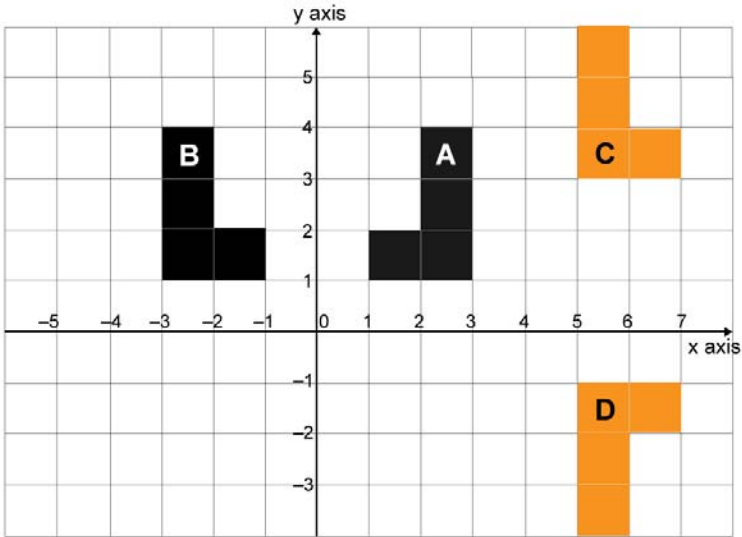


Task 1

Answers			Notes	Total
1	a	<ul style="list-style-type: none"> •¹ $x = 0$ 	Accept the y axis	1
	b	<ul style="list-style-type: none"> •¹ translation of shape B correctly placed (labelled C or not) •² the two orange shapes have a horizontal line of reflection •³ the two orange shapes have a horizontal line of reflection in the line $y=1$ 	<p>The shapes must be correct within tolerance of half a square, otherwise no mark</p> <p>Allow ECF for •² and •³</p> <p>3 or more unlabelled shapes mark •¹ only In case there are labelled and unlabelled shapes, only mark the labelled shapes and ignore unlabelled shapes</p>	3
	c	<ul style="list-style-type: none"> •¹ 180 (degree clockwise or anticlockwise) •² centre (4,0) 	<ul style="list-style-type: none"> •¹ The requirement is description of rotation of their shape D into A (It has to be description of rotation) •² "Centre 4" award no marks <p>Note: if their rotation is by 90 degrees Accept 90° for anticlockwise or 90° for clockwise Do not accept left or right for direction.</p>	2

2	a	<ul style="list-style-type: none"> •¹ 1st mark for two from the points below •² 2nd mark for four from the points below <p>correct comment comparing median or LQ or UQ or min or max correct comment comparing IQR or range correct values of median or LQ or UQ or min or max correct values of IQR or range</p>	<p>A comment for comparison would have higher or lower or same in both countries or WTTE</p> <p>Any reference to mode e.g. “most/usually shoe sizes” is incorrect Accept use of average for the median Accept values of IQR given as (LQ-UQ) Accept values of range given from min to max</p> <p>SC If there is not enough comments or correct values but the candidate states: that the shoes sizes in Brazil are bigger than in Egypt WTTE: award 1mark</p>	2
	b	<ul style="list-style-type: none"> •¹ 45 – 37 (or 37 to 45) •² 8 	<ul style="list-style-type: none"> •¹ 45 and 37 seen: award 1 mark •² 8 without working: award 2 marks 	2
	c	<ul style="list-style-type: none"> • 0.4 and 0.95 	OE Allow 40 % and 95 % (not 40)	1
	d	<ul style="list-style-type: none"> •¹ one multiplication correct •² second multiplication and addition correct •³ their 0.08 after addition 	<ul style="list-style-type: none"> •¹ OE 6% or 0.06 seen or 2% or 0.02 •² OE 0.06+0.02 •³ OE 0.08 without working: award 2 marks <p>Allow their values as ECF from (c) only if less than 1</p>	3

3	a	<ul style="list-style-type: none"> •¹ for cross multiplication •² for re-arranging y on one side and x in the other •³ for correct expression of y in terms of x 	<ul style="list-style-type: none"> •¹ $2y - 1 = 2x$ •² $2y = 2x + 1$ accept not seeing this step •³ $y = \frac{2x+1}{2}$ (If a further step is written as $y=x+1$ do not award •³) <p>Alternative method $y - \frac{1}{2} = x$</p> <ul style="list-style-type: none"> •¹ first term y •² second term $-\frac{1}{2}$ •³ $y = x + \frac{1}{2}$ <p>SC Award 1 mark For a correct equation written in words without working</p> <p>SC Award 2 marks $y = \frac{2x+1}{2}$ or $y = x + \frac{1}{2}$ without working</p> <p>SC Award 3 marks $y = \frac{2x+1}{2}$ or $y = x + \frac{1}{2}$ with at least one correct working step</p> <p>Accept seeing the equation not in-line</p>	3
	b	<ul style="list-style-type: none"> •¹ for equating $\frac{x+5}{2}$ with their expression for L_1 •² a correct algebraic step leading to the value of x •³ $x = 4$ or their value of x •⁴ for substituting in any of the two formulas •⁵ (4, 4.5) or their coordinate correctly evaluated 	<ul style="list-style-type: none"> •¹ (their) $\frac{2x+1}{2} = \frac{x+5}{2}$ •² e.g. $2x+1 = x+5$ accept not seeing this step •⁴ $y = \frac{4+5}{2}$ accept not seeing this step •⁴ Accept solving by elimination •⁵ Accept 4 and 4.5 OE •⁵ (4,4.5) without any working award 3 marks <p>SC Many candidates have $y = x+1$ in 7a) which leads to non-intersecting lines in 7b) in this case if they recognise that lines are parallel and do not intersect: award 4 marks</p>	5

4	a	<ul style="list-style-type: none"> • (Radius =) 5 substituted in area formula 	<p>(Area =) $\pi \times 5^2 = 25\pi$</p> <p>Accept describing in words</p>	1
	b	<ul style="list-style-type: none"> •¹ correct use of Pythagoras •² a correct algebraic step leading to the value of l^2 •³ their l written as exact value 	<ul style="list-style-type: none"> •¹ $(l^2 =) 5^2 + 5^2$ or $l^2 + l^2 = 10^2$ or $a^2 + b^2 = 10^2$ •² $l^2 = 50$ or $l^2 = 50$ or $2l^2 = 100$ Accept not seeing this step •³ $l = \sqrt{50}$ <i>or</i> $5\sqrt{2}$ without working: award 2 marks <p>Alternative method</p> <ul style="list-style-type: none"> •¹ Evidence of using sin45 or cos45 •² $\frac{1}{\sqrt{2}} = \frac{5}{l}$ <i>or</i> $\frac{1}{\sqrt{2}} = \frac{l}{10}$ •³ $l = \sqrt{50}$ (= $5\sqrt{2}$) <p>If a further step is showing 7.07.. do not award •³</p>	3
	c	<ul style="list-style-type: none"> •¹ area of square calculated =50 •² subtracting areas •³ their value approximated to 1 decimal place 	<ul style="list-style-type: none"> •² 28.53981634...or $25\pi - 50$ or accept 25π - area of square <p>Accept not seeing this step</p> <ul style="list-style-type: none"> •³ 28.5 •³ 28.53981634... without working: award 1 mark •³ 28.5 without working: award 2 marks 	3
	d	<ul style="list-style-type: none"> •¹ recognising radius is 25 m •² correctly substituting their radius into perimeter formula •³ calculating their value using the circumference formula 	<ul style="list-style-type: none"> •¹ Accept not seeing this step •² $(c =) 2\pi \times$ their radius or $(c =) \pi \times$ their diameter •³ 50π or 157.0796... exact or correctly rounded 	3

5	a	<ul style="list-style-type: none"> •¹ (the maximum height occurs at $x=$)15 •² $(h(15) =)9(m)$ 	<ul style="list-style-type: none"> •¹ Can be seen as substitution in the equation •² ECF only for x values [13,17] •² 9 without working: award 1 mark 	2
	b	<ul style="list-style-type: none"> •¹ $x=26$ or any evidence of substituting it •² $h = 4.16$ •³ Their $4.16 > 3$ m (therefore score) 	<ul style="list-style-type: none"> •¹ Accept not seeing this step •² 4.16 without working: award 2 marks •³ $4.16 > 3$ m, without working award 3 marks Their 4.16 must be greater than 3 	3
	c	<ul style="list-style-type: none"> •¹ for setting numerator = 0 •² for correct factorisation or evidence of correct substitution into the quadratic formula •³ for both correct values of x 	<ul style="list-style-type: none"> •¹ $-x^2 + 30x - 125 = 0$ accept not seeing this step •² $(x-5)(x-25) = 0$ accept not seeing this step •³ $x = 5, x = 25$ accept (5,0) (25,0) •³ $x = 5, x = 25$ without working: award 3 marks 	3
	d	<ul style="list-style-type: none"> •¹ no •² correct justification with correct values 	<ul style="list-style-type: none"> •² because it hits the ground before the post at 25 m or •² $x = 26$ to $h(26) = -0.84$ •² ECF for their x values only 	2

Task 2

Answers			Notes	Total
6	a	• the values increase	WTTE: Accept: the values double	1
	b	• 440 880	Both correct	1
	c	• ¹ evaluates 3520 • ² because their values are above 20 and below 20 000	• ¹ 3520 must be seen • ² Accept “because 20< their A<20 000” OE • ² Accept their 3520 is less than 20 000 :Award 2 marks	2
	d	• ¹ $\frac{220}{27.5} = 8$ • ² $8 = 2^3$ • ³ $k = 3$	• ¹ 27.5 seen • ³ 2^3 or 3 or k=3 without working: award 2 marks	3
	e	• ¹ 1 term correct • ² both terms correct and multiplied $(F_n =) 27.5 \times 2^n$	• ¹ $F_n = F_0 \times 2^n$ award 1 mark • ² Allow alternative fully correct formula i.e. $55 \times 2^{n-1}$ OE	2
	f	• ¹ continuing the pattern or using the formula • ² yes	• ¹ 27.5×2^8 or 7040 or 14 080 or 28 160/27.5 or $14080 \times 2 = 28160$ or 2^{10} • ² Yes or No without working: award A0 marks	2

g	This table gives some key values which might be seen – the table goes over two pages		10	
	Aspect	1 mark		2 marks
	IR: Identification of relevant information	One numerical factor mentioned from: <ul style="list-style-type: none"> – Octave (either width 194.5mm or number of octaves 9) – Keys (either width 23mm or number 63-66) – Arm span 1.65m – Width of the piano as shown 148cm – Room/door size (eg. average room 3x4) – Human hearing 20HZ to 20 000HZ 		More than one numerical factor mentioned
	CM: Calculation of measurements including width	Relevant calculation without mentioning gaps or extra width Example: Calculating the number of keys ie $52 + 2 \times 7$ Accept answer is in the range 63-66 OR Calculating the width of the piano keys $(63-66) \times 23$ ACCEPT any reasonable value		Calculating width including gap or adding extra width Examples: 9×194.5 9 octaves and includes gap between keys gap width: $(194.5 - 8 \times 23) / 7$ or 8 gaps = 1.5 / ----mm Key + its gap = $23 + 1.5 = 24.5$ Hence width = $66 \times 24.5 + 1.5$ (1 extra gap at the end) = 1618.5 mm OR Calculating extra width at the end in the original piano: In normal piano of width 1480mm there are 52 keys so extra width both sides is $1480 - (52 \times 24.5 + 1.5) = 204.5$ mm So the 66 keys piano needs to be $1618.5 \text{ mm} + 204.5 = 1823 \text{ mm}$
	JD: Justification of degree of accuracy	Rounding used in any element		Justifies their choice of rounding
PD: Practicality of new design	Limited argument: Some examples: Not acceptable because people are used to smaller pianos Acceptable as it will include all octaves that people can hear	Justified argument Some examples: Referring to price in anyway: Not acceptable because the added octaves will increase the price of the machine and at the same time 2 octaves will not add much Referring to the difference in width between normal piano and this one in any way: Acceptable because the added width will be only about 30 cm which can fit in a standard room width		
QD: Quality of overall discussion (Holistic judgement on the whole response)	Limited discussion	Balanced discussion		

7	a	<ul style="list-style-type: none"> •¹ 24+6 or 30(<i>m</i>) •² 30(<i>cm</i>) etc 	<ul style="list-style-type: none"> •¹ Accept not seeing this step •² 30 cm without working award 2 marks 	2
	b	<ul style="list-style-type: none"> •¹ 24 ÷ 9 •¹ 2.6666666666 (m/cm) •³ 2.7 	<ul style="list-style-type: none"> •² 2.66 or 2.67 (m/cm) without working award 1 mark •³ 2.7 (m/cm) without working award 2 marks 	3
	c	<ul style="list-style-type: none"> •¹ use of a trigonometric function /rule correctly •² correct rearrangement of their trigonometric function •³ calculating their value of <i>d</i> •⁴ round their 2.03... to the nearest cm 	<ul style="list-style-type: none"> •¹ e.g. $\tan(53) = \frac{2.7}{d}$ Accept not seeing this step •² e.g. $\frac{2.7}{\tan(53)}$ seen •³ $d = 2.03 \dots$ •⁴ 2 with 1 correct algebraic step: award 4 marks •⁴ 2 without working: award 3 marks •⁴ 2.03 without working: award 2 marks 	4
	d	<ul style="list-style-type: none"> •¹ for subtracting from 55.3 •² for multiplying by 8 •³ their 22.82 or 23.3 	<ul style="list-style-type: none"> •¹ Attempt to subtract at least one depth <i>d</i> from 55.3 •² Award 2 marks if: 55.3 – 8 x 2 x their 2 55.3 – 16 x their 2 55.3 – 32 •³ 22.82 or 23.3 without working award 2marks 	3

For candidates that do not apply the scale 1:100 treat as a misread **MR** on the first occasion

ECF can be awarded so candidates can gain full marks for subsequent working

The final answer for 7a) 7b) 7c) should be in the answer box. If there is not a value in the answer box, award marks for final answers in the response box

e	Aspect	1 mark	2 marks
	Identify the relevant information required	Identify one of the following: Total measurements of the model Volume of the model Elements of the pyramid (temple and platform) the scale 1:100 Practicality of the size of the model	Identify more than one of the following: Total measurements of the model Volume of the model Elements of the pyramid (temple and platform) the scale 1:100 Practicality of the size of the model
	Consider the degree of accuracy	Consideration the implication of the degree of accuracy on the given values. Examples: Recognizing that the lengths given to the nearest cm Recognizing that the angles given to one decimal place	Consideration the implication of the degree of accuracy on the calculated values. Examples: $2.7 \times 9 + 6 = 30.3$ and not 30cm (2.5 instead of 2.7 we get $2.5 \times 9 + 6 = 28.5$ which is far from 30 or 3cm instead of 2.7 we get $3 \times 9 + 6 = 33$ which is far from 30) The width of first platform 55.3cm while it could be 55 and in this case 9 th platform $55 - 2 \times 2 \times 8 = 23$ cm The width of 9 th platform could be 23 cm instead of 23.3 and in this case the 1 st platform 55cm Recognizing the difficulty of using a model with dimensions more accurate than nearest mm because of measuring tools available
	Comment on the validity	Comment not supported with evidence. Examples: The model will be close enough to look like the real pyramid The model was calculated with correct mathematical steps so it is valid	Comment supported with evidences. Examples: The model is practical and referring to overall size (height being about 30, width being about 50 cm) and can be carried/placed on a table easily The model is not very valid because the total height needs to be to the nearest mm like the height of the platform (27 mm). this will lead to inaccurate angles compared to real pyramid The erosion had an effect on the real pyramid and this is not taken into account in the model

Task 3

Answers			Notes	Total
8	a	<ul style="list-style-type: none"> •¹ student shows correct method for averaging AG •² 8 	<ul style="list-style-type: none"> •¹ Averaging values •² Correct limit 	2
	b	<ul style="list-style-type: none"> •¹ two correct from p=5 q=6 r=7 •² all three correct 	<ul style="list-style-type: none"> •¹ Award 1 mark for two correct values 	2
	c	<ul style="list-style-type: none"> •¹ one correct pattern •² another different correct pattern 	<p>For example Column A increases by 3 or multiples of 3 Column L increase by 1 Divide column <i>a</i> by 3 and then add 2 Adding <i>a</i> and <i>b</i> gives the next <i>a</i> L equals <i>a</i> minus 2 two times the row Accept column <i>b</i> are the same / all 3 Accept any correct pattern written algebraically</p>	2
	d	<ul style="list-style-type: none"> •¹ any correct working leading to the general rule •² any correct arrangement of $L = \frac{1}{3}a + 2$ 	<p>examples $L = \frac{1}{3}a + \text{any value}$ or $L = \text{any value of } a + 2$ or describing in words</p> <ul style="list-style-type: none"> •² Both terms correct: award 2 marks <p>SC Accept correct rule involving <i>a</i>, <i>L</i> and the row number: award 2 marks</p>	2

e	Mark holistically			12
	Strand	Holistic markscheme	Mark band	
	Discover patterns DIS: Describe patterns DES: Prove, verify, justify PVJ:	Nothing from below	0	
	Discover patterns DIS: Describe patterns DES: Prove, verify, justify PVJ:	One prediction made Attempt to describe a pattern in words	1 - 3	
	Discover patterns DIS: Describe patterns DES: Prove, verify, justify PVJ:	More than one prediction made A pattern correctly described in words Attempt to test their described pattern	4 - 6	
	Discover patterns DIS: Describe patterns DES: Prove, verify, justify PVJ:	More than one prediction made A pattern described as suggested general rule consistent with some of the findings Their general rule is tested correctly	7 - 9	
	Discover patterns DIS: Describe patterns DES: Prove, verify, justify PVJ:	More than one prediction made A pattern described as correct general rule consistent with findings A general rule is fully proved or verified and justified	10 - 12	
	<p>SC More than one prediction made with constant value for column A without any pattern description award 3 marks Patterns need to refer to a relation involving a b and L Predictions could be seen in the table or in the answer box</p>			

Exemplification

The candidates can populate the table using the simulator.

Candidates who restrict themselves to the pattern shown can only discover simple patterns e.g.

For L in terms of row number [$L=n+3$] and a in terms of row number [$a =3(n+1)$]. Simple patterns can only gain credit up to Mark band 7–9.

Candidates who use the simulator to vary a and b will be able to described more complex patterns and find $\frac{1}{3}a + \frac{2}{3}b$.

Using random values of a and b will probably not prove useful. Some systematic approach will be more helpful. Here are some examples.

Candidates keep the same a values and change b – they will soon see that multiples of 3 are better to use.

	a	b	L
	3	6	5
	6	6	6
	9	6	7
	12	6	8

They might write down a rule and test it again using the simulator.

They might try $b = 0$

	a	b	L
	3	0	1
	6	0	2
	9	0	3
	12	0	4

Candidates need to use other a values. They might keep a constant and vary b . And again put $a = 0$

	a	b	L
	3	3	3
	3	6	5
	3	9	7
	3	12	9

	a	b	L
	0	3	2
	0	6	4
	0	9	6
	0	12	8

9	a	<ul style="list-style-type: none"> an explanation 	$(a + b) \div 2 = \frac{1}{2}a + \frac{1}{2}b$ or an equivalent written explanation	1																					
	b	<ul style="list-style-type: none"> ¹ 32 in denominator for 7th term ² both numerators correct for 7th term ³ 64 in denominator for 8th term ⁴ both numerators correct for 8th term 	Accept coefficients only i.e. no sight of <i>a</i> and <i>b</i> $\frac{11}{32}a$ and $\frac{21}{32}b$ or $11/32 a$ and $21/32 b$ $\frac{21}{64}a$ and $\frac{43}{64}b$ or $21/64 a$ and $43/64 b$	4																					
	c	<table border="1"> <thead> <tr> <th>Strand</th> <th>Holistic markscheme</th> <th>Mark band</th> </tr> </thead> <tbody> <tr> <td>Describe patterns DES: Prove, verify, justify PVJ:</td> <td>Nothing from below</td> <td>0</td> </tr> <tr> <td>Describe patterns DES: Prove, verify, justify PVJ:</td> <td>Attempt to describe a pattern in words</td> <td>1 - 2</td> </tr> <tr> <td>Describe patterns DES: Prove, verify, justify PVJ:</td> <td>A pattern correctly described in words Attempt to test their described pattern</td> <td>3 - 5</td> </tr> <tr> <td>Describe patterns DES: Prove, verify, justify PVJ:</td> <td>A pattern described as suggested general rule consistent with some of the findings Their general rule is tested correctly</td> <td>6 - 9</td> </tr> <tr> <td>Describe patterns DES: Prove, verify, justify PVJ:</td> <td>A pattern described as correct general rule consistent with findings A general rule is verified or justified</td> <td>10 - 12</td> </tr> <tr> <td>Describe patterns DES: Prove, verify, justify PVJ:</td> <td>A pattern described as correct general rule consistent with findings A general rule is fully proved or verified and justified</td> <td>13 - 14</td> </tr> </tbody> </table> <p>SC Pattern needs to refer to the coefficients of <i>a</i> and <i>b</i></p>			Strand	Holistic markscheme	Mark band	Describe patterns DES: Prove, verify, justify PVJ:	Nothing from below	0	Describe patterns DES: Prove, verify, justify PVJ:	Attempt to describe a pattern in words	1 - 2	Describe patterns DES: Prove, verify, justify PVJ:	A pattern correctly described in words Attempt to test their described pattern	3 - 5	Describe patterns DES: Prove, verify, justify PVJ:	A pattern described as suggested general rule consistent with some of the findings Their general rule is tested correctly	6 - 9	Describe patterns DES: Prove, verify, justify PVJ:	A pattern described as correct general rule consistent with findings A general rule is verified or justified	10 - 12	Describe patterns DES: Prove, verify, justify PVJ:	A pattern described as correct general rule consistent with findings A general rule is fully proved or verified and justified	13 - 14
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Exemplification

Candidates may look at **their** developing table and find simple and more complex patterns.

Examples of patterns

The denominators go 1, 2, 4, 8, 16, 32, ...

The denominators are 2^n

The numerators always add to give the denominator e.g. $5 + 11 = 16$

The coefficients always add to give 1

The coefficient of ***a*** is always smaller than that of ***b***

The coefficient of ***a*** is always nearly half that of ***b***

The numerators go 1, 3, 5, 11, 21, 43, 87, ... starting at term 3

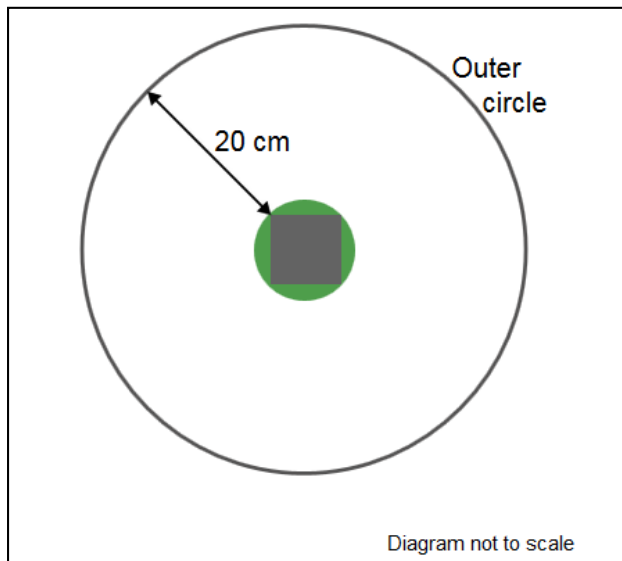
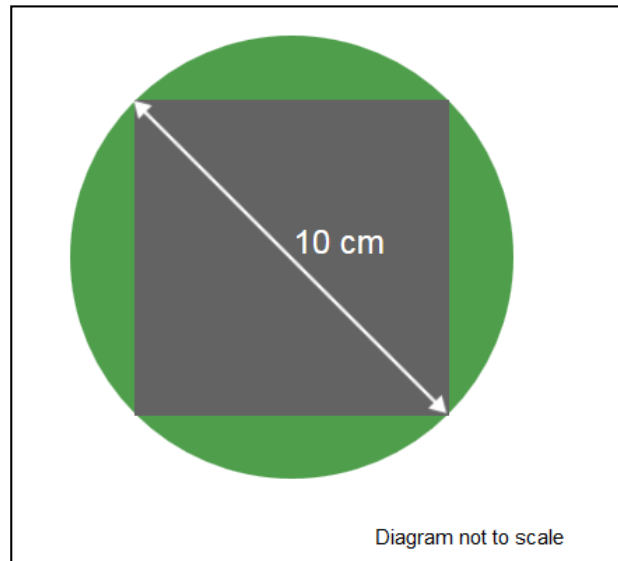
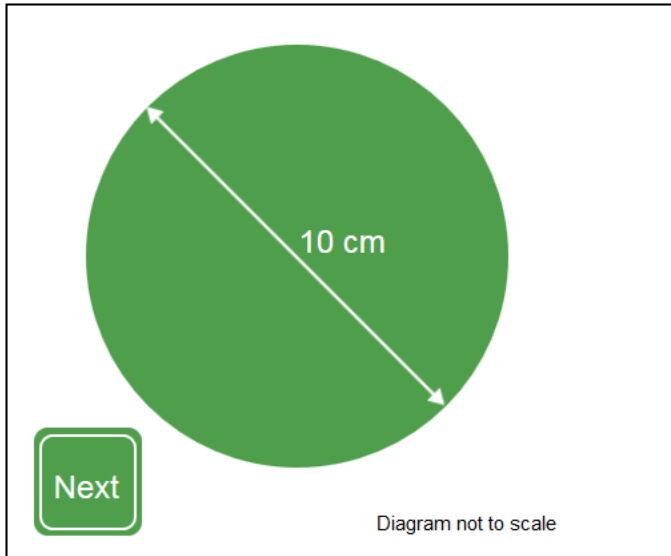
The rule for the numerator of ***b*** is double the numerator of ***a*** and then add or subtract 1

The numerators always add to the denominator

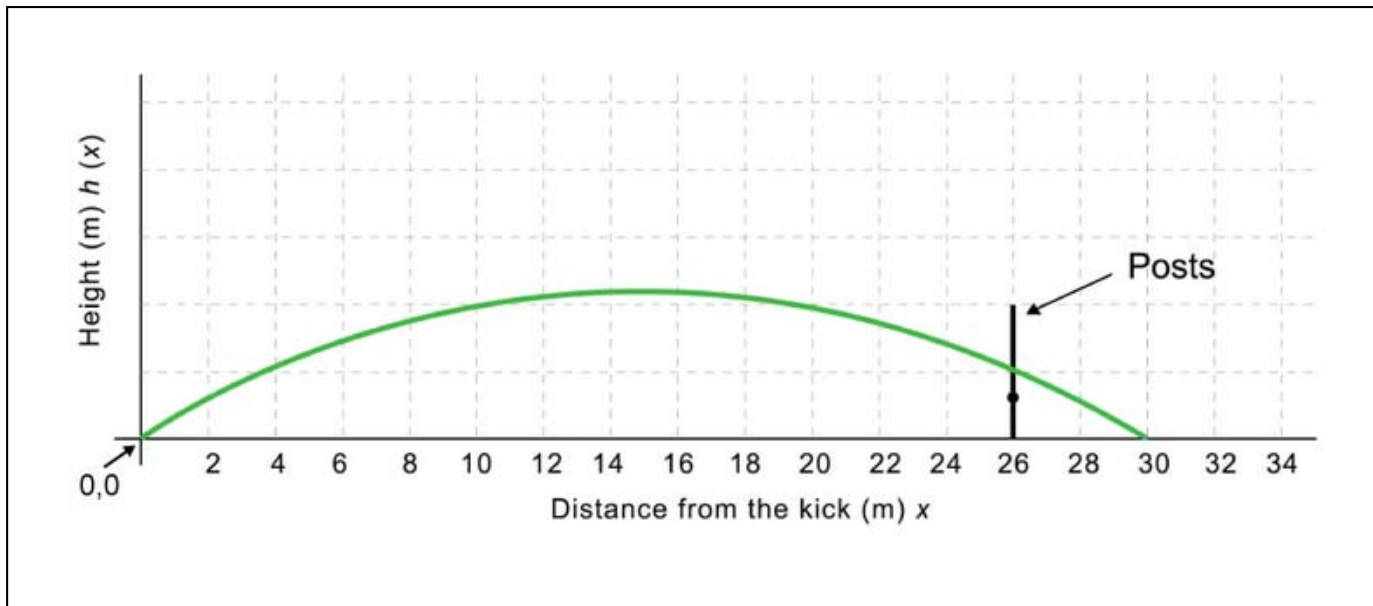
The numerator of ***b*** is the numerator of ***a*** plus twice the previous numerator of ***a***

Appendices

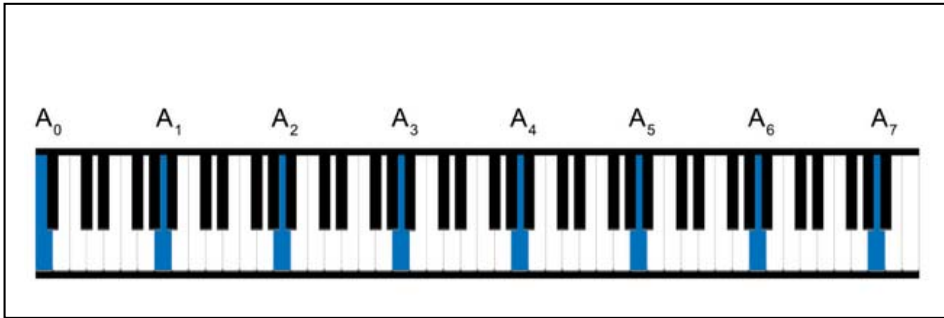
Question 4



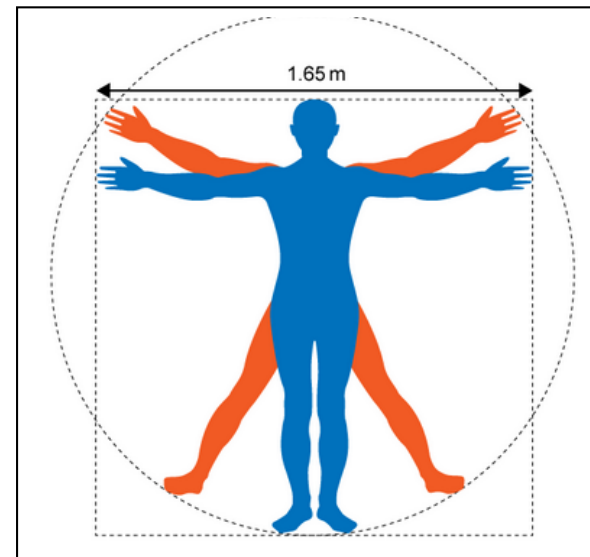
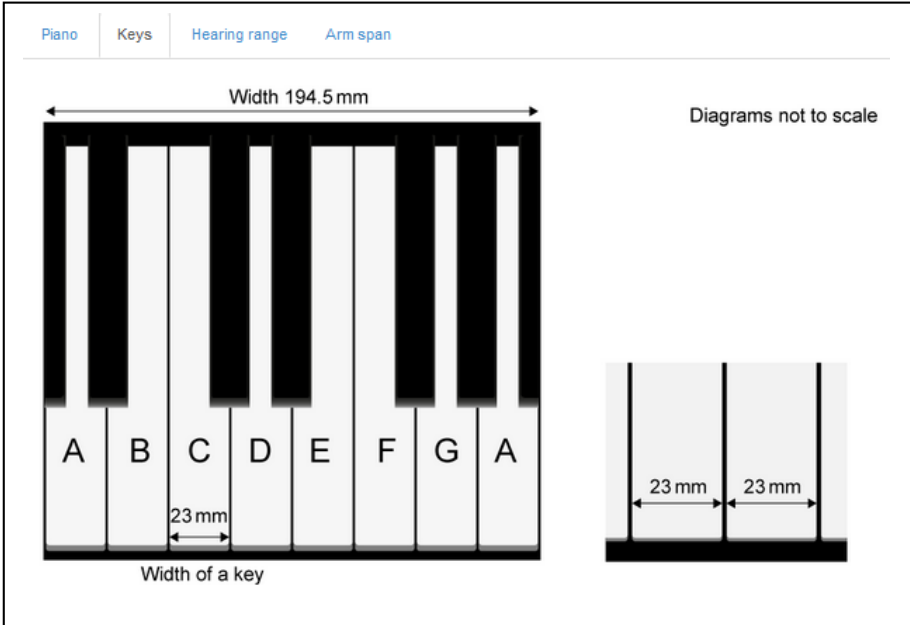
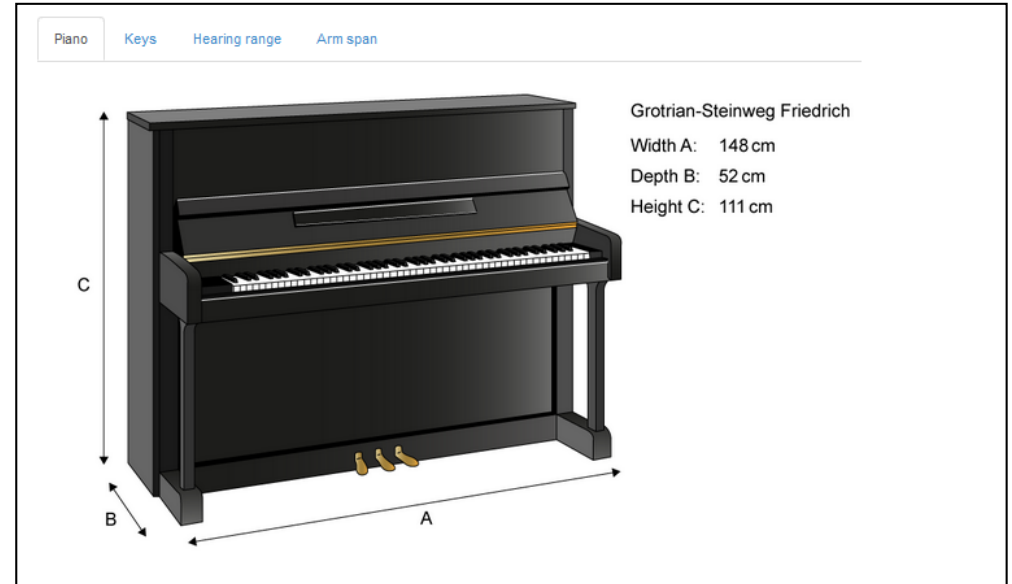
Question 5



Question 6



Humans can only hear between 20 and 20 000 Hertz.



Question 7

Tab 1

Tab 2

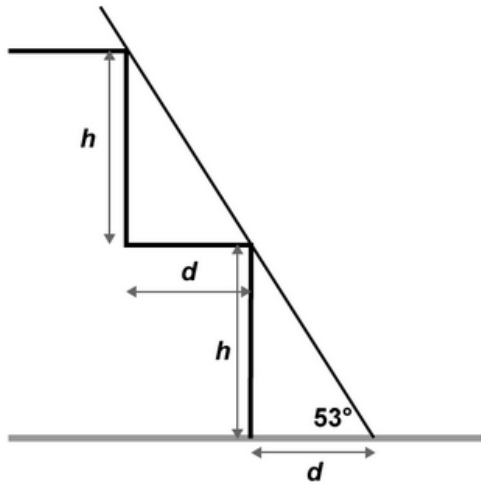


Diagram not to scale

Tab 1

Tab 2

Diagram not to scale

