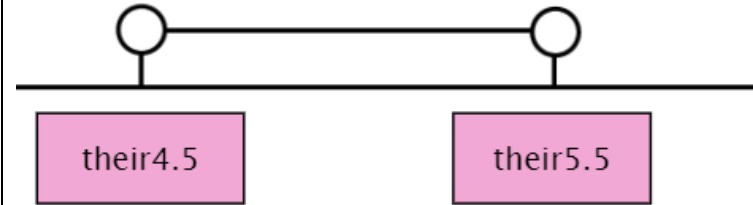


Q1	Answers	Notes	Total																				
a	.1 Correctly write two missing values .2 Correctly write the third missing value	<table border="1"> <thead> <tr> <th></th> <th>Bus</th> <th>Train</th> <th>Car</th> <th>Total</th> </tr> </thead> <tbody> <tr> <th>Students</th> <td>66</td> <td>8</td> <td>20</td> <td>94</td> </tr> <tr> <th>Teachers</th> <td>12</td> <td>29</td> <td>15</td> <td>56</td> </tr> <tr> <th>Total</th> <td>78</td> <td>37</td> <td>35</td> <td>150</td> </tr> </tbody> </table>		Bus	Train	Car	Total	Students	66	8	20	94	Teachers	12	29	15	56	Total	78	37	35	150	2
	Bus	Train	Car	Total																			
Students	66	8	20	94																			
Teachers	12	29	15	56																			
Total	78	37	35	150																			
b	.1 Correct number of students who travel by bus or car .2 Correctly divide their86 by their total number of students in part (a)	.1 86 .2 $(\frac{\text{their}86}{\text{their}150})$ or $\frac{43}{75}$ or 0.57(333...) OE	2																				
c	$\frac{15}{56}$ or 0.267(857...) OE		1																				
d	.1 Correct initial probability .2 Multiply three probabilities without OR with replacement .3 Correctly multiply their three probabilities without replacement .4 Correctly multiply their product of probabilities by 3	.1 $\frac{12}{56}$ OE or $\frac{44}{56}$ OE ACCEPT seeing it embedded in calculations .2 their $(\frac{12}{56} \times \frac{11}{55} \times \frac{44}{54})$ OR their $(\frac{12}{56} \times \frac{12}{56} \times \frac{44}{56})$ or $\frac{99}{2744}$ or 0.036(07..) .3 their $(\frac{5808}{166320})$ or their $(\frac{11}{315})$ or their 0.0349(2...) OE ACCEPT 0.035 .4 their $(\frac{17424}{166320})$ or their $(\frac{33}{315})$ or their 0.1047(61..) ACCEPT 0.105 Accept only if $0 \leq \text{probability} \leq 1$	4																				

Q2	Answers	Notes	Total	
	a	.1 Correctly state 1 st transformation .2 Correctly state 2 nd transformation	.1 vertical stretch or dilation by a factor of 4 ACCEPT enlargement .2 vertical translation of -1 or shift down 1 unit WTTE	2
	b	<p>AM1</p> .1 Correctly rearrange the equation to have $(x - 5)^2$ on one side .2 Correctly square root .3 Correctly calculate their two values of x <p>AM2</p> .1 Correctly expand the equation to have all terms on one side equal zero .2 Correctly factorise their quadratic or correctly substitute their coefficients into quadratic formula .3 Correctly calculate their two values of x	<p>AM1</p> .1 $(x - 5)^2 = \frac{1}{4}$ OE .2 $x - 5 = \pm \frac{1}{2}$ OE ACCEPT $x - 5 = \frac{1}{2}$.3 $x = \text{their}4.5$ AND $x = \text{their}5.5$ OE <p>AM2</p> .1 $4x^2 - 40x + 99 = 0$ ACCEPT $4x^2 - 40x + 100 - 1 = 0$.2 $(2x - 9)(2x - 11)$ or $\frac{40 \pm \sqrt{40^2 - 4 \times 4 \times 99}}{2 \times 4}$ OE ACCEPT solving correctly their simpler quadratic for one value of x .3 $x = \text{their}4.5$ AND $x = \text{their}5.5$ OE ACCEPT their correctly calculated values provided only one mistake in substitution into the quadratic formula	3

c

- .1 Correctly place two items
- .2 Correctly place the rest of the five items



DO NOT ACCEPT if their 4.5 and their 5 are switched in places
DO NOT ACCEPT their inequalities in the boxes e.g. $x > 4.5$

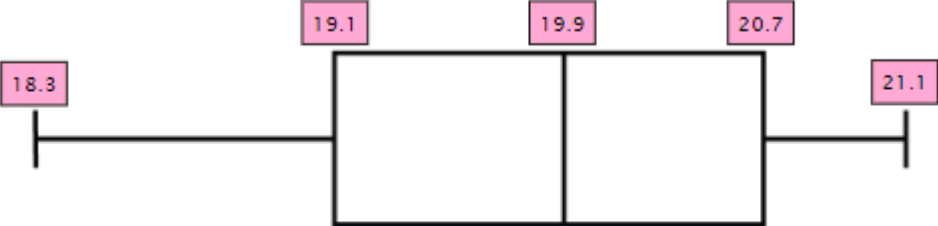
2

Q3	Answers	Notes	Total
a	.1 Correct use of Pythagoras .2 Correct value of height .3 Correct comparison of their 230.48... and 230 Storage unit cannot be lifted into place AG	.1 $50^2 + 225^2 = h^2$ OE .2 ($h =$) 230.48(...) ACCEPT 230.5 .3 their 230.48(...) > 230 or anything that WTTE Ex: 230.48 is greater than height of ceiling .3 ACCEPT 53125 > 52900 or anything that WTTE .3 DO NOT ACCEPT unless .1 or .2 is awarded	3
b	.1 Correctly substitute h , x and 230 into the Pythagoras's theorem .2 Correctly rearrange the formula to have h on one side	.1 $h^2 + x^2 = 230^2$ OE .1 ACCEPT using inequality sign .2 ($h =$) $\sqrt{52900 - x^2}$ OE .2 ACCEPT using inequality sign	2
c	Correctly calculate their h using $x=50$ and 230 into their formula for h	Their 224(.4994432) ACCEPT in the working ex: $50^2 + 224.(499)^2 = hyp^2$ DO NOT ACCEPT 224.49	1
d	.1 Correctly substitute 50 and 220 into volume of cuboid .2 Correct calculate their volume for their height	.1 $50 \times 50 \times 220$.2 their 550 000 (cm ³)	2

Q4	Answers	Notes	Total
a	<p>.1 A correct reason for a pair of congruent angles</p> <p>.2 A correct reason for another pair of congruent angles (AA)</p> <p>◆ABC ~◆ADE AG</p>	<p>Examples of correct reasons for pair of congruent angles:</p> <p>- Angle BAC = Angle DAE or Angle A is common angle or same angle A WTTE. (They have to mention the angle A). ACCEPT angle A = angle A DO NOT ACCEPT they share same angle or they have a common angle</p> <p>- Angle ABC= Angle ADE with reason Ex: BC parallel to DE or parallel lines or corresponding angles ACCEPT Angle B = Angle D instead of Angle ABC= Angle ADE</p> <p>- Angle ACB= Angle AED with reason Ex: BC parallel to DE or parallel lines or corresponding angles ACCEPT Angle C = Angle E instead of Angle ACB= Angle AED</p> <p>DO NOT ACCEPT Angle ABC and Angle ADE are similar or Angle ACB and AED are similar DO NOT ACCEPT seeing only Angle ABC= Angle ADE or Angle ACB= Angle AED without correct reasoning</p>	2

	<p>b</p> <p>AM1</p> <p>.1 Correct ratio</p> <p>.2 Their correct ratio of area (squaring their ratio)</p> <p>.3 Multiply their ratio of area by 9</p> <p>.4 Correctly subtract their area of triangle ADE by 9</p> <p>AM2</p> <p>.1 Correct ratio</p> <p>.2 Correctly calculate length BC</p> <p>.3 Correctly calculate their length of DE</p> <p>.4 Correctly calculate their area of trapezium</p>	<p>AM1</p> <p>.1 $\frac{7}{3}$ or 0.428(57...) OE ACCEPT $\frac{3}{7}$ OE</p> <p>.2 $(\text{their } \frac{7}{3})^2$ OE</p> <p>.3 $\text{their } (\frac{7}{3})^2 \times 9$ or 49</p> <p>.3 ACCEPT seeing their $\frac{7}{3} \times 9$ or 21 BUT DO NOT ACCEPT <i>their</i> $\frac{3}{7} \times 9$</p> <p>.4 $(\text{their } 49 - 9 =)$ their 40 (cm²) Accept only if positive</p> <p>AM2</p> <p>.1 $\frac{7}{3}$ or 0.428(57...) OE ACCEPT $\frac{3}{7}$ OE</p> <p>.2 $(9 = \frac{1}{2} \times BC \times 3 \times \sin 96)$, (BC =) 6.03(3...) OR $(\frac{3 \times \sin 59}{\sin 96} =) 6.084(69...)$</p> <p>.3 $(\text{their } \frac{7}{3} \times \text{their } 6.03(...) =) 14.077(1...)$ ACCEPT 14</p> <p>.4 $(\frac{1}{2} \times \text{their } 14.077(1...) \times 7 \times \sin 96 - 9) = \text{their } 39.99$ ACCEPT 39.98</p> <p>OR</p> $(\frac{6.03(3...) + \text{their } 14.077(1...)}{2}) \times (\frac{9}{0.5 \times 6.03(3...)} \times \frac{7}{3} - \frac{9}{0.5 \times 6.03(3...)}) = 40(.03...)$ <p>.4 ACCEPT their 40 only if .2 and .3 are awarded</p>	<p>4</p>
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c	<p>AM1</p> <p>.1 Correct substitution into sine rule .2 Correctly rearranging to make $\sin \angle ABC$ the subject .3 Correctly calculate the angle ABC using their sine rule</p> <p>AM2</p> <p>.1 Correctly calculate length BC .2 Correctly substitute their sides of triangle ABC into cosine rule .3 Correctly calculate the angle ABC using their cosine rule</p> <p>25 AG</p>	<p>AM1</p> <p>.1 $\frac{\sin \angle ABC}{3} = \frac{\sin 96}{7}$ OE .2 $((\sin \angle ABC) =) \frac{3 \sin 96}{7}$.3 25.2(...)</p> <p>AM2</p> <p>.1 $(9 = \frac{1}{2} \times BC \times 3 \times \sin 96)$, $(BC =) 6.03(3\dots)$ OR $(\frac{3 \times \sin 59}{\sin 96} =) 6.084(69\dots)$.2 $(\cos B =) \frac{\text{their } 6.03(3\dots)^2 + 7^2 - 3^2}{2 \times \text{their } 6.03(3\dots) \times 7}$ OE .3 25.2(...) ACCEPT their 25.2 if it rounds to 25</p>	3
d	<p>AM1</p> <p>.1 Correctly calculate angle BAC .2 Correctly substitute their angle BAC into cosine rule .3 Correctly calculate their BE after substitution into cosine rule</p> <p>AM2</p> <p>.1 Correctly calculate angle BAC .2 Correctly calculate angle ABE (or AEB) AND correctly substitute their values into sine rule .3 Correctly calculate their BE after substitution into sine rule</p> <p>AM3</p> <p>.1 Correctly calculate angle BAC .2 Correctly calculate angles of triangle BCE AND correctly substitute their values into sine rule or cosine rule .3 Correctly calculate their BE after substitution into sine rule</p>	<p>AM1</p> <p>.1 $(180 - 96 - 25 =) 59$ (degrees) ACCEPT their 25 .2 $(BE^2) = 7^2 + 7^2 - 2 \times 7 \times 7 \times \cos(\text{their } 59)$ or 47.5(2626...) .3 their 6.89(39...) (cm) ACCEPT 7 only if .2 or .1 is awarded</p> <p>AM2</p> <p>.1 $(180 - 96 - 25 =) 59$ (degrees) .2 $(ABE \text{ or } AEB) = (\frac{180 - 59}{2} =) 60.5$ AND $\frac{7}{\sin 60.5} = \frac{BE}{\sin 59}$.3 their 6.89(39...) (cm) ACCEPT 7 only if .2 or .1 is awarded</p> <p>AM3</p> <p>.1 $(180 - 96 - 25 =) 59$ (degrees) .2 $(BCE =) 84$ and $(CBE = \frac{180 - 59}{2} - 25) = 35.5$ AND $\frac{4}{\sin 35.5} = \frac{BE}{\sin 84}$ or $6.(033\dots)^2 + 4^2 - 2 \times 4 \times 6.(033\dots) \times \cos 84$.3 their 6.85(04...) (cm) ACCEPT 7 only if .2 or .1 is awarded</p>	3

Q5	Answers	Notes	Total
a	Correct mass of phone case	(1.25 x 29 =) 36(.25) (g)	1
b	.1 Divide 1000 by their mass .2 Correctly rounds their answer to nearest whole number	.1 $\frac{1000}{\text{their } 36.25}$ or 27.586.. .2 their 27 ACCEPT only if $\frac{1000}{\text{their } 36.25}$ is not a whole number	2
c	.1 Correct method to calculate the mean .2 Correct value of mean before rounding 19.9 AG	.1 $\frac{18.3 + 18.5 + 19.1 + \dots + 21.1}{11}$ or $\frac{218.7}{11}$ ACCEPT 18.3 + 18.5 + 19.1 + ... + 21.1 /11 .1 ACCEPT if they divide at least sum of eight values by 10 or 11 .2 19.88(18....) DO NOT ACCEPT 19.89	2
d	.1 two correct values .2 another two correct values .3 another two correct values	<p>Printer A</p>  <p>Mean: 19.9 Mode: 19.8</p> <p>Min 18.3, Q1 19.1, Median 19.9, Q3 20.7, Max 21.1 and Mode 19.8</p>	3

	<p>e</p> <p>One fully correct reason for Printer A referring to a measure of dispersion or mode</p> <p>Printer A is better AG</p>	<p>Examples (WTTE):</p> <p>has smaller IQR</p> <p>has smaller range</p> <p>less spread</p> <p>Mode is less ACCEPT most recurring time or most common or most frequent</p> <p>ACCEPT Printer A is better because it is more reliable or more consistent</p> <p>ACCEPT using the descriptor 'better' for 'less/lower/smaller' WTTE</p> <p>DO NOT ACCEPT comments about skewness ex: less skewed</p> <p>DO NOT ACCEPT the length of the box is smaller</p> <p>DO NOT ACCEPT comments just about the maximum Ex: The maximum is less</p>	<p>1</p>
	<p>f</p> <p>One fully correct reason for Printer B referring to a measure of central tendency</p> <p>Printer B is better AG</p>	<p>Examples (WTTE):</p> <p>has a lower median</p> <p>has smaller average</p> <p>ACCEPT using the descriptor 'better' for 'less/lower/smaller' WTTE</p> <p>ACCEPT "smaller Q1 and Q3" DO NOT ACCEPT smaller Q1 only or smaller Q3 only</p> <p>DO NOT ACCEPT comments just about the minimum Ex: The minimum is less</p>	<p>1</p>

Q6	Answers	Notes	Total
a	.1 b = 2.5 OE ACCEPT [2,2.5] OE .2 c = 50 OE	ACCEPT using capital letters ACCEPT seeing values replaced in the equation	2
b	.1 (n=)8 and (Fmax) = 96 (%)		1
c	<p>AM1 (Solving)</p> <p>.1 Equate their E with $-1.5(n-8)^2 + 96$</p> <p>.2 Correctly expand $(n-8)^2$ and multiply by -1.5</p> <p>.3 Correctly rearrange their quadratic equation on one side = 0</p> <p>.4 Correctly substitute into quadratic formula</p> <p>.5 Correctly calculate their n</p> <p>AM2 (substitution trials)</p> <p>.1 Correctly substitute in their E and the F same value of n, accept decimal within domain</p> <p>.2 Correctly calculate their value of E and the value of F for their value of n</p> <p>.3 Correctly calculate their value of E and the value of F for another value of n</p> <p>.4 Compare value of E and F</p> <p>.5 Correctly identify their n within the given domain</p>	<p>AM1 (Solving)</p> <p>.1 their $2.5n + 50 = -1.5(n-8)^2 + 96$ ACCEPT using < instead of =</p> <p>.1 ACCEPT their E to be 70</p> <p>.2 $-1.5n^2 + 24n - 96$ OE SEEN</p> <p>.3 their $1.5n^2 - 21.5n + 50 = 0$ ACCEPT using < instead of =</p> <p>.4 their $\frac{21.5 \pm \sqrt{21.5^2 - 4 \times 1.5 \times 50}}{2 \times 1.5}$</p> <p>.5 (n=) Their 2.92 or 3</p> <p>.5 ACCEPT their positive value of n correctly rounded regardless the domain</p> <p>AM2 (substitution trials)</p> <p>.1 Ex: $2.5(2) + 50$ and $-1.5(2-8)^2 + 96$</p> <p>.2 Ex: their 55 and 42 when n=2 ACCEPT values from graph not exact</p> <p>.3 Ex: their 60 and 72 when n=4 ACCEPT values from graph not exact</p> <p>.4 evidence of comparing values of their E and F at same value of n Ex: $72 >$ their 60 ACCEPT argument based on the graph</p> <p>.5 (n=) Their 3</p> <p>.5 DO NOT ACCEPT if $n > 8$</p> <p>.5 DO NOT ACCEPT their 3 if they use only values from graph</p>	5

	d	<p>1 Correct value of h</p> <p>.2 Correct value of k</p> <p>.3 Substitute point (2,50) into conic form</p> <p>.4 Correct value of a</p>	<p>.1 $h=8$ ACCEPT seeing 8 in the expression $(L =)a(n - 8)^2 + k$</p> <p>.2 $k=86$ ACCEPT seeing 86 in the expression $(L =)a(n - h)^2 + 86$</p> <p>.3 $50 = a(2 - h)^2 + k$ ACCEPT substituting $n=2$ and any values for a,f, and k that gives Ex: $4(2-5)^2+14=50$</p> <p>.4 $a = -1$ ACCEPT seeing -1 in the expression $(L =)-(n - h)^2 + k$</p> <p>.4 evidence of comparing values of their E and F at same value of n Ex: $72 > \text{their}60$ ACCEPT argument based on the graph</p> <p>.5 (n=)their3</p> <p>.5 DO NOT ACCEPT if $n > 8$</p> <p>.5 DO NOT ACCEPT their3 if they use only values from graph</p>	4
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6	e					10
Mark	1	2	3	4	5	
Identify factors (F)	State one factor from: <ul style="list-style-type: none"> - Number of observations - The y-intercept Ignore additional irrelevant factors					
Calculation (C)	Equate their L with $-1.5(n-8)^2 + 96$ OR Correctly substitute in their L and the F same value of n	Correctly Expand both quadratics Ex: $-n^2 + 16n - 64 + 86 = -1.5n^2 + 24n$ OR Correctly calculate their value of L and the value of F for a certain value of n	Correctly rearrange their quadratics on one side = 0 Ex: $0.5n^2 - 8n + 22 = 0$ OR Correctly calculate their value of L and the value of F for another value of n	Correctly substitute into quadratic formula OR Compare value of L and F	Correctly calculate their value of n Ex: $(n =)3.53$ OR Correctly identify their n within the given domain Accept their correctly calculated n only if between 2 and 5	
Accuracy (A)	Recognizing it is not accurate with weak justification Examples: (WTTE) these are approximate calculations and not accurate Inaccurate because of rounding Inaccurate because equations not accurate OR Sensible rounding used in calculations without a comment ex: 2.55 is 3 DO NOT ACCEPT: my results are accurate WTTE	Recognizing it is not accurate with acceptable justification Examples: The equations we are using are not exactly the models that represent the data OR Accurate with strong justification Ex: Regardless of the equation I use the intersection between both will still be in the range 2 to 3	—		—	

Justify (J)	<p>Weak Justification</p> <p>Appropriate comment on one of the methods Examples: (WTTE) - Correct comment on the graphical behaviour of a method -The success rate of E is 50% even with zero observations</p> <p>OR</p> <p>Attempt to comment on two or more methods Examples: (WTTE) - The Fisherface is most accurate (or highest success rate) - The maximum success rate for F is 96% while for L only 86%</p>	<p>Good Justification</p> <p>Appropriate comment/comparison on at least two methods Examples: (WTTE) - Fisherface is better than LBPH in the long run - When $n = 2$ or less use LBPH and when $n = 4$ or more use Fisherface - The maximum success rate for F is 96% while for L only 86% for the maximum n -The success rate of E is 50% even with zero observations while for others it is less</p> <p>ACCEPT: The Fisherface is most accurate (or highest success rate) for the maximum n.</p> <p>DO NOT ACCEPT if they do not have a choice of method</p>			
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Q7	Answers	Notes	Total
a	<p>AM1 .1 correctly substitute 4 or -4 into the correct equation .2 subtract 2 from 16</p> <p>AM2 .1 equate 14 to $g(x)-2$ or $f(x)-2$.2 evidence of determining $x=4$ using $g(x)$ or $x=-4$ using $f(x)$</p> <p>14 AG</p>	<p>AM1 .1 $y = 2^4$ or $(1/2)^{-4}$.2 (height =) $16 - 2$ or $2^4 - 2$</p> <p>AM2 .1 $2^x - 2 = 14$ or $(\frac{1}{2})^x - 2 = 14$.2 $x=4$ or $x=-4$ ACCEPT $2^4 = 16$ or $(\frac{1}{2})^{-4} = 16$</p>	2

b	Correctly place 64 AND 128	<table border="1"> <thead> <tr> <th>Stage (n)</th> <th>Number of new squares added (S)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4</td> </tr> <tr> <td>2</td> <td>8</td> </tr> <tr> <td>3</td> <td>16</td> </tr> <tr> <td>4</td> <td>32</td> </tr> <tr> <td>5</td> <td>64</td> </tr> <tr> <td>6</td> <td>128</td> </tr> </tbody> </table>	Stage (n)	Number of new squares added (S)	1	4	2	8	3	16	4	32	5	64	6	128	1
Stage (n)	Number of new squares added (S)																
1	4																
2	8																
3	16																
4	32																
5	64																
6	128																
c	<p>.1 correctly describe one pattern for S in words</p> <p>.2 correctly describe a second pattern for S in words</p>	<p>Examples of accepted terminology:</p> <ul style="list-style-type: none"> - Even numbers, multiples of 2 - Multiples of 8 except the first row OE - Multiples of 4, divisible by 4 - Multiplies by 2, doubles, ratio 2, powers of 2, twice of previous, added to itself -powers of 2 - Geometric with ratio 2 <p>DO NOT ACCEPT incomplete terminology, for example: Geometric, multiplies by a constant, has a common ratio, the even numbers or the multiples of 4</p> <p>DO NOT ACCEPT the rule in words, for example: 2 power $n+1$</p> <p>DO NOT ACCEPT n goes up by 1 It is increasing general rules in terms of n, example: $S = 2^{n+1}$</p> <p>More than two different patterns, all correct award (2 marks) Ex: multiplies by 2, and multiples of 4 and it is 2 to the power $n+1$ More than two different patterns, with any incorrect award (1 mark) Ex: multiplies by 2, and multiples of 4 and it is 2 to the power n</p>	2														

	d	.1 the correct general rule .2 the correct simplified general rule with correct notation for S in terms of n .	.1 $(S =) 2^{n+1}$ or $S = 2 \times 2^n$ ACCEPT $S = 4 \times 2^{n-1}$ OE .2 $S = 2^{n+1}$ DO NOT ACCEPT description in words	2
	e	.1 correctly substitute $n \geq 5$ into their general rule .1 Correctly substitute $n \geq 5$ into their general rule .2 Correctly calculate their value of S after substituting $n \geq 5$.3 Recognize that their result is the same as the correctly predicted value	.1 Ex: 2^{5+1} .2 Ex: 64 (for $n = 5$) .3 “the same as when we continue the pattern” WTTE and states how Ex: For $n=5$, 64 is obtained from pattern of multiplying 32 by 2 .3 ACCEPT if their value from .2 is the same as their value in the table in part b) or seen here in part e)	3

7	f						22
Mark	1	2	3	4	5		
Predictions (P)	Correctly predict one term for T ACCEPT whether in the table or in the response box	Correctly predict two terms for T ACCEPT whether in the table or in the response box					
Description (D)	<p>Correctly describe a pattern in words or recursive rule for T (Ignore additional incorrect patterns) Ex : even numbers, multiples of 2 Multiples of 4 Increases by even numbers Increases by 8, 16, 32.. Adds up by 8, 16, 32... First difference doubles Difference is geometric Difference is 2^{n+1} Increases by 2S $T=2S-4$ or 2 power n Or Recursive rule: $T_n = T_{n-1} + S_n$ or $T_n = T_{n-1} + 4 \times 2^{n-1}$ or $T_n = 2T_{n-1} + 4$ OE DO NOT ACCEPT recursive rule in words or double S subtract 4</p>	<p>Correctly describe two patterns in words or recursive rule for T (Ignore additional incorrect patterns) OR Valid attempt to write general rule for T Ex: number times 2^n or number plus 2^n provided it is not the same S rule</p>	<p>Correctly describe one pattern in words or recursive rule for T (Ignore additional incorrect patterns) AND Valid attempt to write general rule for T OR Correctly describe the pattern for T as a general rule $T = 2^{n+2} - 4$ OE</p>	<p>Correctly describe one patterns in words or recursive rule for T (Ignore additional incorrect patterns) AND Correctly write down the general rule for T OR Correctly describe two patterns in words or recursive rule for T (Ignore additional incorrect patterns) AND Valid attempt to write general rule for T</p>	<p>Correctly describe two patterns in words or recursive rule for T (Ignore additional incorrect patterns) AND Correctly write down the general rule for T ACCEPT the general rule in words but penalise in notation (for Notation see N)</p>		

<p>Testing (T)</p>	<p>Attempt to test their general rule for T using $n \leq 4$</p> <p>Correctly substitute in their general rule for T value of $n \leq 4$</p> <p>OR</p> <p>Correctly test their rule for T or described pattern or recursive rule</p>	<p>Correctly test their general rule for T using $n \leq 4$</p> <p>Correctly calculate their value for T in their general rule using $n \leq 4$</p> <p>AND</p> <p>Recognize that their correctly calculated value for T is the same as the given value.</p> <p>ACCEPT testing correctly $T_n = T_{n-1} + 4 \times 2^{n-1}$</p> <p>ACCEPT seeing their correctly calculated value for T and the given value in the table being equal</p>			
<p>Verifying (V)</p>	<p>Attempt to verify their general rule for T using $n \geq 5$</p> <p>Correctly substitute in their general rule for T value of $n \geq 5$</p> <p>OR</p> <p>Correctly verify their rule for T or described pattern or recursive rule</p>	<p>Correctly calculate their value for T in their general rule using $n \geq 5$</p>	<p>Correctly calculate their value for T in their general rule using $n \geq 5$</p> <p>AND</p> <p>Recognise that their correctly calculated value for T is the same as their predicted value obtained by continuing the pattern</p> <p>ACCEPT verifying correctly $T_n = T_{n-1} + 4 \times 2^{n-1}$</p> <p>ACCEPT seeing their correctly calculated value for T and their predicted value in the table being equal</p>		

<p>Justify/ proof (J)</p>	<p>Attempt to justify their described pattern or their general rule Ex: trying at least two more values and arguing as justification that they are the same or rule works or seen as justification Ex: It is partially geometric, the increase doubles so rule includes exponential WTTE Ex: The difference is geometric</p> <p>Weak attempt to justify their general rule geometrically</p> <p>Ex: $T=2S-4$ (or in words)</p>	<p>Justify their general rule arithmetically Ex: Seen as justification Part of it is geometric with first term 4 and ratio 2 then we subtract 4</p> <p>OR Attempt to justify their general rule geometrically Ex: Try to calculate area rectangle Adding $2^{n+1} + 2^{n+2} + \dots$ $T=2S-4$ (or in words) and $2^{n+2} - 4 = 2 \times 2^{n+1} - 4$</p>	<p>Good attempt to justify the general rule for T geometrically by using incorrect equations or information.</p> <p>height of $y = 2^x$ minus the blank space under the rectangle of area 4 (4 squares) and $x=n+2$</p> <p>OR Good attempt to proof by induction</p>	<p>Correctly justify the general rule for T geometrically by using area of rectangle with base 2 and functions for the height. Total number of squares is the area of a rectangle with base 2 and height of $y = 2^x$ minus the blank space under the rectangle of area 4 (4 squares) $x = n + 1$ (because of starting at $x=2$) $A = b \cdot h - 4$ $A = 2 \cdot (2)^{n+1} - 4$ $A = 2^{n+2} - 4$</p> <p>OR Correctly proof by induction</p> <p>J4 automatically gains T2 and V3</p>	
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Communication criteria

Mark	1	2	3
<p>Notation and terminology (N)</p>	<p>Correct notation of <u>their</u> general_rule for T</p> <p>OR The notation of <u>the general</u> rule for T includes errors, ex: $2^{(n+2)}-4$ or non-simplified general rule Ex: $T = 2(2^n + 2^n) - 4$</p> <p>OR Correctly describe at least one pattern in words for T</p> <p>DO NOT ACCEPT if they don't have any rules and they don't describe any patterns</p>	<p>Correct notation of <u>the general</u> rule for T $T = 2^{n+2} - 4$ ACCEPT $T = 4 \times 2^n - 4$ or $T = 4(2^n - 1)$ ACCEPT the use of brackets</p> <p>OR The notation of <u>the general</u> rule includes errors (see examples in N1) AND Correctly describe at least one pattern in words for T</p> <p>ACCEPT using U_n instead of T only if they mention that $T = U_n$</p> <p>DO NOT ACCEPT using * for multiplication using / for division using ^ for power Using x instead of n</p> <p>DO NOT ACCEPT if they don't have the general rule for T</p>	<p>Correct notation of <u>the general</u> rule for T (see examples in N2)</p> <p>AND Correctly describe at least one pattern in words for T</p> <p>ACCEPT using U_n instead of T only if they mention that $T = U_n$</p> <p>DO NOT ACCEPT using * for multiplication using / for division using ^ for power Using x instead of n</p> <p>DO NOT ACCEPT if they don't have the general rule for T</p>

Continued on next page

Mark	1	2	3
<p>Communication (L)</p> <p>Organisation and coherence</p> <p>Can be awarded even if there are errors</p> <p>Describing pattern and writing rule can be considered an item even if D0 awarded</p> <p>Test, verify, and justify may include errors but cannot be considered item (or identified for coherence) if they are zeros</p>	<p>At least three from the following items are seen:</p> <ul style="list-style-type: none"> · 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) 	<p>DO NOT ACCEPT if they don't have a general rule</p> <p>At least four of the following items are seen:</p> <ul style="list-style-type: none"> · 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) <p>AND</p> <p>For coherence, they identify the processes correctly. At least one from the following:</p> <ul style="list-style-type: none"> · test (at least T1) · verify (at least V1) · justify (at least J1) <p>Ex:</p> <ul style="list-style-type: none"> • For test: they say "test" and they test using value(s) of $n \leq 4$ only • For verify: they say "verify" and they verify using value(s) of $n \geq 5$ only • For test and for verify: they say 'test and verify' and they test using value(s) of $n \leq 4$ and then verify using value(s) of $n \geq 5$ <p>For justify: At least J1 awarded</p>	<p>The following two items must be seen :</p> <ul style="list-style-type: none"> • write <u>the general rule for T</u> • justify <u>the general rule</u> (at least J2) <p>AND</p> <p>At least two of the following items are seen:</p> <ul style="list-style-type: none"> • describe a pattern or rule in words • test <u>the general rule</u> (at least T1) • verify <u>the general rule</u> (at least V1) <p>AND</p> <p>For coherence, they identify the processes correctly. At least one from the following:</p> <ul style="list-style-type: none"> • test (at least T1) • verify (at least V1) <p>Ex:</p> <ul style="list-style-type: none"> • For test: they say "test" and they test using value(s) of $n \leq 4$ only • For verify: they say "verify" and they verify using value(s) of $n \geq 5$ only • For test and for verify: they say 'test and verify' and they test using value(s) of $n \leq 4$ and then verify using value(s) of $n \geq 5$

Stage (n)	Number of new squares (S)	Total number of squares (T)
1	4	4
2	8	12
3	16	28
4	32	60
5	64	124
6	128	252
7	256	508
8	512	1020