Question number	Scheme	Marks
11.	(a) $u_{25} = a + 24d = 30 + 24 \times (-1.5)$	M1
	$= -6$	A1 (2)
	(b) $a + (n-1)d = 30 - 1.5(r-1) = 0$	M1
	$r = 21$	A1 (2)
	(c) $S_{20} = \frac{20}{2}\{60 + 19(-1.5)\}$ or $S_{21} = \frac{21}{2}\{60 + 20(-1.5)\}$ or $S_{21} = \frac{21}{2}\{30 + 0\}$	M1 A1ft
	$= 315$	A1 (3)
		7

(a) M: Substitution of $a = 30$ and $d = \pm 1.5$ into $(a + 24d)$.
Use of $a + 25d$ (or any other variations on 24) scores M0.

(b) M: Attempting to use the term formula, equated to 0, to form an equation in r (with no other unknowns). Allow this to be called n instead of r.
Here, being 'one off' (e.g. equivalent to $a + nd$), scores M1.

(c) M: Attempting to use the correct sum formula to obtain S_{20}, S_{21}, or, with their r from part (b), S_{r-1} or S_r.
1st A(ft): A correct numerical expression for S_{20}, S_{21}, or, with their r from part (b), S_{r-1} or S_r …. but the ft is dependent on an <u>integer</u> value of r.

Methods such as calculus to find a maximum only begin to score marks <u>after</u> establishing a value of r at which the maximum sum occurs.
This value of r can be used for the M1 A1ft, but must be a positive integer to score A marks, so evaluation with, say, $n = 20.5$ would score M1 A0 A0.

<u>'Listing' and other methods</u>
(a) M: Listing terms (found by a correct method), and picking the <u>25th</u> term.
(There may be numerical slips).

(b) M: Listing terms (found by a correct method), until the zero term is seen.
(There may be numerical slips).
'Trial and error' approaches (or where working is unclear or non-existent) score M1 A1 for 21, M1 A0 for 20 or 22, and M0 A0 otherwise.

(c) M: Listing sums, or listing and adding terms (found by a correct method), at least as far as the 20th term. (There may be numerical slips).
A2 (scored as A1 A1) for 315 (clearly selected as the answer).
'Trial and error' approaches essentially follow the main scheme, beginning to score marks when trying S_{20}, S_{21}, or, with their r from part (b), S_{r-1} or S_r.
If no working (or no legitimate working) is seen, but the answer 315 is given, allow one mark (scored as M1 A0 A0).

<u>For reference</u>:
Sums: 30, 58.5, 85.5, 111, 135, 157.5, 178.5, 198, 216, 232.5, 247.5, 261, 273, 283.5, 292.5, 300, 306, 310.5, 313.5, 315, ……..

Question number	Scheme	Marks	
7. (a)	5, 7, 9, 11 or 5+2+2+2=11 or 5+6=11 use a = 5, d = 2, n = 4 and $t_4 = 5 + 3 \times 2 = 11$	B1	(1)
(b)	$t_n = a + (n-1)d$ with one of a = 5 or d = 2 correct (can have a letter for the other)	M1	
	= 5 + 2(n − 1) or 2n + 3 or 1 + 2(n + 1)	A1	(2)
(c)	$S_n = \frac{n}{2}[2 \times 5 + 2(n-1)]$ or use of $\frac{n}{2}(5 + \text{"their } 2n+3\text{"})$ (may also be scored in (b))	M1A1	
	= {n(5 + n - 1)} = n(n + 4) **(*)**	A1cso	(3)
(d)	43 = 2n + 3	M1	
	[n] = 20	A1	(2)
(e)	$S_{20} = 20 \times 24$, = <u>480</u> (km)	M1A1	(2)
			10
(a)	B1 Any other sum must have a convincing argument		
(b)	M1 for an attempt to use a + (n - 1)d with one of a or d correct (the other can be a letter) Allow any answer of the form 2n + p ($p \neq 5$) to score M1. A1 for a correct expression (needn't be simplified) [**Beware** $5 + (2n-1)$ scores A0] Expression must be in n not x. Correct answers with no working scores 2/2.		
(c)	M1 for an attempt to use S_n formula with a = 5 or d = 2 or a = 5 and their "2n + 3" 1st A1 for a fully correct expression 2nd A1 for correctly simplifying to given answer. No incorrect working seen. Must see S_n used. Do not give credit for part (b) if the equivalent work is given in part (d)		
(d)	M1 for forming a suitable equation in n (ft their (b)) and attempting to solve leading to n =… A1 for 20 Correct answer only scores 2/2 . Allow 20 following a restart but check working. eg 43 = 2n + 5 that leads to 40 = 2n and n =20 should score M1A0.		
(e)	M1 for using their answer for n in n(n + 4) or S_n formula, their n must be a value. A1 for 480 (ignore units but accept 480 000 m etc)[no matter where their 20 comes from] NB "attempting to solve" eg part (d) means we will allow sign slips and slips in arithmetic but not in processes. So dividing when they should subtract etc would lead to M0. Listing in parts (d) and (e) can score 2 (if correct) or 0 otherwise in each part. Poor labelling may occur (especially in (b) and (c)) . If you see work to get n(n + 4) mark as (c)		

Question Number	Scheme	Marks
9 (a)	$a+17d=25$ or equiv. (for 1st B1), $a+20d=32.5$ or equiv. (for 2nd B1),	B1, B1 (2)
(b)	<u>Solving</u> (Subtract) $3d = 7.5$ so $\boldsymbol{d} = \underline{\mathbf{2.5}}$ $a = 32.5 - 20\times 2.5$ so $\boldsymbol{a} = \underline{\mathbf{-17.5}}$ (*)	M1 A1cso (2)
(c)	$2750 = \frac{n}{2}\left[-35+\frac{5}{2}(n-1)\right]$ { $4\times 2750 = n(5n-75)$ } $4\times 550 = n(n-15)$ $\underline{n^2 - 15n = 55\times 40}$ (*)	M1A1ft M1 A1cso (4)
(d)	$n^2 - 15n - 55\times 40 = 0$ or $n^2 - 15n - 2200 = 0$ $(n-55)(n+40) = 0$ $n = \ldots$ $\underline{\boldsymbol{n} \mathbf{= 55}}$ (ignore - 40)	M1 M1 A1 (3) **[11]**
	Mark parts (a) and (b) as 'one part', ignoring labelling.	
(a)	<u>Alternative</u>: 1st B1: $d = 2.5$ or equiv. or $d = \frac{32.5-25}{3}$. No method required, but $a = -17.5$ must not be assumed. 2nd B1: Either $a+17d=25$ or $a+20d=32.5$ seen, or used with a value of d… or for 'listing terms' or similar methods, 'counting back' 17 (or 20) terms.	
(b)	M1: In main scheme: for a full method (allow numerical or sign slips) leading to solution for d or a without assuming $a = -17.5$ In alternative scheme: for using a d value to find a value for a. A1: Finding correct values for both a and d (allowing equiv. fractions such as $d = \frac{15}{6}$), with no incorrect working seen. In the main scheme, if the given a is used to find d from one of the equations, then allow M1A1 if both values are <u>checked</u> in the 2nd equation.	
(c)	1st M1 for attempt to form equation with correct S_n formula and 2750, with values of a and d. 1st A1ft for a correct equation following through their d. 2nd M1 for expanding and simplifying to a 3 term quadratic. 2nd A1 for correct working leading to printed result (no incorrect working seen).	
(d)	1st M1 forming the correct 3TQ = 0 . Can condone missing "= 0" but all terms must be on one side. First M1 can be implied (perhaps seen in (c), but there must be an attempt at (d) for it to be scored). 2nd M1 for attempt to solve 3TQ, by factorisation, formula or completing the square (see general marking principles at end of scheme). If this mark is earned for the 'completing the square' method or if the factors are written down directly, the 1st M1 is given by implication. A1 for n = 55 dependent on both Ms. Ignore – 40 if seen. <u>No working</u> or 'trial and improvement' methods in (d) score all 3 marks for the answer 55, otherwise no marks.	

Question Number	Scheme	Marks
Q5 (a)	$a + 9d = 2400$ $\quad a + 39d = 600$	M1
	$d = \dfrac{-1800}{30}$ $\quad d = -60$ $\quad$ (accept $\pm$ 60 for A1)	M1 A1 (3)
(b)	$a - 540 = 2400$ $\quad a = 2940$	M1 A1 (2)
(c)	Total = $\dfrac{1}{2}n\{2a + (n-1)d\} = \dfrac{1}{2} \times 40 \times (5880 + 39 \times -60)$ (ft values of *a* and *d*)	M1 A1ft
	= <u>70 800</u>	A1cao (3) **[8]**
	Note: If the sequence is considered 'backwards', an equivalent solution may be given using *d* = 60 with *a* = 600 and *l* = 2940 for part (b). This can still score full marks. **Ignore labelling of (a) and (b)**	
(a)	1st M1 for an attempt to use 2400 and 600 in $a + (n-1)d$ formula. Must use both values i.e. need *a* + *pd* = 2400 <u>and</u> *a* + *qd* = 600 where *p* = 8 or 9 and *q* = 38 or 39 (any combination) 2nd M1 for an attempt to solve <u>their</u> 2 linear equations in *a* and *d* as far as *d* =… A1 for *d* = $\pm$ 60. Condone correct equations leading to *d* = 60 or *a* + 8*d* = 2400 and *a* + 38*d* = 600 leading to *d* = - 60. They should get penalised in (b) and (c). **NB This is a "one off" ruling for A1. Usually an A mark must follow from their work.** ALT 1st M1 for (30*d*) = $\pm$ (2400 - 600) 2nd M1 for $(d =) \pm \dfrac{(2400 - 600)}{30}$ A1 for *d* = $\pm$ 60 *a* + 9*d* = 600, *a* + 39*d* = 2400 **only** scores M0 BUT if they solve to find *d* = $\pm$ 60 then use ALT scheme above.	
(b)	M1 for use of <u>their</u> *d* in a **correct** linear equation to find *a* leading to *a* = … A1 their *a* must be compatible with their *d* so *d* = 60 must have *a* = 600 and *d* = -60, *a* = 2940 So for example they can have 2400 = *a* + 9(60) leading to *a* = … for M1 but it scores A0 Any approach using a list scores M1A1 for a correct *a* but M0A0 otherwise	
(c)	M1 for use of a correct S_n formula with *n* = 40 and at least one of *a*, *d* or *l* correct or correct ft. 1st A1ft for use of a correct S_{40} formula and both *a*, *d* or *a*, *l* correct or correct follow through ALT Total = $\dfrac{1}{2}n\{a + l\} = \dfrac{1}{2} \times 40 \times (2940 + 600)$ (ft value of *a*) M1 A1ft 2nd A1 for 70800 only	

Question number	Scheme	Marks
Q7	(a) $a+9d = 150+9\times 10 = 240$	M1 A1 (2)
	(b) $\frac{1}{2}n\{2a+(n-1)d\} = \frac{20}{2}\{2\times 150+19\times 10\}$, $= 4900$	M1 A1, A1 (3)
	(c) Kevin: $\frac{1}{2}n\{2a+(n-1)d\} = \frac{20}{2}\{2A+19\times 30\}$ Kevin's total = $2\times$"4900" (or "4900" = $2\times$ Kevin's total) $\frac{20}{2}\{2A+19\times 30\} = 2\times$"4900" $A = 205$	B1 M1 A1ft A1 (4) **[9]**
	(a) M: Using $a+9d$ with at least one of a = 150 and d = 10. Being 'one off' (e.g. equivalent to a + 10d), scores M0. Correct answer with no working scores both marks. (b) M: Attempting to use the correct sum formula to obtain S_{20}, with at least one of a = 150 and d = 10. If the wrong value of n or a or d is used, the M mark is only scored if the correct sum formula has been quoted. 1st A: Any fully correct numerical version. (c) B: A correct expression, in terms of A, for Kevin's total. M: Equating Kevin's total to twice Jill's total, or Jill's total to twice Kevin's. For this M mark, the expression for Kevin's total need not be correct, but must be a linear function of A (or a). 1st A: (Kevin's total, <u>correct</u>, possibly unsimplified) = 2(Jill's total), ft Jill's total from part (b). <u>'Listing' and other methods</u> (a) M: Listing terms (found by a correct method with at least one of a = 150 and d = 10), and picking the <u>10th</u> term. (There may be numerical slips). (b) M: Listing sums, or listing and adding terms (found by a correct method with at least one of a = 150 and d = 10), far enough to establish the required sum. (There may be numerical slips). Note: <u>20th term is 340</u>. A2 (scored as A1 A1) for 4900 (clearly selected as the answer). If no working (or no legitimate working) is seen, but the answer 4900 is given, allow one mark (scored as M1 A0 A0). (c) <u>By trial and improvement</u>: Obtaining a value of A for which Kevin's total is twice Jill's total, or Jill's total is twice Kevin's (using Jill's total from (b)): M1 Obtaining a value of A for which Kevin's total is twice Jill's total (using Jill's total from (b)): A1ft Fully correct solutions then score the B1 and final A1. The answer 205 with no working (or no legitimate working) scores no marks.	

Question Number	Scheme	Marks
9. **(a)**	$a + 29d = 40.75$ or $a = 40.75 - 29d$ or $29d = 40.75 - a$	M1 A1 (2)
(b)	$(S_{30}) = \frac{30}{2}(a+l)$ or $\frac{30}{2}(a+40.75)$ or $\frac{30}{2}(2a+(30-1)d)$ or $15(2a+29d)$	M1
	So $1005 = 15[a + 40.75]$ *	A1 cso (2)
(c)	$67 = a + 40.75$ so $\underline{a = (£)\ 26.25 \text{ or } 2625\text{p or } 26\tfrac{1}{4}}$ NOT $\frac{105}{4}$	M1 A1
	$29d = 40.75 - 26.25$	M1
	$= 14.5$ so $\underline{d = (£)0.50 \text{ or } 0.5 \text{ or } 50\text{p}}$ or $\frac{1}{2}$	A1 (4)
		8
	Notes	
(a)	M1 for attempt to use $a + (n - 1)d$ with $n = 30$ to form an equation . So $a + (30 – 1)d$ = any number is OK A1 as written. Must see $29d$ not just $(30 - 1)d$. Ignore any floating £ signs e.g. $a + 29d = £40.75$ is OK for M1A1 These two marks must be scored in (a). Some may omit (a) but get correct equation in (c) [or (b)] but we do not give the marks retrospectively.	
	Parts (b) and (c) may run together	
(b)	M1 for an attempt to use an S_n formula with $n = 30$. **Must see one of the printed forms.** ($S_{30} =$ is not required) A1cso for forming an equation with 1005 and S_n and simplifying to printed answer. Condone £ signs e.g. $15[a + £40.75] = 1005$ is OK for A1	
(c)	1st M1 for an attempt to simplify the given linear equation for a. Correct processes. Must get to $ka = \dots$ or $k = a + m$ i.e. one step (division or subtraction) from $a = \dots$ Commonly: $15a = 1005 - 611.25\ (= 393.75)$ 1st A1 For $a = 26.25$ or 2625p or $26\tfrac{1}{4}$ NOT $\frac{105}{4}$ or any other fraction 2nd M1 for correct attempt at a linear equation for d, follow through their a or equation in (a) Equation just has to be linear in d, they don't have to simplify to $d = \dots$ 2nd A1 depends upon 2nd M1 and use of correct a. Do not penalise a second time if there were minor arithmetic errors in finding a provided $a = 26.25$ (o.e.) is used. Do not accept other fractions other than $\frac{1}{2}$ **If answer is in pence a "p" must be seen.**	
Sim Equ	Use this scheme: 1st M1A1 for a and 2nd M1A1 for d. Typically solving: $1005 = 30a + 435d$ and $40.75 = a + 29d$. If they find d first then follow through use of their d when finding a.	