Q1		Answers	Notes	Total
	a	**AM1** .1 Two from: • Subtract correct y-coordinates • Subtract correct x-coordinates • Divide their difference in y by their difference in x .2 Correctly calculate gradient of AB .3 Correctly calculate gradient of AD .4 Showing that the two gradients are opposite reciprocals **AM2** .1 Correct length of AB .2 Correct length of AD .3 Correct length of BD .4 Show that the value of AB^2+AD^2 is equal value of BD^2 **AM3** .1 Two from: • Subtract correct y-coordinates • Subtract correct x-coordinates • Write vector as (x,y) OE .2 Correct vector AB .3 Correct vector AD .4 Show that the dot product =0	**AM1** .1 Two from (for AB or AD). Ex for AB: • 10-4 or 4-10 or 6 or -6 • 9- -3 or -3-9 or 12 or -12 • $\frac{\text{their}(10-4)}{\text{their}(9--3)}$ .2 6/12 OE .3 -2 OE .4 “they are opposite reciprocals” WTTE or 0.5x-2 =-1 .4 ACCEPT negative instead of opposite **AM2** .1 $\sqrt{6^2+12^2}$ OE or 13.4(16…) OE .2 $\sqrt{4^2+8^2}$ OE or 8.9(44…)OE .3 $\sqrt{8^2+14^2}$ OE or 16.1(2…) (OE .4 Ex: 260=180+80 **AM3** .1 Two from: • 10-4 or 4-10 or 6 or -6 • 9- -3 or -3-9 or 12 or -12 • (Their12,their6) OE .2 (12,6) .3 (4,-8) .4 12x4-6x8=0	**4**

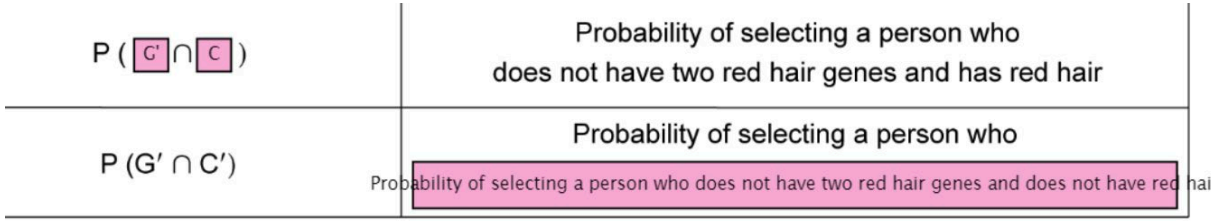
	b	.1 Correct equation involving *x* and their gradient of AB used in a) .2 Correct value of *x*	.1 their $\frac{6}{12}=\frac{2--4}{x-1}$ OE or $\frac{8}{-4}=\frac{10-2}{9-x}$ OE or $9-x=-4$ OE .2 (*x* =)13	**2**
	c	.1 Correctly substitute into distance formula .2 Correctly calculate their length of AB after substitution into distance formula .3 Correctly write their AB in simplest surd form	.1 $\sqrt{(9--3)^2+(10-4)^2}$ OE .2 their $\sqrt{180}$ or their13.4(164...) .2 ACCEPT their AB correctly calculated after one mistake examples: $(\sqrt{(9--3)^2+(10-4)}=)12.2(47...)$ or $(\sqrt{(9--3)^2}+(10-4)^2=)48$ .3 their $6\sqrt{5}$ .3 DO NOT ACCEPT if their surd does not need simplification	**3**
	d	.1 Correctly substitute into mid-point formula for x OR y coordinates .2 Correct coordinates of point E	.1 $\frac{1+9}{2}$ or $\frac{-3+\text{their}13}{2}$ OR $\frac{10-4}{2}$ or $\frac{4+2}{2}$ .2 (5 , 3) OE ACCEPT 5,3	**2**

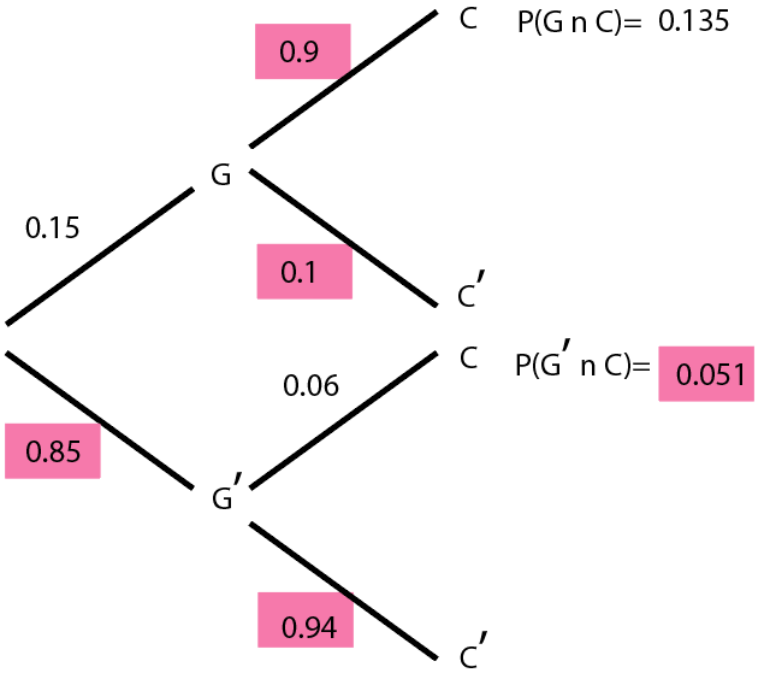
Q2		Answers	Notes	Total
	a	.1 Correctly write **the** first simultaneous equation .2 Correctly write **the** second simultaneous equation .3 Correct **steps** to solve **the** system of equations for one unknown .4 Correctly substitute x=0.5 or y=3 into one of the equations and show calculation of the other AG x=0.5 and y =3	.1 6x+3y = 12 ACCEPT using inequality .2 6x + 8x + 4y =19 or 14x + 4y =19 ACCEPT using inequality .3 By elimination. Example: $4\times(6x+3y=12)$ and $3\times(14x+4y=19)$ ACCEPT "4 times eq1 and 3 times eq2" And 42x-24x=57-48 OE Or by substitution y = 4-2x or x = 2-0.5y or 4y = 19-14x or 14x = 19-4y OE And 6x+3(4-2x)=12 OE .3 DO NOT ACCEPT if the solution is incorrect .4 Ex: 6(0.5)+3y=12 and y=9/3 OE ACCEPT showing simplified equality with one variable .4 ACCEPT substituting 0.5 and 3 into one equation Ex: 6(0.5)+3(3)=12	**4**
	b	.1 Correct route .2 Correct minimum distance for the correct path	.1 3+4+12+8+7+9+5+14 OE ACCEPT in letters .1 ACCEPT passing by all paths Ex: ABDECEBCA or ACEDBECBA .1 ACCEPT if only 6 of the paths are added Ex: 3+4+12+8+5+14 .1 ACCEPT use of the same value (I.e. repeating a paths) .2 62 (km)	**2**
	c	.1 Correctly add a route with adjacent nodes and passing by all the nodes .2 Correct route .3 Correct minimum distance	.1 Ex: 3+4+12+8+7+9+5+14 =62 ACCEPT in letters .2 ABDECBA or ABCEDBA OE ACCEPT 3+4+12+7+5+3 or 3+5+7+12+4 +3 .2 ACCEPT rout passing by all nodes and with a seen total of 40 or less Ex: the route ABDECA (40) or ABCEBDBA (36) for bp2 .3 (3+4+12+7+5+3=)34 (km)	**3**

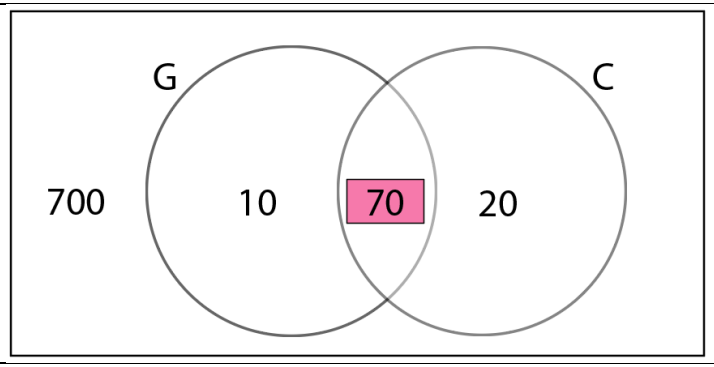
Q3 Ext		Answers	Notes	Total
	a	Apply power rule on at least one term and show equality or ratio 2 AG	Ex: $2x\log 2=\log 2^2=\log 4$ ACCEPT log4/log2 =2log2/log2 ACCEPT using other terms Ex: log256/log16=8log2/4log2 DO NOT ACCEPT only log4 / log2	**1**
	b	**AM1** .1 Correctly apply law of product or law of quotient .2 Correctly write the total of left-hand side as one log .3 Correct write the fifth term in log form **AM2** .1 Correctly write <u>two</u> of the three terms in terms of log2 .2 Correctly write the total of left-hand side in terms of log2 .3 Correct write the fifth term in log form	**AM1** .1 Log(1024*256) or log(256/4) OE .2 log65536 ACCEPT log(1024x256/4) .3 log 256^2 OE .3 ACCEPT log65536/log256=2 .3 ACCEPT calculating n=5 using the GS general rule and r=2 only if bp2 is awarded **AM2** .1 10log2+8log2-2log2 .2 16 log 2 ACCEPT 10log2+8log2-2log2 .3 $\log 2^{16}$ OE	**3**
	c	**AM1** .1 Correctly write the first 6 terms in terms of log2 .2 Correctly write down the sum of first 6 terms in terms of log2 **AM2** .1 Correctly substitute into the sum of GP formula .2 Correctly write down the sum of first 6 terms in terms of log2	**AM1** .1 log2,2log2,4log2,8log2,16log2,32log2 .1 ACCEPT only 4 correct terms .2 63 log2 **AM2** .1 (S6=)log2 x $(2^6-1)/(2-1)$ ACCEPT seeing only (2^6-1)/1 OE .2 63log2	**2**

Q4		Answers	Notes	Total
	a	.1 Correctly substitute into the sine rule .2 Correctly calculate their s for their trig ratio .3 Their s correct to three significant figures	.1 s/sin60=3/sin105 s=3sin60/sin105 OE .2 their2.689(726...) ACCEPT 2.7 .2 ACCEPT only if their seen trigonometric sine rule operation involves side=3 and two of the angles: 105, 60, 15 .2 ACCEPT using the 3 sig fig rounded value of the trig function only if bp1 is awarded .3 their2.69 .3 ACCEPT their2.69 only if their used sine rule is with maximum two mistakes and their bp2 can be rounded	**3**
	b	1	ACCEPT (2,1) OE	**1**
	c	.1 Correctly substitute 0 and 2.6 into the parabola .2 Correctly re-arrange their equation to find a AG 0.4	.1 $a(0-2)^2+1=2.6$ or 2.6 = 4a+1 ACCEPT substituting 4 and 2.6 .2 (a =)1.6/4 ACCEPT 1.6=4a	**2**

	d	**AM1 (working with $(x-2)$)** .1 Correctly substitute 1.4 into the equation .2 Correctly rearrange to have $(x-2)^2$ on one side .3 Correctly square root both sides of their quadratic from .2 .4 Correctly identify 3 **AM2 (expanding $(x-2)^2$)** .1 Correctly substitute 1.4 into the equation .2 Correct quadratic after expansion and multiplying by 0.4 .3 Correctly factorise their quadratic from .2 or correctly substitute their coefficients into quadratic formula .4 Correctly identify 3 **AM3 (working with numbers)** .1 Correctly substitute a value for x into the equation and calculate corresponding value of y .2 Correctly substitute 1 into the equation and equate with 1.4 .3 Correctly substitute 3 into the equation and equate with 1.4 .4 Correctly identify 3	**AM1** .1 $1.4 = 0.4(x-2)^2 + 1$ or $0.4 = 0.4(x-2)^2$ .2 $0.4/0.4 = (x-2)^2$ or $1=(x-2)^2$ .3 x-2 =+-their1 OE ACCEPT x-2=their1 or x-2=their1 .4 (L=) 3 (m) **AM2** .1 $1.4=0.4(x-2)^2 + 1$ .2 $0.4x^2-1.6x+1.6+1 = 1.4$ or $x^2-4x+3=0$ OE .3 their (x-3)(x-1) or $\frac{-\text{their}1.6 \pm \sqrt{\text{their}1.6^2 - 4(0.4 \times \text{their}1.2)}}{2(0.4)}$ OE .3 In the case when their bp2 is in the form $ax^2 + c = 0$, ACCEPT correctly <u>solving</u> their quadratic for x^2 Ex: if their bp2 is $0.4x^2 + 10 = 0$ and $x^2 = \frac{-10}{0.4}$ .4 (L=) 3 (m) **AM3** .1 Ex: $0.4(5-2)^2 + 1 = 4.6$ .2 $0.4(1-2)^2 + 1 = 1.4$ .3 $0.4(3-2)^2 + 1 = 1.4$ .4 (L=) 3 (m) **For Any AM:** Seeing only bp2 implies bp1 (so award **2 marks**) Seeing only bp3 implies bp1 and bp2 (so award **3 marks**)	**4**

Q5		Answers	Notes	Total
	a	.1 correct probability .2 correct statement	 .1 P(G'∩C) ACCEPT P(C∩G') ACCEPT using g instead of G and c instead of C .2 (Probability of selecting a person who) does not have two red hair genes and does not have red hair .2 ACCEPT no red hair genes and no red hair WTTE .2 ACCEPT not have two genes and not have red hair WTTE .2 ACCEPT no red hair genes nor red hair WTTE .2 ACCEPT no red hair genes or red hair WTTE .2 ACCEPT neither red hair genes nor red hair WTTE .2 ACCEPT neither red hair genes and red hair WTTE	**2**

	b	.1 Correctly write 0.85 and the complementary in the 2nd branch (**their**0.1 and 0.94) .2 Correctly write the P(C/G) as 0.9 .3 Correctly write **their** P(G'nC) ACCEPT rounded to 2dp, Ex: their 0.05		**3**
	c	.1 Correctly add 0.135 to their 0.051 from b) to find P(C) .2 Correct reason based on their bp1 AG independent	.1 (P(C)=)0.135+their0.051 =0.186 .2 Either P(C)xP(G) not equal P(CnG) ie:0.15xtheir0.186 is not equal 0.135 OR P(C/G) is not equal P(C) i.e. their0.9 is not equal 0.15xtheir0.186	**2**
	d	.1 Correct lower bound .2 Multiply **their0.186 seen in c) or here in d)** by their 15450 .3 correctly write their result as a whole number after **multiplying a probability** by their15450	.1 15450 .2 their0.186xtheir15450 ACCEPT their0.186x15500 .3 their2873 OE ACCEPT 2874 .3 ACCEPT only if bp1 or bp2 are awarded .3 ACCEPT their whole number to be a rounding up or down for their result	**3**

	e	correctly write 70 in the appropriate place		**1**
	f	.1 correct P(C) OR ratio .2 correctly write **their** N that satisfies **their ratio** $\frac{\text{their}90}{800}=\frac{1}{N}$ before rounding .3 correctly round up their N	.1 $(\frac{1}{N}=)\frac{90}{800}$ or 0.1125 OE OR 90:800 .1 ACCEPT ratio in any notation Ex: 90 to 800 .1 ACCEPT their90 used in bp1 instead of 90 only if it is equal to 20+their70 from (g) .2 $(\frac{800}{\text{their}90}=)\text{their}\,8.88(8...)$ ACCEPT $\frac{\text{their}90}{800}=\frac{1}{\text{their}\,8.88(8...)}$ OE .2 ACCEPT (N=)8.88 or 8.9 .2 ACCEPT their90 used in bp2 being any number .2 ACCEPT if their N satisfies their ratio $\frac{90}{\text{their}800}=\frac{1}{N}$ .3 their 9 .3 ACCEPT only if their bp2 needs rounding .3 ACCEPT only if bp1 or bp2 awarded	**3**

	g	correctly subtract their11.25 from their18.6 seen in c) or d) or calculated here	(their18.6-their11.25=) their7.(35)(%) ACCEPT their11.25 even if it is incorrect ACCEPT only if percentage ACCEPT positive or negative Ex: (18.6-20=)-1.4(%) DO NOT ACCEPT their7.35(%) without working	**1**

Q6	Answers	Notes	Total
a	30<A ≤40	ACCEPT in any notation Ex: 30<A<40 or 30≤A<40 or 30≤A≤40 30 – 40 30 to 40 DO NOT ACCEPT 31≤A≤40 OE	**1**
b	.1 Correct mid-interval values .2 Add the product of their mid-interval values by frequency .3 Divide **their sum** by 331 .4 Correctly divide **the sum of their <u>products</u>** by 331	.1 5,15,25,35,45,55 ACCEPT seeing only four correct .2 $5\times59+15\times72+25\times54+35\times126+45\times15+55\times5$ OE or 8085 .2 ACCEPT seeing only four correct products OE added .3 $\frac{\text{their sum}}{331}$ ACCEPT their sum being any sum .4 their 24.(425...) ACCEPT only if 0<their24.(425…)<60 .4 DO NOT ACCEPT if it is the result of a sum divided by 331 Ex: ((5+15+25+35+45+55)/331=)0.54(38…)	**4**
c	.1 Apply the ratio on 72 .2 Correct operation based on the data 115 AG	.1 $72\times\frac{7}{9}$ OE OR $72\times\frac{2}{9}$ OE .1 ACCEPT “9 is 72 so 7 is” OE .2 56+59 or 59+72-16 or 131-16 ACCEPT 115-59=56 or 131-115=16 .2 ACCEPT in words. Ex: add 56 to 59 **Note:** Seeing only bp2 award **1 mark** Ex: seeing only 56+59=115 or 115-59=56 award **1 mark**	**2**
d	.1 Multiply 1400 or 90 by 15% OE .2 Correct result	.1 0.15x1400 or 210 or 0.15x90 or 13.5 OE ACCEPT 1400x90 or 126000 .2 (0.15x1400x90=)($)18900	**2**

6	e		10

Mark	1	2
Identify factors (F)	**Two** from the four factors below mentioned in the factors box • Number of children or number of users of playground ACCEPT under 14 ACCEPT using numbers even if incorrect. Ex: there are 56 children • Number of adults or number of users of fitness centre ACCEPT above 14 ACCEPT using numbers even if incorrect. Ex: there are 200 adults • Needed area per child or children per m^2 ACCEPT area or size of playground ACCEPT using numbers even if incorrect. Ex: $50m^2$ for 24 children or 3 m^2 per child • Cost ACCEPT money spent ACCEPT using numbers even if incorrect. Ex: ($)15 per m^2 for playground or ($)1000 for fitness	**Three** from the four factors mentioned in the factors box
	ACCEPT Factors that WTTE Ex: "not everyone is going to use the playground" is WTTE for the 1st factor Ex: "not everyone uses the fitness: is WTTE for the 2nd factor The use of "residents scheduled for" instead of "number of". The use of the word "gym" instead of "fitness centre". "Number of people" or "Number of residents in apartments" or "Number of users" instead of either the 1st factor or the 2nd factor but not both "Number of children in $15m^2$" instead of either the 1st factor or the 3rd factor but not both "People under 14 and older" as the 1st factor only "cost of maintenance for the playground/recreational area" as the 4th factor only "Residents scheduled for the playground and for the gym" as the 1st and 2nd factors	
	DO NOT ACCEPT Incomplete factors (using just a word). Examples: Number or Age or Area or recreational area or maintenance or children or adults Factors related to budget. Example: Maintenance budget or number of apartments or the ($)1400 or the 15% or ($)18900 "Budget of the recreational area"	

	1	2	3	4	5

<table>
<tr>
<td rowspan="3">Calc. (C)

ACCEPT rounding in calculations</td>
<td rowspan="2">
Weak attempt to calculate maintenance cost for area of playground (involves one correct operation)
Ex:

6 in 15 so 115 is…
$\frac{6}{15} = 0.4$ OE
$\frac{15}{6} = 2.5$ OE
$\frac{115}{6} = 19.16...$ OE or 20
$15 \times 115 = 1725$
Multiply area by 2
Ex: $15 \times 2 = 30$
Ex: 115x2=230

</td>
<td rowspan="2">
Good attempt to calculate maintenance cost for area of playground (involves two correct operations)
Ex:

$(\frac{15}{6} \times 115$ or $\frac{115}{0.4} =) 287.5$
ACCEPT [285,300]
$(\frac{115}{6} \times 2 =) 38.33...$
ACCEPT [38,40]
$(15 \times 115 \times 2 =)$ ($)3450
(30/6=)($)5

Note: For all the above, only one more remaining operation is needed to reach the maintenance cost.
</td>
<td>
Correctly calculate the maintenance cost for the area of playground

$(\frac{15}{6} \times 115 \times 2 =)($)575

Ex:
$(15 \times 2 \times 19 =)($)570$
$(15 \times 2 \times 20 =)($)600$
$(290 \times 2 =)($)580$

ACCEPT [570,600]
</td>
<td rowspan="3">
Correctly calculate the maintenance cost for the area of playground monthly or yearly

(monthly)
ACCEPT [570,600]

(yearly)
ACCEPT [6840,7200]

AND

Correctly identify the maintenance cost for area of fitness ($)1200
</td>
<td rowspan="3">
Correctly calculate the total cost for recreation area monthly or yearly

(monthly)
(600+1200=)
ACCEPT [1770,1800]

(yearly)
(600x12+1200x12=)
ACCEPT [21240,21600]
</td>
</tr>
<tr>
<td>
OR
Correct number of fitness centre users
$(331 - 115 =) 216$
</td>
<td>
OR
Correctly identify the maintenance cost for area of fitness ($)1200
</td>
<td>
OR
Good attempt to calculate maintenance cost for area of playground (involves two correct operations)
AND
Correctly identify the maintenance cost for area of fitness ($)1200
</td>
</tr>
<tr>
<td>
OR
Correctly identify the maintenance cost for area of fitness based on their number of adults
Their($)1200 (for their216 adult)
</td>
</tr>
</table>

Mark	1	2
Accuracy (A)	Correct sensible rounding seen in any calculation and ACCEPT not seeing the value before rounding Ex: Round their19.1666 to their 19.2 or their19 or their20 ACCEPT 115/6=19.2 Round their 287.5 to 285 or 288 or 290 or 300	
	ACCEPT Rounding up or down No rounding of exact calculations leading to whole numbers only if C3 is achieved "my calculations do not need rounding" WTTE and C1 or C2 achieved with a result of a whole number	
	DO NOT ACCEPT Insensible rounding. In particular, rounding to two decimal places. Ex: 19.16666 = 19.17	

<table>
<tr><th>Mark</th><th>1</th><th>2</th></tr>
<tr><td>Justify (J)</td><td>ACCEPT ONLY IF C1 is achieved

Justify suitability by comparing their calculations of maintenance cost to their budget from d)
Ex:
Maintenance cost exceeds the budget so not good WTTE
Maintenance cost is less than budget so it is fine WTTE
The suitable budget should be $\text{their}1800\times12=(\$)\text{their}21600$ per year WTTE
The suitable budget should be $(\frac{\text{their}1800}{90}=)(\$)\text{their}20$ per apartment per month WTTE
ACCEPT
<u>Incorrect justification</u> by comparing correct monthly maintenance cost with their yearly budget
Ex: 1800 less than 18900, <u>so it is suitable</u>
OR
The correct cost and their corresponding (monthly or yearly) budget seen OE without comment (at least C4 achieved)
Ex: seeing the cost as ($)1800 and the budget as (their18900/12=)($)their1575
Ex: seeing the cost as ($)21240 and the budget as their ($)18900
Ex: the remaining for fitness is 1575-575=($)1000 and we see cost fitness ($)1200
OR
General justification of suitability
Ex:
-The spaces calculated are just estimates so calculations are estimates
-Collect more money for maintenance just in case
-Number of persons in each category will vary overtime and hence the areas need to consider being a bit bigger for the future use. WTTE
- Some families may get new babies and children number increases so we need to have the recreation spaces a bit bigger
-Some of the children will become adults soon so we need to have the fitness spaces a bit bigger</td><td>ACCEPT ONLY IF C4 is achieved

Justify suitability by comparing the correct calculations of maintenance cost to their budget from d)

The maintenance cost exceeds budget so not good WTTE
The maintenance cost is less than budget so it is fine WTTE
The suitable budget should be $1800\times12=(\$)21600$ per year WTTE
The suitable budget should be $(\frac{1800}{90}=)(\$)20$ per apartment per month WTTE
ACCEPT
<u>Correct justification implied</u> by comparing correct monthly maintenance cost with their yearly budget
Ex: The monthly cost is 1800 and the budget is 18900 <u>so not suitable</u>

DO NOT ACCEPT
Justification by comparing monthly value with yearly value
Ex: 1800 less than 18900 so it is suitable</td></tr>
<tr><td></td><td colspan="2">NOTE
ACCEPT Seeing just the word ”budget” when comparing instead of their actual value in part (d). Check their value in part (d) when marking the justification</td></tr>
</table>

<table>
<tr><th colspan="2">Q7</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td></td><td>a</td><td>Correctly place 9 and 11</td><td>
<table>
<tr><th>Stage (n)</th><th>Number of squares (Q)</th></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>2</td><td>3</td></tr>
<tr><td>3</td><td>5</td></tr>
<tr><td>4</td><td>7</td></tr>
<tr><td>5</td><td>9</td></tr>
<tr><td>6</td><td>11</td></tr>
</table>
</td><td>1</td></tr>
<tr><td></td><td>b</td><td>.1 correctly describe one pattern for Q in words

.2 correctly describe a second pattern for Q in words</td><td>ACCEPT complete terminology only, for example (below are four different descriptions)
(The) odd numbers
increasing by 2, adds 2, goes up by 2, moving up by 2
difference 2, common difference 2, linear with difference 2, arithmetic with difference 2
second difference is zero

DO NOT ACCEPT incomplete terminology, for example: Arithmetic, linear, increasing by a constant, constant difference

DO NOT ACCEPT general description, for example:

Integers, whole numbers, positive

DO NOT ACCEPT the rule in words or description related to n for example: 2 times n minus 1, n multiplied by 2 minus 1, WTTE
DO NOT ACCEPT
n goes up by 1
It is increasing
general rules in terms of n, example: Q = 2n-1
Note, in the case when they have more than two different patterns:

If two are accepted and the rest are all correct: award 2 marks
Ex: odd numbers and adds 2 and Second difference is zero and it is 2 times n then subtract 1.
Ex: odd numbers and goes up by 2 and linear and difference is 2

If two are accepted and any of the rest is incorrect: award 1 mark
Ex: increases by 2 and Second difference is zero and it is divisible by 2
If only one is accepted, ignore the rest and award 1 mark</td><td>2</td></tr>
</table>

	c	.1 the correct general rule .2 the correct simplified general rule with correct notation	.1 (Q =) 2n-1 or (Q =) (2n–1) or Q =2x-1 or Q =1+2(n-1) Q=2xn-1 or Q=2*n-1 .2 Q = 2n–1 ACCEPT Q=(2n-1) ACEEPT using Q_n instead of Q ACCEPT Q=n2-1 ACCEPT using q and N DO NOT ACCEPT description in words **SC 1 mark in 8d and consequently mark 8e as appropriate** If NR in 8d and correct general rule seen in 8c or 8e If they write in 8d the rule in terms of u_1 and d Ex: $u_1 + (n-1)d$ then in 8e, when they test or verify, they directly use 1 instead of u_1 and 2 instead of d	**2**
	d	·1 Correctly substitute n ≥ 5 into their general rule ·2 Correctly calculate their value of P after substituting n ≥ 5 ·3 Recognize that their result is the same as the correctly predicted value	.1 Ex: 2x5-1 ·2 Ex: 9 .3 “the same as when we continue the pattern” WTTE and states how Ex: For n=7, 13 is obtained from pattern of adding 2 to 11 For n=7, 13-2=11 ·3 ACCEPT if their value from .2 is the same as their value in the table in part a) or seen here in part d) Ex: we see their calculated P=9 and we see P=9 in their table **SC for 1 mark** Correctly test their general rule by applying the steps of verification mentioned in the left column with a value of $n \leq 4$ **SC for 1 mark** verify with n ≥ 5 the correctly described pattern or recursive rule from part b) or c)	**3**
	e	Correctly write the value of u1 and the value of d	u1=2 and d=3 ACCEPT 2+(n-1)x3	**1**
	f	Correct substitution of 7 into the 2+(n-1)x3	2+(7-1)x3 or 2+6x3 ACCEPT incorrect notation ACCEPT in words DO NOT ACCEPT other operations DO NOT ACCEPT substitution in the recursive rule	**1**

Glossary for task 3

Term used	**Clarification**
General rule	Rule in terms of only n (if they use x, it is still general rule but penalise in notation)
The general rule	The correct general rule in terms of only n (if they use x, it is still the general rule but penalise in notation)
Their general rule	Incorrect rule but in terms of only n (if they use x, it is still their general rule but penalise in notation)
Their rule	Correct rule not in terms of only n
Recursive rule	$U_n = U_{n-1} + d$ or $U_{n+1} = U_n + d$ or $B_{n+1} = B_n + 12n + 1$

We accept subsequent use of their general rule (when marking D,T,V,J,N, and L) provided it is of similar complexity. In general, the complexity of the rule depends on its form. The table below shows examples.

The general rule	ACCEPT for their general rule	DO NOT ACCEPT for their general rule
$Q = 2n - 1$	linear	constant
$B = 6n^2 - 5n + 1$	Qudratic or exponential	Linear or constant

Stage number (n)	Area of shape (B)
1	2
2	15
3	40
4	77
5	126
6	187
7	260
8	345

Mark	1	2	3	4
Predictions (P)	Correctly predict two terms for *B* ACCEPT whether in the table or in the response box			
Description (D) **ACCEPT incorrect terminologies, notation errors, non-simplified rule, or rule in words but penalize in notation (N)** **Ignore additional incorrect patterns**	Correctly describe a pattern in words or recursive rule for *B* ($B_{n+1} = B_n + 12n + 1$ or $B_n = Q(n + Q)$) Examples of different patterns: <u>(can be seen anywhere in the response)</u> even then odd then even then odd difference is odd the increase increases by 12 first difference increases by 12 second difference 12 It is quadratic ACCEPT patterns described with incorrect terminologies or recursive rule with incorrect notation but penalise in notation (N).	Correctly describe two patterns in words for *B* (or one pattern and the recursive rule for *B*)	Correctly describe two patterns in words for *B* (or one pattern and the recursive rule for *B*) AND Valid attempt to write down a general rule for *B*	Correctly describe two patterns in words for *B* (or one pattern and the recursive rule for *B*) **AND** Correctly write down the general rule for *B*
	OR Valid attempt to write down a general rule for *B* Ex: $B = 6n^2$ Ex: An exponential rule that satisfies one value for n	**OR** Correctly describe a pattern in words for *A* (or the recursive rule for *B*) AND valid attempt to write down a general rule for *B*	**OR** Correctly write down the general rule for *B* $B = 6n^2 - 5n + 1$	
	DO NOT ACCEPT Descriptions of how bricks are added Goes up by 13,25,37,… Recursive rule in words Second difference constant			

<table>
<tr><th>Mark</th><th>1</th><th>2</th><th>3</th></tr>
<tr><td rowspan="3">Testing (T)</td><td>Attempt to test their general rule for B using $n \leq 4$

Ex:
Substitute in their general rule for B value of $n \leq 4$</td><td rowspan="2">Correctly test their general rule for B using $n \leq 4$ Ex:
Correctly calculate their value for B in their general rule using $n \leq 4$
AND

Recognise that their correctly calculated value for B is the same as the given value.</td><td rowspan="3"></td></tr>
<tr><td>OR
Correctly test their described pattern or their rule (e.g. the recursive rule for B or their linear rule for B)</td></tr>
<tr><td></td><td>ACCEPT
seeing their correctly calculated value for B and the given value in the table being equal</td></tr>
<tr><td rowspan="3">Verifying (V)</td><td>Attempt to verify their general rule for B using $n \geq 5$

Ex:
Correctly substitute in their general rule for B value of $n \geq 5$</td><td rowspan="3">Correctly calculate their value for B in their general rule using $n \geq 5$</td><td>Correctly calculate their value for B in <u>the general rule</u> using $n \geq 5$
AND
Recognise that their correctly calculated value for B is the same as the correct predicted value obtained by continuing the pattern</td></tr>
<tr><td>OR
Correctly verify their described pattern or their rule (e.g. the recursive rule for B or their linear rule for B)</td></tr>
<tr><td>ACCEPT
seeing their correctly calculated value for B and the correctly predicted value in the table being equal</td></tr>
</table>

Mark	1	2	3	4
Justify/ proof (J)	**ACCEPT only if D1 is achieved**	**ACCEPT only if they have a general rule for B**	**ACCEPT only if they have the correct general rule for B**	**ACCEPT only if they have the correct general rule for B**
	Attempt to justify <u>their</u> general rule aligned with their notation for <u>their</u> general rule or recursive rule by attempting to find coefficients of quadratic using any method	Correctly justify <u>the</u> general rule aligned with their notation for <u>the</u> general rule for *A* by correctly substituting and finding parameters	Attempt to justify the general rule for B in relation to the context Ex: $B = Q(n+Q)$ And (2n-1)x(3n-1) *Ex :* *B* = 1x2 , 3x5 , 5x8, 7x11,...etc And (2n-1)x(3n-1)	Correctly justify the general rule for B in relation to the context Ex: B=number of Squares times number of bricks placed on the square And (2n-1)x(3n-1)
	OR Weak attempt to justify <u>their</u> general rule for *B* in relation to arithmetic series Ex: Ex: (what is added forms arithmetic sequence with u1=13 and d=12 Ex: realizing B is $S_N = \frac{N}{2}(2u_1 + (N-1)d)$ but using N and d incorrect	**OR** Weak attempt to justify <u>the</u> general rule for *B* in relation to arithmetic series or using numbers in the context Ex: $S_N = \frac{N}{2}(2u_1 + (N-1)d)$ but either N incorrect or d incorrect *Ex :* *B* = 1x2 , 3x5 , 5x8,...etc And either (2n-1) or (3n-1) in the product of the rules	Ex: $S_N = \frac{N}{2}(2u_1 + (N-1)d)$ using N=2n-1 and d=3 **OR** Good attempt to prove by induction	Ex: Substitute N=2n-1 and d=3 in $S_N = \frac{N}{2}(2u_1 + (N-1)d)$ And simplify correctly the $\frac{(2n-1)}{2}(2\times 2 + (2n-1-1)\times 3)$ **OR** Correct proof by induction
	OR Substitute at least two other values of n in their general rule for *B* and say they are the same or hence the rule works WTTE			

<table>
<tr><th>Mark</th><th>1</th><th>2</th><th>3</th></tr>
<tr><td rowspan="4">Notation and terminology (N)</td><td>ACCEPT only if D1 achieved</td><td>ACCEPT only if D3 achieved</td><td>ACCEPT only if D3 achieved</td></tr>
<tr><td rowspan="2">Correct notation of <u>their</u> general rule for B</td><td>Correct notation of <u>the general</u> rule for A in simplest form
$B = 6n^2 - 5n + 1$
ACCEPT using B_n or An instead of B</td><td rowspan="2">Correct notation of <u>the general</u> rule for B in simplest form (see examples in N2)
AND
Correctly describe one pattern in words for B using correct terminology or correct recursive rule for B using correct notation</td></tr>
<tr><td>OR
The notation of <u>the general</u> rule includes errors or not simplified or in words (see examples in N1) <u>AND</u> Correctly describe one pattern in words for A using correct terminology or correct recursive rule for A using correct notation</td></tr>
<tr><td rowspan="2">OR
The notation of <u>the general</u> rule includes errors or not simplified or in words Ex:
B=6xn^2-5n+1
The rule for B is $B = 6n^2 - 5n + 1$
$B = (2n-1)(3n-1)$</td><td>ACCEPT
using U_n instead of B only if they mention that
$B = U_n$</td><td>DO NOT ACCEPT
using * for multiplication
using / for division
using ^ for power
using x instead of n</td></tr>
<tr><td>DO NOT ACCEPT
using * for multiplication
using / for division
using ^ for power
using x instead of n</td><td rowspan="2">DO NOT ACCEPT
if they don't have the general rule for B</td></tr>
<tr><td>OR
Correctly describe one pattern in words for B using correct terminology or correct recursive rule for B using correct notation
$B_{n+1} = B_n + 12n + 1$ or $B_n = B_{n-1} + 12n - 11$ or $B_n = Q(n + Q)$</td><td>DO NOT ACCEPT
if they don't have the general rule for B</td></tr>
</table>

Mark	1	2	3
Communication (L) Organisation and coherence Can be awarded even if there are errors **For items:** Describing pattern and writing rule can be considered an item even if D0 awarded	**At least three** from the following **items** are seen: • describe a pattern in words • write a rule • test their general rule or rule or recursive rule or pattern (at least T1) • verify their general rule or rule or recursive rule or pattern (at least V1) • justify their general rule or rule or recursive rule or pattern (at least J1)	**ACCEPT only if they have a general rule** **At least four** of the following **items** are seen: • describe a pattern in words • write a general rule • test their general rule (at least T1) • verify their general rule (at least V1) • justify their general rule (at least J1) **AND** **For coherence**, they identify the processes correctly. **At least one** from the following: • test • verify • justify Ex: • **For test:** they say "test" and they substitute in their general rule value(s) of $n \leq 4$ only • **For verify:** they say "verify" and they substitute in their general rule value(s) of $n \geq 5$ only • **For justify:** They say "justify" and they write a justification **Note for coherence:** If they say "test and verify" and they substitute in their general rule value(s) of $n \leq 4$ followed by value(s) of $n \geq 5$, consider it as only one identified process	**ACCEPT only if they have the general rule for B** **The following two items must be seen** : • write the general rule for *B* • justify the general rule (at least J2) **AND** **At least two** of the following **items** are seen: • describe a pattern or rule in words • test the general rule (at least T1) • verify the general rule (at least V1) **AND** **For coherence**, they identify the processes correctly. **At least two** from the following: • test • verify • justify Ex: • **For test:** they say "test" and they substitute in the general rule for B value(s) of $n \leq 4$ only • **For verify:** they say "verify" and they substitute in the general rule for B value(s) of $n \geq 5$ only • **For justify:** They say "justify" and they write a justification **Note for coherence:** If they say "test and verify" and they substitute in the general rule value(s) of $n \leq 4$ followed by value(s) of $n \geq 5$, consider it as only one identified process