

Markscheme

November 2020

Extended mathematics

On-screen examination

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The markscheme may make use of the following abbreviations:

ECF Marks that can be awarded as **error carried forward** from previous results in the question

BOD Benefit of the doubt

MR misread

NWS no working shown

SC special case

OE or equivalent

WTTE or words to that effect

AG Answer given

- Bullet notation means award 1 mark – see example 1 below

Example
•¹ mark awarded and corresponding notes are aligned

b	• ¹ Show clear line of reasoning in the method • ² their correct result	• ¹ 45 & 49 seen OE eg, $49 = 45 + x$ • ² their 4	2
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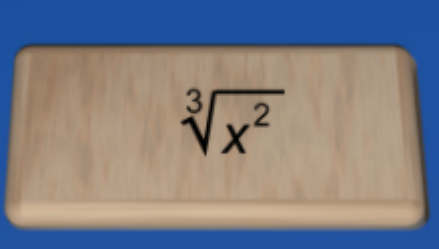
Error Carried Forward (ECF) marks

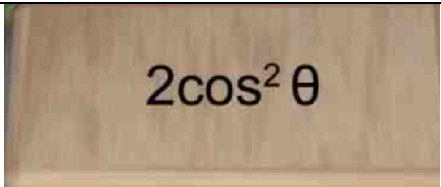
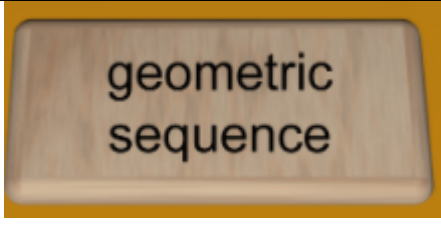
Errors made at any step of a solution affect all working that follows. In general, **Error Carried Forward (ECF)** marks are awarded after an error.

- a) **ECF** applies from one part of a question to a subsequent part of the question and also applies within the same part.
- b) If an answer resulting from **ECF** is inappropriate (eg, negative distances or $\sin x > 1$) then subsequent marks should not be awarded.
- c) If a question is transformed by an error into a **simpler question** then **ECF** may not be fully awarded.
- d) To award **ECF** marks for a question part, **there must be working present for that part**.
- e) **ECF** is only applied to working which is correct. This means that all working subsequent to an error must be checked for accuracy.
- f) A misread (**MR**) is an error. **ECF** is normally awarded.

General points

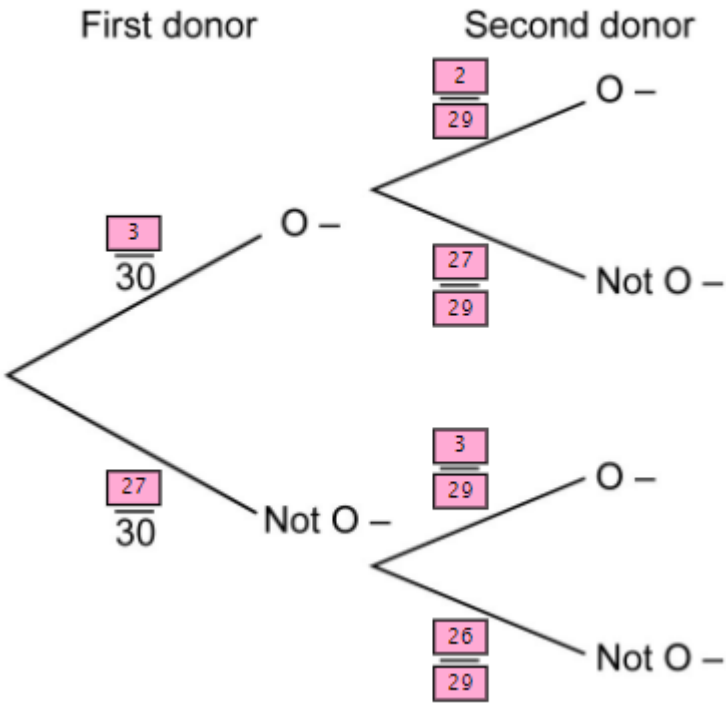
- a) As this is an international examination, accept all alternative forms of **notation**, for example 1.9 and 1,9 or 1 000 or 1.000. However, **DO NOT ACCEPT** incorrect mathematical notation e.g x^2 for x^2 in final answers unless noted otherwise in the MS.
- b) Accept notation errors in intermediate steps.
- c) Ignore further working after a correct answer **unless** it indicates a lack of mathematical understanding **i.e. if the further working contradicts the correct answer**, then the last mark cannot be awarded.
- d) In the case when a correct result is obtained by coincidence based on incorrect seen method, do not award the mark for the result.
- e) Where candidates have written two solutions to a question, mark the response that deserves more marks.
- f) In the markscheme, equivalent examples of **numerical** and **algebraic** forms or **simplified** answers will generally be written in the notes preceded by **OE** or equivalent e.g. $\frac{1}{2}$ or $1/2$ or $1 \div 2$ and $\frac{x}{2}$ or $x / 2$ or $x \div 2$
- g) In the markscheme, information provided in brackets indicate detail that may be seen in a candidate response but is not necessary to award the marks.
- h) Special case marks **SC** can be allocated instead of but not in addition to the marks prescribed in the markscheme..
- i) When a calculator screenshot is taken, accept not seeing the whole operation.
- j) Accept seeing an equation not in-line

Question	Answers	Notes	Total	
1	a			1
	b			1
	c			1
	d			1
	e			1

	f				1
	g				1

Question		Answers	Notes	Total
2	a	$2\ln(x - 6)$ OE		1
	b	<ul style="list-style-type: none"> •1 (s =) 2 •2 (t =) 6 		2
	c	<ul style="list-style-type: none"> •1 correctly eliminate ln •2 correctly expand their quadratic •3 correctly factorise their quadratic or substitute into quadratic formula •4 correctly select their single result after factorisation or using quadratic formula 	<ul style="list-style-type: none"> •1 $(x - 6)^2 = x$ •2 their $x^2 - 12x + 36 = x$ or their $x^2 - 13x + 36 = 0$ •3 their $(x - 4)(x - 9)$ •4 their $(x =) 9$ only, Accept only if their $x > 6$ 	4

Standard (9 marks)

Question	Answers	Notes	Total
3 a	<ul style="list-style-type: none"> •1 seeing 40(%) •2 multiply their 40 % by 25 % AG 0.1	<ul style="list-style-type: none"> •1 0.4, ACCEPT 40(%) on the diagram •2 0.4 x 0.25 OE 	2
	b	Correctly write 3 as the answer	1
	c	 <p>.1 ACCEPT their 3 only if positive integer $0 < \text{their } 3 < 30$.2 or .3 ACCEPT only $0 < \text{their probability} < 1$</p>	3

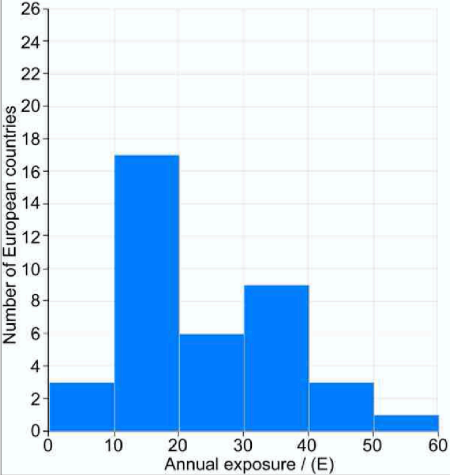
	<p>d</p>	<ul style="list-style-type: none"> •1 correctly calculate the probability first O- and second O- from their tree diagram •2 correctly calculate the probability first not O- and second O- from their tree diagram •3 correctly substitute their values into the correct conditional probability formula •4 correctly calculate their probability after applying the formula 	<ul style="list-style-type: none"> •1 $\frac{their3}{30} \times \frac{their2}{their29}$ or $\frac{1}{145}$ OE •2 $\frac{their27}{30} \times \frac{their3}{their29}$ or $\frac{27}{290}$ OE •3 $\frac{their \bullet 2}{their \bullet 1 + their \bullet 2}$ OE •4 $\frac{their27}{their29}$ OE 	<p style="text-align: center;">4</p>
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Question	Answers	Notes	Total
4	<p>a</p> <ul style="list-style-type: none"> •1 correctly write 5 hours 15 mins as 5.25 (h) •2 correctly calculate their volume in cubic metres •3 correctly set their equation of v •4 correctly calculate their r^2 •5 correctly calculate their r before rounding <p>AG 4 m</p>	<ul style="list-style-type: none"> •1 ACCEPT not seeing this step •2 5.25×11.2 or 58.8 or 58800/1000 seen •3 $\pi r^2 \times 1.17 =$ their 58.8 •4 $\frac{58.8}{\pi \times 1.17}$ or 15.997(...) or 15.779(...) •5 3.99(...) or 3.97(...) Accept only if their answer rounds to 4 For .4 and .5 DO NOT ACCEPT substituting $r = 4$ and calculating volume 	5
	<p>b</p> <ul style="list-style-type: none"> •1 correctly substitute 4 into the correct area of circle formula •2 correctly substitute 4 into the correct circumference of a circle formula •3 multiply their circumference of circle by 0.3 •4 correctly add their •1 and •3 •5 correctly round their .4 to the nearest square metre 	<ul style="list-style-type: none"> •1 $\pi \times 16$ or $\pi \times 4^2$ or 50.27 or 50.24 (using 3.14) •2 $\pi \times 8$ or $2 \times \pi \times 4$ or 25.1(327...) •3 their $\pi \times 8 \times 0.3$ or their $2 \times \pi \times 4 \times 0.3$ or 7.5(398...) •4 Their 57.8(05...) •5 their 58 ACCEPT earlier all correct rounding 	5
	<p>c</p> <p>correctly multiply their 57.8(05...) or 58 by 3.4</p>	<p>Their (\$)196.52 or (\$)197.2</p> <p>ACCEPT their 196.52 without working DO NOT ACCEPT their 57.8(05...) x 3.4 incorrectly rounded in c)</p>	1

Question	Answers	Notes	Total
5	<p>a</p> <ul style="list-style-type: none"> •1 correctly determine 1.95 •2 correct trig ratio used •3 correctly write their answer before rounding or correct inverse trig ratio <p>AG 70(°)</p>	<ul style="list-style-type: none"> •1 12.55 – 10.6 •2 $\cos y = \frac{1.95}{5.7}$ accept not seeing this step •3 $y = \cos^{-1} \frac{1.95}{5.7}$ or 69.99(480991) Accept only if their answer rounds to 70 	3
	<p>b</p> <p>AM1</p> <ul style="list-style-type: none"> •1 correctly convert 70 from degrees to radians •2 subtract double of y from π <p>AM2</p> <ul style="list-style-type: none"> •1 subtract double of y from 180 •2 correctly convert 40 from degrees to radians <p>AG $\frac{2}{9}\pi$</p>	<p>AM1</p> <ul style="list-style-type: none"> •1 $70 \times \frac{\pi}{180}$ or $\frac{7\pi}{18}$ seen •2 $\pi - 2 \times \frac{7\pi}{18}$ <p>AM2</p> <ul style="list-style-type: none"> •1 180 – 2 × 70 or 40 seen . ACCEPT seeing 40 degrees on the canvas in part (a) •2 $40 \times \frac{\pi}{180}$ 	2
	<p>c</p> <p>AM1</p> <ul style="list-style-type: none"> •1 correct trig ratio used with 10.6 OR correctly substitute into sine rule •2 correctly rearrange their trig ratio for v •3 correctly calculate their v after dividing by their trig ratio 	<p>AM1</p> <ul style="list-style-type: none"> •1 $\cos \frac{7\pi}{18} = \frac{10.6}{v}$ or $\sin \frac{\pi}{9} = \frac{10.6}{v}$ OE OR $\frac{v}{\sin \frac{7\pi}{18}} = \frac{21.2}{\sin \frac{2\pi}{9}}$ OE <p>ACCEPT using degrees: $\cos 70 = \frac{10.6}{v}$ OE or $\sin 20 = \frac{10.6}{v}$ or $\frac{v}{\sin 70} = \frac{21.2}{\sin 40}$ OE</p> <ul style="list-style-type: none"> •1 ACCEPT 10.6 and $\cos \frac{7\pi}{18}$ or $\sin \frac{\pi}{9}$ seen •2 their $(v =) \frac{10.6}{\cos 70}$ or their $(v =) \frac{10.6}{\sin 20}$ or their $(v =) \frac{21.2 \sin 70}{\sin 40}$ OE 	3

	<p>AM2</p> <ul style="list-style-type: none"> •1 correct trig ratio used with 12.55 OR correctly substitute into sine rule •2 correctly calculate their hypotenuse •3 correctly calculate their v after subtracting 5.7 from their calculated hypotenuse <p>AM3</p> <ul style="list-style-type: none"> •1 seeing evidence of using similar triangles correctly •2 correctly rearrange for v OR correctly apply their scale factor •3 correctly calculate their v after dividing their product 	<ul style="list-style-type: none"> •3 their 30.99(23....) or 31 or 31.2(11..) ACCEPT only if .1 or .2 is awarded <p>AM2</p> <ul style="list-style-type: none"> •1 $\cos \frac{7\pi}{18}$ or $\sin \frac{\pi}{9} = \frac{12.55}{hyp}$ OR $\frac{a}{\sin \frac{7\pi}{18}} = \frac{25.1}{\sin \frac{2\pi}{9}}$ OE •2 their 36.69(37...) ACCEPT (hyp=) $\frac{12.55}{\cos 70}$ OE •3 their 30.99(23....) or 31 or 31.2(11..) ACCEPT only if .1 or .2 is awarded <p>AM3</p> <ul style="list-style-type: none"> •1 Seeing $\frac{12.55}{1.95}$ or $\frac{10.6}{12.55}$ OE or $\frac{v}{10.6} = \frac{v+5.7}{12.55}$ OE •2 $10.6 \times \frac{5.7}{1.95}$ OR $1.95v = 60.42$ •3 their 30.99(23....) or 31 or 31.2(11..) ACCEPT only if .1 or .2 is awarded 	
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<p>d</p>	<p>AM1</p> <ul style="list-style-type: none"> •1 correctly substitute $\frac{2}{9}\pi$ and their v or their v+5.7 into correct sector formula •2 subtract their areas of sectors •3 correctly calculate their area after subtracting their areas of sectors <p>AM 2</p> <ul style="list-style-type: none"> •1 correctly substitute their v or their v+5.7 into correct area of circle formula •2 subtract their areas of circles or sectors •3 correctly calculate their result after multiplying their difference of areas by their 40/360 or $\frac{\pi}{9}$ 	<p>AM1</p> <ul style="list-style-type: none"> •1 $(A =) \frac{1}{2} \text{their } 36.7^2 \times \frac{2}{9}\pi$ or $(A =) \frac{1}{2} \text{their } 31^2 \times \frac{2}{9}\pi$ •2 $(A =) \frac{1}{2} \text{their } 36.7^2 \times \frac{2}{9}\pi - \frac{1}{2} \text{their } 31^2 \times \frac{2}{9}\pi$ •3 their 134.6(...) or 134.7(...) or 135 <p>AM 2</p> <ul style="list-style-type: none"> •1 $\pi \times \text{their } 36.7^2$ or $\pi \times \text{their } 31^2$ seen •2 $\pi \times \text{their } 36.7^2 - \pi \times \text{their } 31^2$ OE •3 their 134.6(...) or 134.7(...) or 135 	<p>3</p>
<p>e</p>	<ul style="list-style-type: none"> •1 correctly calculate the material wasted •2 correctly write their fraction of material wasted •3 correctly calculate their percentage <p>AM1</p> <ul style="list-style-type: none"> •1 correctly write their fraction of material used •2 Subtract their fraction from 1 •3 correctly calculate their percentage 	<ul style="list-style-type: none"> •1 $(25.1 \times 7.6 - \text{their } 134.6 =) \text{their } 56.16$ •2 $\frac{\text{their } 56.16}{\text{their } 25.1 \times 7.6}$ •3 their 29(.....) (%) <p>AM1</p> <ul style="list-style-type: none"> •1 $\frac{\text{their } 134.6}{\text{their } 25.1 \times 7.6}$ •2 $1 - \text{their } 0.705(\dots)$ •3 their 29(.....) (%) 	<p>3</p>

Question	Answers	Notes	Total	
6	a	<ul style="list-style-type: none"> •1 correctly drag three heights •2 correctly drag the other three heights 	 <p data-bbox="1189 778 1771 804">SC: All six bars correct and thinner award 1 mark</p>	2
	b	<p data-bbox="315 810 887 836">A valid statement including both 1990 and 2016</p>	<p data-bbox="1189 810 1989 932">DO NOT ACCEPT a comment on only one interval Ex: in 1990, 3 countries had E between 0 and 10 while in 2016 there are 8 Ex: Highest in 1990 is 17 while highest in 2016 is 24</p> <p data-bbox="1189 963 1989 1114">ACCEPT Overall correct comment ex: Less particulates or less exposure in the air in 2016 than 1990 OE Comments including more than one interval. Ex: In 2016 no countries had E more than 40 but in 1990 there were</p>	1
	c	<ul style="list-style-type: none"> •1 seeing two correct midpoints and two correct frequencies •2 Add their four products of midpoints and frequencies •3 Divide the sum of their products by 39 •4 Correctly write their mean before rounding <p data-bbox="315 1251 517 1276">AG 15.3 ($\mu\text{g}/\text{m}^3$)</p>	<ul style="list-style-type: none"> •1 Any two of 5,15,25,35 AND any two of 8, 24, 5, 2 seen •2 $5 \times 8 + 15 \times 24 + 25 \times 5 + 35 \times 2$ OR 595 •3 <i>their</i> $\frac{595}{39}$ •4 15.25(6....). ACCEPT only if their answer rounds to 15.3 	4
	d	<ul style="list-style-type: none"> •1 ($a =$) $- 1/5$ OE •2 ($b =$) 18 	<ul style="list-style-type: none"> •1 ACCEPT $- 0.21 < a < - 0.14$ •2 ACCEPT correctly calculated b from their correct a 	2

6	e	Mark	1	2	3	10
		F Identification of Factors	<p>One factor mentioned from: The model/equation used to predict. or Whether the data will follow same trend or not or Acknowledge the E is decreasing or The fact that these are models based on scatter plots. ACCEPT factors affecting the trend like more data in the last 5 years collected or using electric cars or new technology that affects the environment or using solar power instead of petrol or air pollution or control of particular matter DO NOT ACCEPT only saying many factors</p>			
		PL (Prediction from line)	<p>Attempt to calculate the E in 2030 using their line equation</p> <p>Ex: Substitute 40 in the equation and make incorrect calculation OR Substitute 2030 into the equation and make correct calculation OR Attempt to use the drop every 5 years to predict the drop in 2030 from the graph OR Describe the trend in words and predict it will reach below 13</p>	<p>Correctly calculate the E in 2030 using their line equation</p> <p>Ex: their $(-0.15(40) + 18 =)12$</p> <p>OR correctly use the drop every 5 years to predict the drop in 2030 from the graph</p>		

	<p>PE (Prediction from Exponential)</p>	<p>Attempt to calculate the E in 2030 using the exponential equation</p> <p>Ex: Substitute 40 in the equation $(6 \times 0.91^{40} + 13.8)$ and make incorrect calculation</p> <p>OR</p> <p>Substitute 2030 into the equation and make correct calculation</p> <p>OR</p> <p>Attempt to use the drop every 5 years to predict the drop in 2030 from the graph</p> <p>OR</p> <p>Describe the trend in words and predict it will <u>not</u> reach 13</p>	<p>Correctly calculate the E in 2030 using the exponential equation $(6 \times 0.91^{40} + 13.8 =) 13.9(379)$, accept 14</p> <p>OR</p> <p>use the drop every 5 years to predict the drop in 2030 from the graph</p> <p>ACCEPT if they mention that the exponential will never reach 13 and refer to horizontal asymptote being $E=13.8$</p>		
	<p>D degree of accuracy</p>	<p>Inaccurate with weak reason (Interpolating)</p> <p>Example: inaccurate because I used line of best fit</p> <p>Inaccurate because of sudden increase of pollution happening</p> <p>OR</p> <p>Accurate with valid reason</p> <p>Example: accurate because I used my line of best fit to estimate and made correct calculations</p> <p>OR</p> <p>Rounding to a whole number used for their estimated year</p> <p>Ex: 14 for the E from exponential</p> <p>DO NOT ACCEPT if they just write down a year without any reference or calculations</p> <p>DO NOT ACCEPT accurate or inaccurate without reason</p>	<p>Inaccurate with a valid reason related to variables affecting the future (extrapolating)</p> <p>Ex: The prediction I made not very accurate because many factors may vary in the future</p> <p>or</p> <p>predictions using line of best fit for the future not guaranteed</p> <p>or</p> <p>The prediction using the line equation not very accurate because it is taking only a window or isolated time</p> <p>or</p> <p>The prediction using the line equation not very accurate because it assumes the future follows same pattern</p> <p>or</p> <p>My predictions not very accurate because a disaster may happen and affect pollution</p> <p>DO NOT ACCEPT if they did not make a prediction</p>		

		<p>J Justifying the model</p>	<p>Selecting the Exponential model (even implicitly ex: substituting only in exponential model) without justification OR Select the line with acceptable justification Ex: it passes through more points OR comparison comment without selection Ex: Line will decrease in a short time while exponential will take longer OE</p>	<p>Selecting the Exponential model (even implicitly) with general justification (no explicit data) Ex: I advise using graph 2 because it takes most of the points into account or Line will decrease in a short time while exponential will take longer or exponential more fitting</p>	<p>Selecting the Exponential model (even implicitly) With good justification involving data in the last years Ex: graph 2 is better because in the last years, the E did not vary much or it is nearly constant in the last years and it takes this into account while graph 1 doesn't or the decrease in the line is constant while E is not is not and the exponential does not have constant decrease rate</p>	
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Answers		Notes	Total	
7	a	<p>AM1</p> <ul style="list-style-type: none"> •1 evidence of using Pythagoras correctly for diagonal of small square •2 correctly rearrange their equation to have y^2 on one side •3 square root the diagonal <p>AM2</p> <ul style="list-style-type: none"> •1 evidence of using Pythagoras correctly in the right angled triangle •2 correctly rearrange their equation to have x^2 on one side •3 doubling the value of the side of triangle <p>AM3</p> <ul style="list-style-type: none"> •1 evidence of using $\sin 45$ or $\cos 45$ •2 correctly rearrange their ratio to have unknown on one side •3 doubling the value of side of triangle <p>AG $3\sqrt{2}$</p>	<p>AM1</p> <ul style="list-style-type: none"> •1 $3^2 + 3^2 = y^2$ •2 $18 = y^2$ •3 $\sqrt{18}$ <p>AM2</p> <ul style="list-style-type: none"> •1 $x^2 + x^2 = 3^2$ •2 $x^2 = \frac{9}{2}$ •3 $2 \times \frac{3}{\sqrt{2}}$ <p>AM3</p> <ul style="list-style-type: none"> •1 $\sin 45 = \frac{x}{3}$ or $\cos 45 = \frac{x}{3}$ or $x\sqrt{2} = 3$ OE •2 $(x =) 3 \sin 45$ or $(x =) 3 \cos 45$ or $(x =) \frac{3}{\sqrt{2}}$ OE •3 $2 \times 3 \sin 45$ or $2 \times 3 \cos 45$ or $(x =) \frac{2 \times 3}{\sqrt{2}}$ OE <p>DO NOT AWARD *3 unless their result simplifies to $3\sqrt{2}$</p> <p>SC Using $(\frac{3\sqrt{2}}{2})^2 + (\frac{3\sqrt{2}}{2})^2 = 9$ and $\sqrt{9} = 3$ award 2 marks.</p>	3
	b	<ul style="list-style-type: none"> •1 correctly place 144 •2 correctly place 288 	2	

<p>c</p>	<ul style="list-style-type: none"> •1 correctly describe one pattern in words •2 correctly describe a second pattern in words <p>Allow ECF from their table in 8b</p>	<p>ACCEPT</p> <p>Multiply by 2 every time ...WTTE</p> <p>All even numbers except first (9) or after stage 1</p> <p>The ratio is constant</p> <p>It is geometric</p> <p>Multiplies of 9</p> <p>Starting from 9, every second number is a square number</p> <p>ACCEPT if they correctly describe in words their pattern</p> <p>DO NOT ACCEPT</p> <p>It is the square of L</p> <p>$A = L^2$</p> <p>It is increasing</p> <p>All A are even numbers</p> <p>general rules in terms of n, example: $A = 9 \times 2^{n-1}$</p>	<p>2</p>
<p>d</p>	<ul style="list-style-type: none"> •1 The correct general rule •2 The correct general rule with correct notation 	<ul style="list-style-type: none"> •1 $9 \times 2^{n-1}$ OE •2 $A = 9 \times 2^{n-1}$ OE 	<p>2</p>
<p>e</p>	<ul style="list-style-type: none"> •1 correctly substitute $n \geq 5$ into their rule •2 correctly calculate their value of P after substitution $n \geq 5$ •3 recognize that their result is the same as their predicted value 	<ul style="list-style-type: none"> •1 Ex: 9×2^4 •2 Ex: 144 (for the $n = 5$) •3 Same as value I predicted in table (and we find the candidate has 144 in the table for $n = 5$) OR same as when we continue the pattern and explains how 144 is obtained from pattern of multiplying 72 by 2 <ul style="list-style-type: none"> •3 ACCEPT seeing the 144 in the table and seeing their calculated $A=144$ when $n = 5$ <p>SC for 1 mark</p> <p>Correctly test by applying the steps of verification mentioned in the left column with a value of $n \leq 4$</p> <p>SC for 1 mark</p> <p>Correctly verify their described pattern or rule (e.g. recursive rule)</p>	<p>3</p>

7	f	Mark	1	2	3	4
		Predictions (P)	Correctly predict one value for P	Correctly predict two values for P		
		Description (D)	Attempt to describe a pattern in words or to write a rule Ex: number beside $\sqrt{2}$ multiplies by 2 every other time $\sqrt{2}$ is there every other time OR Correctly describe one pattern in words for L OR Correctly describe in words their pattern for P OR Attempt to write down a general rule for L, example: $(\sqrt{2})^n$ OR Weak attempt to write down a general rule for P, example $(\sqrt{2})^{n-1}$ DO NOT ACCEPT L or P is increasing n goes up by 1	Correctly describe one pattern in words for P Ex: P multiplies by $\sqrt{2}$ P is a geometric sequence P is exponential function DO NOT ACCEPT the general rule in words OR Correctly write down general rule for L in terms of n. Rule: $(L =) 3 \times (\sqrt{2})^{n-1}$ OR Acceptable attempt to write down a general rule for P, example: $12(\sqrt{2})^n$ or recursive rule For notation see N	Correctly describe one pattern in words for P AND Acceptable attempt to write down a general rule for P OR Correctly write down general rule for P in terms of n. $12(\sqrt{2})^{n-1}$ OE OR Correctly describe one pattern in words for P AND correctly write down general rule for L For notation see N	Correctly describe one pattern in words for P AND Correctly write down the general rule for P in terms of n For notation see N
		Testing (T)	Attempt to test their general rule for P using $n \leq 4$ Ex: correctly substitute in their general rule value of $n \leq 4$ Ex:	Correctly test their general rule for P using $n \leq 4$ Ex: Correctly calculate their value for P in their general		

		<p>substitute in their general rule value of $n \leq 4$</p> <p>OR</p> <p>Correctly test their described pattern or their rule (e.g. recursive rule)</p>	<p>rule using $n \leq 4$</p> <p>AND</p> <p>Recognise that their correctly calculated value for P is the same as the given value.</p> <p>ACCEPT seeing their correctly calculated value for P and the given value in the table being equal</p>		
	Verifying (V)	<p>Attempt to verify their general rule for P using $n \geq 5$</p> <p>Ex: correctly substitute in their general rule value of $n \geq 5$</p> <p>OR</p> <p>Correctly verify their described pattern or their rule (e.g. recursive rule)</p>	<p>Correctly calculate their value of P using their $n \geq 5$ in their general rule</p>	<p>Correctly calculate their value for P in their general rule using $n \geq 5$ AND</p> <p>Recognise that their correctly calculated value for P is the same as their predicted value obtained by continuing the pattern</p> <p>ACCEPT seeing their correctly calculated value for P and their predicted value in the table being equal</p>	
	Justify/prove (J)	<p>Weak attempt to justify their described pattern or their general rule</p> <p>Examples: trying at least two more values and arguing as justification that they are the same or rule works</p> <p>OR</p> <p>Just seeing their rule as $12 \times (\sqrt{2})^{n-1}$ without any explanation</p> <p>OR</p> <p>Assuming geometric sequence and valid attempt to find U1 and r</p>	<p>Good attempt to justify their general rule for P</p> <p>Examples: Recognise it is a geometric sequence and correctly write values of U1 and r</p> <p>OR</p> <p>multiplying by 4 incorrect rule for L</p>	<p>correctly justify the correct general rule for P in relation to geometry</p> <p>Examples: Writing in words OE that multiplying side by 4 gets perimeter if their L rule is $3 \times (\sqrt{2})^{n-1}$ and their general rule is $12 \times (\sqrt{2})^{n-1}$</p> <p>J3 automatically gains T2 and V3</p>	

			DO NOT ACCEPT if D2 not achieved				
	Notation and terminology (N)	<p>Correct notation of <u>their</u> rule OR Correct terminology describing a pattern</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 P OR The notation of <u>the general</u> rule includes errors AND Correct terminology describing pattern in words for P</p> <p>DO NOT ACCEPT if they don't have a general rule</p>	<p>Correct notation of <u>the general</u> rule for P AND Correct terminology describing pattern in words for P</p> <p>ACCEPT using U_n instead of P only if they mention that $P = U_n$</p> <p>For notation of the general rule, DO NOT ACCEPT Ex: $12(\sqrt{2})^{(n-1)}$ Or the rule is: $12(\sqrt{2})^{n-1}$ Or non-simplified rules</p>			
	Communication (L)	<p>Very weak communication</p> <p>More than two lines of communication that lacks organisation and coherence OR Only calculations or algebraic steps</p>	<p>Weak communication</p> <p>At least three lines of communication with an attempt of organisation but lacks coherence</p>	<p>Good communication</p> <p>More than three lines of communication with acceptable organisation and coherence</p> <p>Can be awarded only if J2 is achieved</p>			

Stage number (n)	Side length (L)	Perimeter of square (P)
1	3	12
2	$3\sqrt{2}$	$12\sqrt{2}$
3	6	24
4	$6\sqrt{2}$	$24\sqrt{2}$
5	12	48
6	$12\sqrt{2}$	$48\sqrt{2}$
7	24	96
8		

General rules:

$$L = 3 \times (\sqrt{2})^{n-1} \text{ or } 3 \times 2^{\frac{n-1}{2}}$$

$$P = 12 \times (\sqrt{2})^{n-1} \text{ or } 12 \times 2^{\frac{n-1}{2}}$$