when terms are separated by commas

A1*: Shows correct work (no errors) with all steps shown leading to given answer.

There should be no incorrect terms. A minimum of 3 terms should be shown in each sum

The solution below is a variation of this.

$$S = a + (a+d) + \dots\dots + l$$
$$S = l + (l-d) + \dots\dots + a$$
$$2S = n(a+l)$$
$$S = \frac{n}{2}(a+l) = \frac{n}{2}(a+a+(n-1)d) = \frac{n}{2}(2a+(n-1)d)$$

B1 and A1 are not scored until the last line, M scored on line 3

The following scores B1 M0 A0 as the terms in the second sum are not reversed

(i) $S_n = a + (a+d) + (a+2d) \dots a+(n-1)d$

$+$

$S_n = a + (a+(n-1)d + (a+(n-2)d) + a+(n-3)d$

$=$

$2S_n = 2a + (n-1)d + 2a+(n-1)d + 2a(n-1)d$

$2S_n = n[2a+(n-1)d]$

SC in (a) Scores B1 M0 A0.

They use $0+1+2+\dots+(n-1) = \frac{n(n-1)}{2}$ which relies on the quoted proof.

13 i) a_n $a+d$ $a+2d$ (1)

$\sum_{p=1}^{n} a+(p-1)d$

$S_n = a + a+d + a+2d + \dots a+(n-1)d$

$S_n = an + (0+1+2+3+\dots n-1)d$

sum of 1 to $n-1 = \frac{n(n-1)}{2}$

$S_n = an + \frac{n(n-1)}{2}d$

$S_n = n\left(a + \frac{(n-1)d}{2}\right)$

$S_n = \frac{n}{2}(2a+(n-1)d)$

(ii) (a)

M1: Uses the information given to set up a correct equation in *n*.

The values of *S*, *a* and *d* need to be correct and used within a correct formula

Possible ways to score this include unsimplified versions $64 = \frac{n}{2}(2\times10+(n-1)\times-0.8)$,

$64 = \frac{n}{2}(10+10+(n-1)\times-0.8)$ or versions using pence rather than £'s $6400 = \frac{n}{2}(2000+(n-1)\times-80)$

Allow recovery for both marks following $64 = \frac{n}{2}(2\times10+(n-1)-0.8)$ with an invisible ×

A1*: Proceeds without error to the given answer. (Do not penalise a missing final trailing bracket)
Look for at least a line with the brackets correctly removed as well as a line with the terms in *n* correctly combined

E.g. $64 = \frac{n}{2}(20+(n-1)\times-0.8) \Rightarrow 64 = 10n - 0.4n^2 + 0.4n \Rightarrow 0.4n^2 - 10.4n + 64 = 0 \Rightarrow n^2 - 26n + 160 = 0$

(ii)(b)

B1: $n = 10, 16$

(ii)(c)

B1: Chooses 10 (weeks) and gives a minimal acceptable reason. The reason must focus on why the answer is 10 (weeks) rather than 16(weeks) or alternatively why it would not be 16 weeks.