

J255mathmeoeengt0xxm



# Markscheme

May 2025

Extended Mathematics

On-screen examination

29 pages





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

















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## RM Assessor

### Important

**NR** only use when the candidate has not made any response also stamp the response with  Do not award  for NR responses

The following are the annotations available to use when marking responses.

Annotation	Explication	Annotation	Explication
	Unclear		Award 0 marks
	Special case		Award 1 mark
	Misread		Award 2 marks
<b>NWS</b>	No working shown		Award 3 marks
	Error carried forward		Award 4 marks
	Words to that effect		Award 5 marks
	Benefit of the doubt		Incorrect
	Answer Given		Highlight tool
	Wavy underline tool		Seen
	Ellipse tool		On page comment tool

### Markscheme abbreviations

**MS** : Markscheme

**OE** : Or equivalent

**SC** : Special case

**AM** : Alternative method **AM1, AM2 etc**

[ ] : Answers within a range Ex: [4,5] this means values between 4 and 5 inclusive ( $4 \leq x \leq 5$ ) are accepted

] [ : Answers within a range Ex: ]4,5[ this means values between 4 and 5 not inclusive ( $4 < x < 5$ ) are accepted

**bp** : Bullet notation Ex: .1 (bp1) or .2 (bp2) or .3 (bp3) etc bullet notation means award one mark – see example below

**bp2 implies bp1** : Seeing bp2 award the mark for bp2 and bp1 whether bp1 is not seen or if bp1 is incorrect

Example 1  
.1 mark awarded and corresponding notes are aligned

b	.1 Show clear line of reasoning in the method	.1 45 and 490 seen <b>OE</b> Ex: $490 = 10(45 + x)$	<b>Award 1 mark</b>
	.2 The value of $x$	.2 4	<b>Award 1 mark</b>

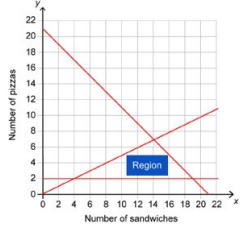
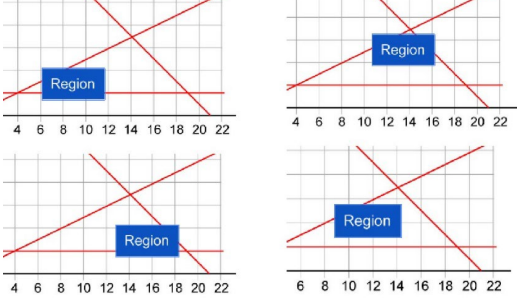
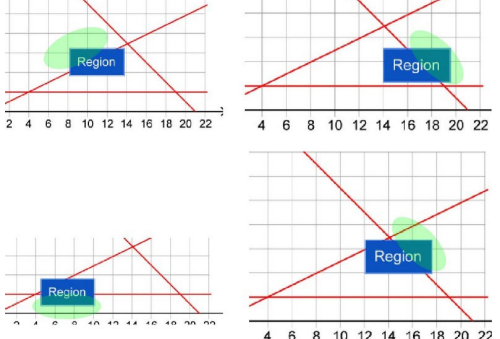
**Error Carried Forward (ECF) marks**

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.

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

**General notes**

- As this is an international examination, accept all **alternative forms of notation**, for example 1,9 as 1.9 ; 1,000 or 1.000. However, **DO NOT ACCEPT** incorrect mathematical notation  $x^2$  for  $x^2$  unless noted otherwise in the MS.
- ACCEPT** notation errors in intermediate steps.
- Unless noted otherwise, ignore further working after a correct answer even if further working is incorrect.
- In the case when a correct result is obtained using incorrect seen method, do not award the mark for the result.
- Where candidates have written two solutions to a question, mark the first solution.
- 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 0.5 or  $2 \div 4$  ;  $\frac{x}{2}$  or  $x/2$  or  $x \div 2$  ; 0.23 or 23%
- 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. However, it indicates what the candidate’s result represents. Ex: if last mark is for the result: (AB)=5; this means we award the mark for seeing 5 as the result of calculating AB without necessarily seeing AB=5, but it does not mean we award the mark for seeing 5 representing another length.
- Special case marks **SC** can be allocated instead of but not in addition to the marks prescribed in the markscheme.
- ACCEPT** seeing equation not in-line or the fraction line missing.
- Calculator screenshots are accepted as working steps. And when a calculator screenshot is taken, accept not seeing the whole operation.
- In task 2 and 3 where the markscheme is set out in a table then, unless noted otherwise, awarding the highest mark in a category includes all the lower marks in that category. It is probably best to look for the top category mark answer and if you don't find it look at the next mark down.
- Unless noted otherwise, **ACCEPT** using the correct values or working regardless their previous result.
- Candidates will sometimes use methods other than those in the markscheme. Unless the question specifies a method, other correct methods should be marked in line with the markscheme. **If in doubt, contact your team leader for advice.**
- Unless noted otherwise, if a note in a part says to accept the answer without working for 1 mark less than total marks, then seeing the correct answer with any acceptable working step, award full marks. Example: If the note in a part worth 3 marks says “4.3(3...) without working award 2 marks”, then seeing any acceptable working step and seeing 4.3(3...) as the answer award the 3 marks.
- For “**show that**” questions, unless otherwise noted, every bullet point has to be seen in order to be awarded.
- When a result is written as “their5.7(37...)” it means accept their result if its minimum accuracy is 1 dp. Providing higher accuracy is of course accepted but not required. Rounding their result incorrectly to nearest 1 dp is not accepted.
- When there are multiple alternative methods (multiple AM), mark the response using one specific AM. Do not add different marks from different AM.

Q1	Answers	Notes	Total															
a	.1 Correct constraint in the first line (number of pizzas) .2 Correct inequality sign in the second line .3 Correct inequality sign in the third line .4 The correct region	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Draggable inequalities</th> <th style="width: 30%;">Inequalities</th> <th style="width: 50%;">Constraints in context</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>\geq</math></td> <td style="text-align: center;"><math>y \geq 2</math></td> <td style="text-align: center;"><b>At least 2 pizzas</b></td> </tr> <tr> <td style="text-align: center;"><math>&gt;</math></td> <td style="text-align: center;"><math>x + y \leq 21</math></td> <td style="text-align: center;">A maximum of 21 items</td> </tr> <tr> <td style="text-align: center;"><math>\leq</math></td> <td style="text-align: center;"><math>x \geq 2y</math></td> <td style="text-align: center;">There should be at least twice as many sandwiches as there are pizzas</td> </tr> <tr> <td style="text-align: center;"><math>&lt;</math></td> <td></td> <td></td> </tr> </tbody> </table> <p>.1 ACCEPT more than one pizza, two or more pizzas, minimum of 2 pizzas</p>	Draggable inequalities	Inequalities	Constraints in context	$\geq$	$y \geq 2$	<b>At least 2 pizzas</b>	$>$	$x + y \leq 21$	A maximum of 21 items	$\leq$	$x \geq 2y$	There should be at least twice as many sandwiches as there are pizzas	$<$			4
Draggable inequalities	Inequalities	Constraints in context																
$\geq$	$y \geq 2$	<b>At least 2 pizzas</b>																
$>$	$x + y \leq 21$	A maximum of 21 items																
$\leq$	$x \geq 2y$	There should be at least twice as many sandwiches as there are pizzas																
$<$																		
	<p><b>.4 Correct answer</b></p> 	<p><b>ACCEPT if the word "region" is in the correct zone.</b></p> 	<p><b>DO NOT ACCEPT if the word "region" crosses lines.</b></p> 															
b	The correct number of sandwiches.	4 ACCEPT $x \geq 4$ DO NOT ACCEPT $x \leq 4$ or $x > 4$ or $x < 4$ DO NOT ACCEPT ECF from their graph	1															
c	The correct number of pizzas.	7 ACCEPT $y \leq 7$ DO NOT ACCEPT $y \geq 7$ or $y > 7$ or $y < 7$ DO NOT ACCEPT ECF from their graph	1															

Q2	Answers	Notes	Total
a	<p>.1 correct algebraic step or log simplification</p> <p>.2 correct follow-on step for their .1</p> <p>.3 The correct value for <math>a</math></p>	<p>.1 <math>\log 49 = 2\log a</math> or <math>\log 49 = \log a + \log a</math> or <math>\log\left(\frac{49}{a}\right) = \log a</math></p> <p>.2 <math>\log 49 = \log a^2</math> or <math>49 = a^2</math> or <math>\sqrt{49} = a</math> or <math>\frac{49}{a} = a</math> or <math>0.5\log 49 = \log a</math> or <math>2\log 7 = 2\log a</math></p> <p>.3 <math>a = 7</math></p> <p><math>a = 7</math> as final answer after number trials or without working, <b>award 2 marks</b></p> <p>ACCEPT the use in the working of another letter instead of "<math>a</math>".</p>	3

b	<p><b>AM1 Converting exponents</b></p> <p>.1 Correctly convert numerator <b>AND</b> denominator using exponents</p> <p>.2 Subtract <b>their</b> denominator exponent from <b>their</b> numerator exponent</p> <p>.3 The correct values for <math>b</math> and <math>c</math>.</p> <p><b>AM2 Using logs</b></p> <p>.1 Correctly convert to one log.</p> <p>.2 Correctly calculate <b>their</b> exponent.</p> <p>.3 Correctly convert to reach the correct values for <math>b</math> and <math>c</math>.</p>	<p><b>AM1 Converting exponents</b></p> <p>.1 <math>5^{\frac{1}{2}}</math> and <math>5^2</math> OR <math>5^{\frac{1}{2}}</math> and <math>5^{-2}</math> OR <math>\frac{5^{\frac{1}{2}}}{5^2}</math> OR <math>5^{\frac{1}{2}} \times 5^{-2}</math></p> <p>.1 ACCEPT <math>\frac{1}{2}</math> or 2 seen as converted exponents of <math>\sqrt{5}</math> or 25.</p> <p>.2 <math>5^{\text{their}(\frac{1}{2}-2)}</math> OR their <math>(\frac{1}{2}-2)</math> OR <math>5^{\text{their}(-1.5)}</math></p> <p>.3 <math>b = -3</math> and <math>c = 2</math> OR <math>b = 3</math> and <math>c = -2</math> ACCEPT <math>5^{-\frac{3}{2}}</math> or <math>5^{\frac{3}{-2}}</math> or <math>5^{-\frac{3}{2}}</math></p> <p>.3 ACCEPT correct values of <math>b</math> and <math>c</math> that simplify to <math>-\frac{3}{2}</math>.</p> <p><b>AM2 Using logs</b></p> <p>.1 <math>\log_5 \frac{\sqrt{5}}{25}</math> ACCEPT <math>\log_5(0.089442719)</math></p> <p>.2 <math>(\log_5 \frac{\sqrt{5}}{25} =) -1.5</math> or <math>(\frac{\log_5(0.089442719)}{\log 5} =) -1.5</math></p> <p>.3 <math>b = -3</math> and <math>c = 2</math> OR <math>b = 3</math> and <math>c = -2</math> ACCEPT <math>5^{-\frac{3}{2}}</math> or <math>5^{\frac{3}{-2}}</math> or <math>5^{-\frac{3}{2}}</math></p> <p>.3 ACCEPT correct values of <math>b</math> and <math>c</math> that simplify to <math>-\frac{3}{2}</math>.</p>	3
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Q3	Answers	Notes	Total
a	.1 Correct answer	.1 $(385-430$ or $340-385=)$ $-45$ ACCEPT 45 is subtracted every time OE.	1
b	.1 Correctly substitute <b>their -45 from part 3a</b> in the arithmetic sequence formula  .2 Correctly calculate <b>their</b> amount of water using their equation in bp1.	.1 $430+(7-1)(\text{their}-45)$ or $430-\text{their}45(6)$ OE .1 ACCEPT substituting their part 3a) as negative even if seen positive in part 3a) .1 ACCEPT incorrect notation with brackets ex.: $430+(7-1)-45$ for bp1  .2 their160 (ml) .2 DO NOT ACCEPT if their160 is greater than 340.  160 without working award <b>2 marks</b>	2
c	<b>AM1 Solving <math>Un = 0</math></b> .1 Correctly set $Un = 0$ using their $-45$ from part 3a).  .2 Correctly rearrange for $n$ on one side  .3 Correctly round down <b>their</b> value for $U$	<b>AM1 Solving <math>Un = 0</math></b> .1 $430+\text{their}-45(n-1) = 0$ or $0 = 475-45n$ OE .1 ACCEPT using their part 3a) as negative even if seen positive in part a) .1 ACCEPT incorrect notation with brackets ex.: $0=430+(n-1)-45$ for bp1 .1 DO NOT ACCEPT $430 - \text{their}45n = 0$ OE  .2 $(n =) \frac{430}{\text{their}45} + 1$ or $\frac{430+\text{their}45}{\text{their}45}$ OE ACCEPT $(n =)$ their10.555...or 10.56 or 10.6 or 10.5 .2 implies bp1  .3 their10 .3 DO NOT ACCEPT $n$ smaller than 8 or negative $n$ . .3 DO NOT ACCEPT if their calculated value didn't need rounding.	3

Q4	Answers	Notes	Total
a	NOTE : For parts a, b and c, <b>DO NOT ACCEPT</b> probabilities <b>more than 1</b> either as an answer or in the working.		
	.1 Correctly substitute $P(A)$ and $P(A \cap B)$ into the multiplication rule for independent events  .2 The correct value of $P(B)$	.1 $0.25 \times P(B) = 0.15$ or $P(B) = \frac{0.15}{0.25}$  .2 0.6 .2 DO NOT ACCEPT 0.6 coming from incorrect working (Ex.: $1 - 0.25 - 0.15$ )	<b>2</b>
b	.1 Subtract $P(A \cap B)$ from <b>their</b> $P(B)$ OR Multiply <b>their</b> $P(B)$ by the $P(A)$  .2 Correct value after <b>their</b> subtraction OR <b>their</b> multiplication from their .1	.1 their $0.6 - 0.15$ OR their $0.6 \times 0.75$  .2 their 0.45 OE	<b>2</b>
c	.1 Correctly calculate <b>their</b> $P(A \cup B)$ using addition rule OR by adding <b>their</b> three separate parts $P(A \cap B')$ , $P(A \cap B)$ and $P(B \cap A')$ OR any other correct method  .2 Correctly calculate $(1 - \text{their } .1)$ as their complementary event	.1 $(0.25 + \text{their } 0.6 - 0.15 = )$ their 0.7 OE OR $(0.1 + 0.15 + \text{their } 0.45 = )$ their 0.7  .2 $(1 - \text{their } 0.7 = )$ their 0.3	<b>2</b>

Q5	Answers	Notes	Total
a	<p><b>AM1 Substituting (0,18)</b>                      .1 Correctly substitute (0,18) into <math>f(x)</math> OR correctly expand <math>f(x)</math> with <math>a</math>.</p> <p>.2 Divide by 9</p> <p><b>AM2 Expanding <math>f(x)</math></b>                      .1 Correctly expand <math>f(x)</math> with <math>a</math></p> <p>.2 Recognize that c (y-intercept) is equal to 18.</p> <p><b>2 AG</b></p>	<p><b>AM1 Substituting (0,18)</b>                      .1 <math>18 = a(0-3)^2</math></p> <p>.2 <math>a = \frac{18}{9}</math> ACCEPT <math>\frac{18}{(0-3)^2}</math> or <math>18 = 9a</math></p> <p><b>AM2 Expanding <math>f(x)</math></b>                      .1 <math>ax^2 - 6ax + 9a</math></p> <p>.2 <math>9a = 18</math></p>	2

	<p><b>b</b></p> <p><b>AM1 Expanding <math>f(x)</math></b>                  .1 Correctly expand <math>f(x)</math>                   .2 Correctly equate <b>their</b> <math>f(x)</math> to <math>g(x)</math> AND rearrange quadratic on one side                   .3 Correctly factorize <b>their</b> equation or correctly substitute <b>their</b> coefficients into quadratic formula                   .4 Identify <b>their</b> correct values for <math>x_1</math> and <math>x_2</math> that satisfy <b>their</b> equation of bp2.</p> <p><b>AM2 Factorizing <math>g(x)</math></b>                  .1 Correctly factorize <math>g(x)</math>                   .2 Correctly equate <b>their</b> <math>g(x)</math> to <math>f(x)</math> AND simplify                   .3 Correctly solve and identify <b>their</b> value for <math>x_1</math>                   .4 Correctly identify the value for <math>x_2 = 3</math></p>	<p><b>AM1 Expanding <math>f(x)</math></b>                  .1 <math>2x^2 - 12x + 18</math> or <math>2x^2 - 6x - 6x + 18</math>                   .2 their <math>x^2 - 2x - 3 (= 0)</math> or their <math>-x^2 + 2x + 3 (= 0)</math> ACCEPT their <math>x^2 - 2x = 3</math> or their <math>-x^2 + 2x = -3</math>                   .3 their <math>(x + 1)(x - 3)</math> or their <math>\frac{2 \pm \sqrt{(-2)^2 - 4(1)(-3)}}{2(1)}</math> OE                   .4 their <math>(x =) -1</math> and their <math>(x =) 3</math></p> <p><b>AM2 Factorizing <math>g(x)</math></b>                  .1 <math>(x - 7)(x - 3)</math>                   .2 their <math>(x - 7) = 2(x - 3)</math>                   .3 their <math>x = -1</math>                   .4 <math>x = 3</math></p>	<p style="text-align: center;">4</p>
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<p><b>c</b></p>	<p>.1 <b>The</b> correct value for <math>h</math></p> <p>.2 <b>The</b> correct value for <math>k</math> OR <b>their</b> correct <math>k</math> from <b>their incorrect</b> <math>h</math>.</p>	<p>.1 (<math>h =</math>) 5 ACCEPT seeing it in <math>(x - 5)^2 + k</math> only if they don't contradict it later saying <math>h = -5</math>                  .1 ACCEPT seeing only <math>(x - 5)^2</math> only if they don't contradict it later saying <math>h = -5</math>                  .1 DO NOT ACCEPT random 5 seen in the working, it has to be related to <math>h</math> or identified as <math>h</math>.</p> <p>.2 (<math>k =</math>) -4 ACCEPT seeing it in <math>(x - h)^2 - 4</math>                  .2 ACCEPT their <math>k</math> only if you see the correct calculation from their incorrect <math>h</math>.                  .2 DO NOT ACCEPT random -4 seen in the working, it has to be related to <math>k</math> or identified as <math>k</math>.</p> <p>ACCEPT seeing <math>(x - 5)^2 - 4</math> for 2 marks only if they don't contradict it later saying <math>h = -5</math> or <math>k = 4</math>.</p>	<p>2</p>														
<p><b>d</b></p>	<p>.1 Correctly select the first transformation</p> <p>.2 Correctly select <b>their</b> second transformation</p> <p>.3 Correctly select <b>their</b> third transformation</p> <p>COMPARING WITH <math>f(x) = 2(x - 3)^2</math></p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center; vertical-align: top;">.1</td> <td style="width: 40%; text-align: center;"> <div style="border: 2px solid red; border-radius: 10px; padding: 2px; display: inline-block;">Stretched vertically ▼</div> </td> <td style="width: 10%; text-align: center; vertical-align: middle;">By factor</td> <td style="width: 15%; text-align: center;"> <div style="border: 2px solid red; border-radius: 10px; padding: 2px; display: inline-block;"><math>\frac{1}{2}</math></div> </td> <td style="width: 25%;"></td> </tr> <tr> <td style="text-align: center; vertical-align: top;">.2</td> <td style="text-align: center;"> <div style="border: 2px solid blue; border-radius: 10px; padding: 2px; display: inline-block;">Translation to the right ▼</div> </td> <td style="text-align: center; vertical-align: middle;">By</td> <td style="text-align: center;"> <div style="border: 2px solid blue; border-radius: 10px; padding: 2px; display: inline-block;">2</div> </td> <td rowspan="2" style="vertical-align: middle; font-size: small;"> <div style="border: 1px solid black; padding: 2px;"> <b>CAUTION .2 and .3</b>                      Need to be <b>THEIR</b>                      transformations                      with their <math>h</math> and <math>k</math>                      from part c).                 </div> </td> </tr> <tr> <td style="text-align: center; vertical-align: top;">.3</td> <td style="text-align: center;"> <div style="border: 2px solid blue; border-radius: 10px; padding: 2px; display: inline-block;">Translation down ▼</div> </td> <td style="text-align: center; vertical-align: middle;">By</td> <td style="text-align: center;"> <div style="border: 2px solid blue; border-radius: 10px; padding: 2px; display: inline-block;">4</div> </td> </tr> </table> <p>Example for the ECF : If their equation in part c) was <math>y = (x + 1)^2 + 46</math>                  .2 is expected to be <b>translation to the left</b> by 4 units.                  .3 is expected to be <b>translation up</b> by 46 units.</p> <p>DO NOT ACCEPT negative values                  .2 and .3 ACCEPT any option from the drop-down menu in case of their <math>h</math> or their <math>k = 0</math></p> <p>DO NOT ACCEPT the SC if their <math>h</math> or <math>k</math> is 0.</p>	.1	<div style="border: 2px solid red; border-radius: 10px; padding: 2px; display: inline-block;">Stretched vertically ▼</div>	By factor	<div style="border: 2px solid red; border-radius: 10px; padding: 2px; display: inline-block;"><math>\frac{1}{2}</math></div>		.2	<div style="border: 2px solid blue; border-radius: 10px; padding: 2px; display: inline-block;">Translation to the right ▼</div>	By	<div style="border: 2px solid blue; border-radius: 10px; padding: 2px; display: inline-block;">2</div>	<div style="border: 1px solid black; padding: 2px;"> <b>CAUTION .2 and .3</b>                      Need to be <b>THEIR</b>                      transformations                      with their <math>h</math> and <math>k</math>                      from part c).                 </div>	.3	<div style="border: 2px solid blue; border-radius: 10px; padding: 2px; display: inline-block;">Translation down ▼</div>	By	<div style="border: 2px solid blue; border-radius: 10px; padding: 2px; display: inline-block;">4</div>	<p>3</p>
.1	<div style="border: 2px solid red; border-radius: 10px; padding: 2px; display: inline-block;">Stretched vertically ▼</div>	By factor	<div style="border: 2px solid red; border-radius: 10px; padding: 2px; display: inline-block;"><math>\frac{1}{2}</math></div>														
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.3	<div style="border: 2px solid blue; border-radius: 10px; padding: 2px; display: inline-block;">Translation down ▼</div>	By	<div style="border: 2px solid blue; border-radius: 10px; padding: 2px; display: inline-block;">4</div>														

Q6	Answers	Notes	Total
a	<p>.1 Correctly substitute into cosine rule</p> <p>.2 Correctly calculate <b>their</b> value for cosB</p> <p>.3 <b>The</b> correct value before rounding</p> <p><b>AG 40</b></p>	<p>.1 <math>\cos B = \frac{3300^2 + 3400^2 - 2300^2}{2(3300)(3400)}</math> ACCEPT <math>2300^2 = 3300^2 + 3400^2 - 2(3300)(3400)\cos B</math></p> <p>.2 (cosB=) their 0.764(7...) or 13/17 OE</p> <p>.3 40.1(191669...)</p> <p><b>Seeing .1 AND .3, award 3 marks</b></p> <p><b>DO NOT ACCEPT</b> Substituting 40 into cosine rule or sine rule to calculate side or angle.</p>	3
b	<p><b>AM1 Using degrees</b></p> <p>.1 Correct fraction of area OR correct area of circle</p> <p>.2 <b>The</b> correct substitution into area of sector formula</p> <p>.3 <b>The</b> correct value of area before rounding</p> <p><b>AM2 Using radians</b></p> <p>.1 Correctly convert 40 degrees to radians</p> <p>.2 Correctly substitute <b>their</b> angle into area of sector formula</p> <p>.3 <b>The</b> correct value of area before rounding</p> <p><b>AG 4 040 000</b></p>	<p><b>AM1 Using degrees</b></p> <p>.1 <math>\frac{40}{360}</math> or <math>\frac{1}{9}</math> OE OR <math>\pi \times 3400^2</math> OE ACCEPT using 3.14 or <math>\frac{22}{7}</math> or pi instead of <math>\pi</math></p> <p>.1 ACCEPT area of circle only if seen on its own or multiplied by their fraction of area</p> <p>.2 <math>\frac{40}{360} \pi \times 3400^2</math> OE ACCEPT using 3.14 or <math>\frac{22}{7}</math> or pi instead of <math>\pi</math></p> <p>.3 4 035 201(.231) ACCEPT only if in the range [4 035 000, 4 036 000]</p> <p><b>AM2 Using radians</b></p> <p>.1 0.698(1317008...) or <math>\frac{40 \times \pi}{180}</math> seen ACCEPT using 3.14 or <math>\frac{22}{7}</math> or pi instead of <math>\pi</math></p> <p>.2 <math>\frac{1}{2} \times 3400^2 \times</math> their 0.698(1317008 ...)</p> <p>.3 their 4 035 201(.231) ACCEPT only if in the range [4 035 000, 4 036 000]</p> <p>.3 DO NOT ACCEPT if the value does not round to 4 040 000</p>	3

c	<p>.1 Correctly substitute into the formula</p> <p>.2 Correctly rearrange <b>their bp1</b> for <b>their <math>d^2</math></b> on one side.</p> <p>.3 <b>The</b> correct value of <math>d</math></p>	<p>.1 <math>1\,500\,000 = \frac{1}{700} \times 4\,040\,000 \times d^2</math></p> <p>.2 <math>\frac{1\,500\,000 \times 700}{4\,040\,000}</math> OE or their 259.9 or 260 ACCEPT <math>\frac{\text{their } 1\,500\,000 \times \text{their } 700}{\text{their } 4\,035\,201}</math> or <math>\frac{E \times 700}{A}</math></p> <p>.2 ACCEPT the correct rearrangement in decimals even if the rounding is incorrect Seeing <math>\frac{1\,500\,000 \times 700}{4\,040\,000}</math> implies bp1</p> <p>.3 16(.12...)</p> <p><b>Note for part 6c): to award 3 marks, bp2 has to be seen</b></p>	3
d	<p>.1 Correct lowest value for <math>d</math></p> <p>.2 Correct lowest value for <math>A</math></p> <p>.3 Correctly substitute <b>their lowest</b> values into the formula</p> <p>.4 <b>Their</b> correct answer after using <b>their values</b> into the correct formula.</p>	<p>.1 14.5 seen anywhere in working</p> <p>.2 3 550 000 seen anywhere in working</p> <p>.3 (<math>E =</math>) <math>\frac{1}{700} \times \text{their } 3\,550\,000 \times \text{their } 14.5^2</math></p> <p>.3 ACCEPT if only one value is brought to lowest value. .3 DO NOT ACCEPT if both values are 15 and 3 600 000 OR 15 and 4 040 000.</p> <p>.4 (<math>E =</math>) their 1 066 267.857 or 1 066 267.9 or 1 066 268</p> <p>.4 ACCEPT 1 157 142.857 or 1 157 143 coming from 15 and 3 600 000</p> <p>.4 ACCEPT 1 298 571.429 or 1 298 571 coming from 15 and 4 040 000</p>	4
e	<p>.1 Square 1.1</p> <p>.2 <b>The</b> correct percentage increase of E</p>	<p>.1 <math>1.1^2</math> or 1.21 or 1.21% or 121(%)</p> <p>.1 ACCEPT seeing their 1.1d squared Ex: <math>(1.1 \times \text{their } 16 = \text{their } 17.6 \text{ squared} =) 17.6^2</math> OE</p> <p>.2 21(%)</p>	2

Q7	Answers	Notes	Total
a	.1 Correct distance $D_1$	.1 $(16 + 32 =)48$	1
b	<p>1 <b>Two</b> from:</p> <ul style="list-style-type: none"> <li>Subtract correct <math>y</math> -coordinates</li> <li>Subtract correct <math>x</math> -coordinates</li> <li>Divide their difference in <math>y</math> by <b>their</b> difference in <math>x</math></li> </ul> <p>2 <b>The</b> correct gradient</p> <p>3 Correctly substitute P(16,12) or B(32,16) into <b>their</b> <math>y = mx + c</math> OR <b>their</b> <math>m = \frac{y-y_1}{x-x_1}</math></p> <p>4 <b>The</b> correct equation</p>	<p>.1 <b>Two</b> from:</p> <ul style="list-style-type: none"> <li><math>16 - 12</math> or <math>12 - 16</math> or <math>4</math> or <math>-4</math></li> <li><math>32 - 16</math> or <math>16 - 32</math> or <math>16</math> or <math>-16</math></li> <li>Their <math>(16 - 12)/</math>their <math>(32 - 16)</math></li> </ul> <p>.2 (gradient or <math>m =</math>)<math>0.25</math> OE ACCEPT <math>y = 0.25x</math> OE <b>bp2 implies bp1</b></p> <p>.3 Ex: <math>16 =</math>their <math>0.25x + c</math> or <b>their</b> <math>0.25 = \frac{y-16}{x-32}</math> or <b>their</b> <math>0.25 = \frac{y-12}{x-16}</math></p> <p>.3 ACCEPT <math>16 = 12m + c</math></p> <p>.4 <math>y = 0.25x + 8</math> or <math>0.25 = \frac{y-16}{x-32}</math> or <math>0.25 = \frac{y-12}{x-16}</math> OE</p> <p>.4 DO NOT ACCEPT <math>0.25x + 8</math></p>	4
c	<p>1 Correctly substitute into distance formula OR into Pythagoras</p> <p>2 <b>The</b> correct length of PB</p> <p>3 Correct sum of 20 and <b>their</b> PB rounded to <b>two</b> decimal places</p>	<p>.1 <math>\sqrt{((32 - 16)^2 + (16 - 12)^2)}</math> or <math>\sqrt{16^2 + 4^2}</math> OR <math>(PB^2 =)(32 - 16)^2 + (16 - 12)^2</math> or <math>(PB^2 =)16^2 + 4^2</math></p> <p>.2 <math>(PB =) \sqrt{272}</math> or 16.49(24...) ACCEPT 16.5</p> <p>.3 <math>(D_2 = 20 +</math>their <math>16.49(24...)) =</math>their <math>36.49</math> .3 DO NOT ACCEPT if their PB does not need rounding .3 ACCEPT the rounding to two decimal places seen in bp2</p>	3

d	<p>1 Correctly substitute into the formula <math>\frac{ \text{their part 7c} - \text{their part 7a} }{\text{their part 7a}} \times 100</math></p> <p>2 Correctly calculate <b>their</b> <math>k</math> using <b>their</b> values from bp1</p>	<p>1 <math>\frac{ \text{their36.49} - \text{their48} }{\text{their48}} \times 100</math> ACCEPT <math>\frac{ \text{their48} - \text{their36.49} }{\text{their48}} \times 100</math></p> <p>1 ACCEPT not seeing the absolute value notation</p> <p>2 their23.979...(%)... or their23.98(%) or their24(%)</p> <p>2 DO NOT ACCEPT if negative</p>	<b>2</b>
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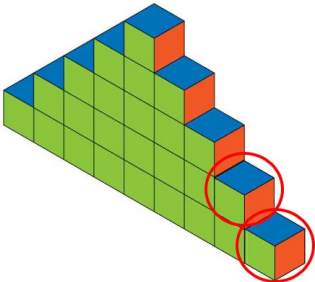
7e

Mark	1	2
<p><b>Identify factors (F)</b></p> <p><b>ignore additional factors</b></p>	<p><b>Two</b> from the factors below mentioned in the factors' response box</p> <ul style="list-style-type: none"> <li>• Price or cost WTTE ACCEPT Robot 1 is for 1000 and Robot 2 is for 1200</li> <li>• Speed OR Time WTTE ACCEPT velocity, how fast it goes OR duration, how long it takes to deliver</li> <li>• Percentage difference or the value of k WTTE ACCEPT The way the robot moves, parallel to walls or directly, mobility, movement, covered distance or distance travelled, the trajectory</li> </ul>	<p><b>The three</b> factors in F1 mentioned in the factors' response box</p>
<p><b>DO NOT ACCEPT</b></p> <p>Incomplete factors. Ex: percentage, distance The size or dimensions or shape of the warehouse Location of point P It stops or not Type of robot</p>		

	1	2	3	4
<b>Calc. (C)</b>  <b>ACCEPT rounding in calculations</b>	Show correct calculation for the minimum value of $k$ $k = \frac{48-48}{48} = 0$ ACCEPT $k = 0$ at P(0,16) <u>and</u> P(32,0) DO NOT ACCEPT $k = 0$ when $D_2 - D_1 = 0$ OE	Any two from C1	Show correct calculation for the minimum value of $k$ $k = \frac{48-48}{48} = 0$ ACCEPT $k = 0$ at P(0,16) <u>and</u> P(32,0)  <b>AND</b> Correct length of the diagonal (see C2)	Show correct calculation for the minimum value of $k$ $k = \frac{48-48}{48} = 0$ <b>AND</b> Show correct calculation for <b>the</b> maximum value of $k$ using the length of diagonal 35.777... or 35.78 or 35.8 and using 48
	<b>OR</b> Show correct working for the length of the diagonal Ex: $\sqrt{(32^2 + 16^2)}$  ACCEPT correct calculation for value of $D_2$ for a pick-up point other than (16,12)	<b>OR</b> Correct length of the diagonal seen even within a calculation  35.777... or 35.78 or 35.8  ACCEPT 35.7 or 35.77 ACCEPT 35 or 36 only if correct working is seen in part 7e)	<b>OR</b> Show correct calculation for <b>their</b> maximum value of $k$ using correct length of the diagonal (see C2) and their 48 from part 7a) Examples: $\frac{ 35.7 - 52 }{52} \times 100 = 31$ Where 52 is their 48 from part a)  $\frac{50 - 35.77}{50} \times 100 = 28(.46)$ Where 50 is their 48 from part 7a)	ACCEPT using the length of diagonal 36 only if correct working is seen in part 7e)  Examples: $\frac{ 35.777... - 48 }{48} \times 100 = 25.(46 \dots)$ $\frac{48 - 35.8}{48} \times 100 = 25(.41 \dots)$
	<b>OR</b> Show working for <b>their</b> maximum value of $k$ using their diagonal and their 48 from part 7a) Ex: $\frac{36.49 - 52}{52} \times 100$ Where 52 is their 48 from part 7a) DO NOT ACCEPT $\frac{\text{their}35.777 \dots - \text{their}48}{\text{their}35.777} \times 100$ ACCEPT maximum value of $k$ is <u>when</u> : P is on the diagonal or travels directly or travels in a straight line			

Mark	1	2
Time (T)	Correctly calculate <b>their</b> time for Robot 1 using <b>their</b> $D_1$ from part 7a) $\frac{48}{0.75} = 64(\text{sec})$	Correctly calculate <b>the</b> time for Robot 1 $\frac{48}{0.75} = 64(\text{sec})$ <p style="text-align: center;"><b>AND</b></p> Correctly calculate <b>the</b> minimum time for Robot 2 using [35,36] $\frac{[35,36]}{0.5} = [70,72]$
	<b>OR</b> Correctly calculate <b>their</b> time for Robot 2 using <b>their</b> length of diagonal <b>their</b> length $\frac{\text{their length}}{0.5} = \text{their time}$ ACCEPT using their 36.49 from part 7c)	

Mark	1	2
Justify (J)	<b>Buy Robot 1</b> and relate to Price and speed WTTE <b>OR</b> Price and time WTTE Examples: Robot 1 is faster and cheaper Robot 1 takes less time and costs less	<b>ACCEPT ONLY IF C3 and T2 are achieved</b> <b>Buy Robot 1</b> and relate to Price and speed WTTE <b>OR</b> Price and time WTTE
	<b>OR</b> <b>Buy Robot 1</b> with T2 achieved	

Q8	Answers	Notes	Total														
a	Correctly place the two cubes	 <p>ACCEPT if new blocks are not perfectly aligned provided total number of blocks is the same (23+2) and the new blocks seem to be at their correct position.</p>	1														
b	Correctly place 25 and 36	<table border="1"> <thead> <tr> <th>Stage (<math>n</math>)</th> <th>Number of cubes (<math>C</math>)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>4</td> </tr> <tr> <td>3</td> <td>9</td> </tr> <tr> <td>4</td> <td>16</td> </tr> <tr> <td>5</td> <td>25</td> </tr> <tr> <td>6</td> <td>36</td> </tr> </tbody> </table>	Stage ( $n$ )	Number of cubes ( $C$ )	1	1	2	4	3	9	4	16	5	25	6	36	1
Stage ( $n$ )	Number of cubes ( $C$ )																
1	1																
2	4																
3	9																
4	16																
5	25																
6	36																

c	<p>.1 correctly describe one pattern for <math>C</math> in words</p> <p>.2 correctly describe a second pattern for <math>C</math> in words</p>	<p>ACCEPT complete terminology only, for example (below are five different descriptions)</p> <ul style="list-style-type: none"> <li>➤ The square numbers or they are square numbers</li> <li>➤ Odd even odd even and so on</li> <li>➤ The first difference made of odd numbers</li> <li>➤ The increase forms an arithmetic sequence where <math>d</math> is 2.</li> <li>➤ Quadratic <u>with second difference of 2</u>, the increase is two more than the previous one, second difference of 2.</li> </ul> <p>ACCEPT spelling mistakes. Ex.: increasing instead of increasing</p> <p>DO NOT ACCEPT incomplete terminology, for example: not increasing by a constant, quadratic, first difference linear.</p> <p>DO NOT ACCEPT general description, for example: Integers, whole numbers, positive, it is increasing, <math>n</math> goes up by 1, etc.</p> <p>DO NOT ACCEPT the rule in words or description related to <math>n</math> or stage number ex.: <math>n</math> times <math>n</math>, <math>n</math> multiplied by <math>n</math>, <math>C</math> is the stage number squared, WTTE</p> <p>DO NOT ACCEPT general rules in terms of <math>n</math>, example: <math>C = n^2</math></p> <p><b>Note, in the case when they have more than two different patterns:</b> If two are accepted award 2 marks, If one is accepted award 1 mark</p>	2
d	<p>.1 <b>the</b> correct general rule</p> <p>.2 <b>the</b> correct simplified general rule with correct notation</p>	<p>.1 <math>(C=)n^2</math> or <math>(C=)n \times n</math> or <math>(C=)n * n</math> or <math>(C=)x^2</math> or <math>Un = n^2</math></p> <p>.2 <math>C=n^2</math></p> <p>ACEEPT using <math>Cn</math> or <math>C(n)</math> or <math>Cn</math> instead of <math>C</math></p> <p>ACCEPT using <math>c</math> and <math>N</math></p> <p>ACCEPT <math>C=(n)^2</math></p> <p>DO NOT ACCEPT description in words</p>	2

e	<p>·1 Correctly substitute <math>n \geq 5</math> into <b>their</b> general rule (from part 8c or part 8d)</p> <p>·2 Correctly calculate <b>their</b> value of <math>C</math> after substituting <math>n \geq 5</math></p> <p>·3 Recognize that <b>their</b> <u>correctly calculated</u> value of <math>C</math> is the same as the correctly predicted value</p>	<p>.1 Ex: <math>5 \times 5</math> or <math>5^2</math></p> <p>·2 Ex: 25</p> <p>.3 If they use <math>n = 5</math> or <math>n = 6</math> (The ones in the table) ACCEPT only if they say "as seen in the table" or "it works" or "hence verified" WTTE OR we see the predicted values re-written here in part 8e)</p> <p>.3 If they use <math>n &gt; 6</math> (values not in the table) ACCEPT only if they say "the same as when we continue the pattern" WTTE <b>and</b> state how. Ex: for <math>n = 7</math>, 49 is obtained from pattern of adding 13 to 36</p>	3
f		<p>20 ACCEPT seeing <math>41 + 20 = 61</math></p>	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)
<b>The</b> general rule	<b>The</b> correct general rule in terms of only $n$ (if they use $x$ , it is still the general rule but penalise in notation)
<b>Their</b> 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 $U_{n+1} = U_n + d$ Ex: $\forall n = \forall n \cdot 1 + 4n$

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
$C = n^2$	Quadratic or exponential	Linear or constant
$V = 2n^2 + 2n + 1$	Quadratic or exponential	Linear or constant

Stage number ( $n$ )	Number of cubes ( $V$ )
1	5
2	13
3	25
4	41
5	61
6	85
7	113
8	145

1									
<b>Predictions (P)</b>	Correctly predict two terms for $V$ ACCEPT whether in the table or in the response box ACCEPT additional incorrect predictions								
	<table border="1"><tr><td>5</td><td>61</td></tr><tr><td>6</td><td>85</td></tr><tr><td>7</td><td>113</td></tr><tr><td>8</td><td>145</td></tr></table>	5	61	6	85	7	113	8	145
	5	61							
	6	85							
	7	113							
8	145								

	1	2	3	4
<p><b>Description (D)</b></p> <p><b>ACCEPT incorrect terminologies, notation errors, non-simplified rule, or rule in words but penalize in notation (N)</b></p> <p><b>Ignore additional incorrect patterns</b></p>	<p>Correctly describe one pattern in words for <math>V</math></p> <p>Examples of different patterns: (<u>can be seen anywhere in the response</u>) WTTE</p> <ul style="list-style-type: none"> <li>All odd numbers</li> <li>It increases by multiples of 4</li> <li>Increase between numbers forms an arithmetic sequence where <math>d=4</math></li> <li>Second difference is 4 or the increase increases by 4 or what I add increases by 4 or Difference increases by 4, increase of the difference is 4, Quadratic with second difference of 4.</li> </ul> <p>ACCEPT "quadratic" or "second difference constant" <u>only if</u> their working shows second difference is 4.</p>	<p>Correctly describe two patterns in words for <math>V</math></p>	<p>Correctly describe two patterns in words for <math>V</math></p> <p><b>AND</b></p> <p>Their general rule for <math>V</math> (quadratic or exponential that satisfies at least one value for <math>n</math>)</p>	<p>Correctly describe two patterns in words for <math>V</math> (OR one pattern and the <u>recursive rule for <math>V</math></u>)</p> <p><b>AND</b></p> <p>The general rule for <math>V</math></p> <p><math>(V =)2n^2 + 2n + 1</math></p> <p>ACCEPT not simplified <math>(V =)(n + 1)^2 + n^2</math> OE</p>
	<p><b>OR</b></p> <p>Their general rule for <math>V</math></p> <p>Ex: a quadratic or exponential that satisfies at least one value for <math>n</math></p> <p>Ex: <math>V = n^2 + 4</math> or <math>V = 2n^2 + 5</math></p>	<p><b>OR</b></p> <p>Correctly describe one pattern in words for <math>V</math></p> <p><b>AND</b></p> <p>Their general rule for <math>V</math> (quadratic or exponential that satisfies at least one value for <math>n</math>)</p>	<p><b>OR</b></p> <p>Correctly describe one pattern AND the <u>recursive rule for <math>V</math></u></p> <p><b>AND</b></p> <p>Their general rule for <math>V</math> (quadratic or exponential that satisfies at least one value for <math>n</math>)</p>	<p><b>OR</b></p> <p>The general rule for <math>V</math></p> <p><math>(V =)2n^2 + 2n + 1</math></p> <p>ACCEPT not simplified <math>(V =)(n + 1)^2 + n^2</math> OE</p>
	<p><b>OR</b></p> <p>Their general rule for <math>V</math></p> <p>Ex: a quadratic or exponential that satisfies at least one value for <math>n</math></p> <p>Ex: <math>V = n^2 + 4</math> or <math>V = 2n^2 + 5</math></p>	<p><b>OR</b></p> <p>The <u>recursive rule for <math>V</math></u>:</p> <p><math>V_{n+1} = V_n + 4n + 4</math></p> <p>or</p> <p><math>V_n = V_{n-1} + 4n</math></p>	<p><b>OR</b></p> <p>The general rule for <math>V</math></p> <p><math>(V =)2n^2 + 2n + 1</math></p> <p>ACCEPT not simplified <math>(V =)(n + 1)^2 + n^2</math> OE</p>	
	<p><b>DO NOT ACCEPT</b></p> <p>Descriptions of how cubes are added</p> <p>Patterns using the stage number</p> <p>Goes up by 8,12,16,...</p> <p>Recursive rule in words</p> <p>Seeing only "quadratic" or "Second difference constant" or the first difference is linear.</p> <p>Incorrect description. Ex: second difference increases by 4.</p>			

Mark	1	2
Testing (T)	Attempt to test their general rule for $V$ using $n \leq 4$ Ex: Correctly substitute in their general rule for $V$ value of $n \leq 4$	Correctly test their general rule for $V$ using $n \leq 4$ Ex: correctly calculate their value for $V$ in their general rule for $V$ using $n \leq 4$ <b>AND</b>
	<b>OR</b> Correctly test their described pattern or their rule (e.g. recursive rule)	Recognise that <u>their</u> correctly calculated value for $V$ is the same as <u>the</u> given value in the table. ACCEPT if their correctly calculated value is the same as the one given in the table.

	1	2	3
Verifying (V)	Attempt to verify their general rule for $V$ using $n \geq 5$ Ex: Correctly substitute in their general rule for $V$ value of $n \geq 5$	Correctly calculate their value for $V$ in their general rule for $V$ using $n \geq 5$	<b>ACCEPT only if they have <u>the</u> general rule for <math>V</math></b>  Correctly calculate the value for $V$ in <u>the</u> general rule using $n \geq 5$ <b>AND</b> Recognise that <u>the</u> correctly calculated value for $V$ is the same as <u>the</u> correct predicted value for $V$ obtained by continuing the pattern ACCEPT if the correctly calculated value is the same as the one given in the table.
	<b>OR</b> Correctly verify their described pattern or their rule (e.g. recursive rule)		

Mark	1	2	3	4
Justify/ proof (J)	<b>ACCEPT only if D1 is achieved</b>	<b>ACCEPT only if D2 is achieved</b>	<b>ACCEPT only if they have the correct general rule for <math>V</math></b>	<b>ACCEPT only if they have the correct general rule for <math>V</math></b>
	Attempt to justify <b>their</b> general rule for $V$  Ex: Quadratic model and <u>valid attempt to find values</u> of coefficients using any method. Showing how <u>one</u> or <u>two</u> of the coefficients are obtained	Attempt to justify <b>the</b> general rule for $V$  Ex: Quadratic model and <u>find the correct values</u> of coefficients using any method. Showing how the <u>three</u> coefficients are obtained  <b>OR</b> Weak attempt to justify <b>their</b> general rule for $V$ geometrically by realizing a sequence of blocks is added to the pattern of $C$  Recognise 4, 9, 16,... are added to their sequence OR $(n + 1)^2$ seen as justification	Good attempt to justify <b>the</b> general rule for $V$ geometrically  IF THEIR RULE IS $2n^2 + 2n + 1$ Sentence WTTE that the previous sequence (or $C$ ) is added to either - same sequence with <u>additional row</u> (or one stage after) or - the three terms 4, 9, 16 OE  Ex.: The horizontal part is the sequence $C$ ( $n^2$ ) seen before and the vertical part is the same with one more row. Ex.: We add the first sequence to square numbers 4, 9, 16, etc.  <b>OR</b> Seeing as justification $(n + 1)^2 + n^2$	Correctly justify geometrically <b>the</b> general rule for $V$  IF THEIR RULE is $2n^2 + 2n + 1$ Sentence WTTE that the previous sequence (or $C$ ) is added to either - same sequence with <u>additional row</u> (or one stage after) or - the three terms 4, 9, 16 OE  <b>AND</b> $(n + 1)^2 + n^2$ seen
	<b>OR</b> Substitute at least two <u>other</u> values of $n$ in the general rule for $V$ <b>AND</b> Say they are the same or it works WTTE	<b>OR</b> Recognizing that it's always the square number plus the next square number without relating to sequence of blocks	IF THEIR RULE is $(n + 1)^2 + n^2$  Recognise two sequences of blocks added together WTTE  (Ex: sum of two sequences)	IF THEIR RULE is $(n + 1)^2 + n^2$  Sentence WTTE that the previous sequence (or $C$ ) is added to either - same sequence with <u>additional row</u> (or one stage after) or - the three terms 4, 9, 16 OE

Mark	1	2	3
<p><b>Notation and terminology (N)</b></p> <p><b>Ignore additional incorrect patterns</b></p>	<p><b>ACCEPT only if D1 achieved</b></p>	<p><b>ACCEPT only if they have <u>the</u> general rule for <math>V</math></b></p>	<p><b>ACCEPT only if they have <u>the</u> general rule for <math>V</math></b></p>
	<p>Correctly describe one pattern for <math>V</math> in words <u>using correct terminology</u> or correct recursive rule for <math>V</math> using correct notation</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Second difference is 4 or quadratic with second difference of 4</li> <li>• Difference between number forms an arithmetic sequence where <math>d=4</math></li> <li>• It increases by multiples of 4</li> <li>• All odd numbers</li> </ul> <p>ACCEPT Using goes up or adds instead of increase DO NOT ACCEPT Using uneven instead of odd DO NOT ACCEPT if the pattern is not accepted in D1</p>	<p>Correctly describe one pattern for <math>V</math> in words <u>using correct terminology</u> (see examples in N1)</p> <p>AND</p> <p>the notation of <u>the general</u> rule for <math>V</math> includes errors or not simplified or in words (see examples in N1)</p> <p>Ex. for the rule not simplified</p> $V = (n + 1)^2 + n^2$	<p>Correctly describe one pattern for <math>V</math> in words <u>using correct terminology</u> (see examples in N1)</p> <p style="text-align: center;"><b>AND</b></p> <p>Correct notation of <u>the general</u> rule for <math>V</math> in simplest form.</p> $V = 2n^2 + 2n + 1$
	<p style="text-align: center;"><b>OR</b></p> <p>The notation of <u>the general</u> rule for <math>V</math> includes errors or not simplified or in words. Examples: <math>V=2n^2+2n+1</math> The rule for <math>V</math> is <math>2n^2+2n+1</math></p> <p>The general rule in words</p>	<p style="text-align: center;"><b>OR</b></p> <p>Correct notation of <u>the general</u> rule for <math>V</math> in simplest form.</p> $V = 2n^2 + 2n + 1$ <p>ACCEPT using <math>V_n</math> or <math>Vn</math> or <math>V(n)</math> instead of <math>V</math></p>	<p>ACCEPT using <math>V_n</math> or <math>Vn</math> or <math>V(n)</math> instead of <math>V</math></p>
	<p style="text-align: center;"><b>OR</b></p> <p>Correct notation of <u>their</u> general rule for <math>V</math>. Examples: <math display="block">V = (n + 2)^2</math> ACCEPT if not simplified.</p>		
	<p><b>The following are considered errors in notation</b></p> <p>using * for multiplication, using / for division, using for power, using <math>x</math> instead of <math>n</math> using <math>Un</math> instead of <math>V</math> without mentioning that <math>V = Un</math></p>		

Mark	1	2	3
<p><b>Communication (L)</b></p> <p>Organisation and coherence  <b>Can be awarded even if there are errors</b>  <b>For items: Describing pattern and writing rule can be considered an item even if D0 awarded</b></p>	<p><b>At least three</b> from the following <b>items</b> are seen:</p> <ul style="list-style-type: none"> <li>describe a pattern in words</li> <li>write a rule</li> <li>test their general rule or rule or recursive rule or pattern (at least T1)</li> <li>verify their general rule or rule or recursive rule or pattern (at least V1)</li> <li>justify their general rule or rule or recursive rule or pattern (at least J1)</li> </ul>	<p><b>ACCEPT only if they have their general rule for <math>V</math></b></p> <p><b>At least four</b> of the following <b>items</b> are seen:</p> <ul style="list-style-type: none"> <li>describe a pattern in words</li> <li>write a general rule</li> <li>test their general rule (at least T1)</li> <li>verify their general rule (at least V1)</li> <li>justify their general rule (at least J1)</li> </ul> <p><b>AND</b>  <b>For coherence</b>, they identify the processes correctly.  <b>At least one</b> from the following:</p> <ul style="list-style-type: none"> <li>test</li> <li>verify</li> <li>justify</li> </ul> <p>Ex:</p> <ul style="list-style-type: none"> <li><b>For test:</b> they say "test" and they substitute in their general rule value(s) of <math>n \leq 4</math> only</li> <li><b>For verify:</b> they say "verify" and they substitute in their general rule value(s) of <math>n \geq 5</math> only</li> <li><b>For justify:</b> They say "justify" and they write a justification</li> </ul> <p><b>Note for coherence:</b>  If they say "test and verify" and they substitute in their general rule value(s) of <math>n \leq 4</math> <u>followed by</u> value(s) of <math>n \geq 5</math>, consider it as only one identified process</p>	<p><b>ACCEPT only if they have the general rule for <math>V</math> and J2.</b></p> <p><b>The following two items must be seen :</b></p> <ul style="list-style-type: none"> <li>write <u>the general rule for <math>V</math></u></li> <li>justify <u>the general rule</u> (at least J2)</li> </ul> <p><b>AND</b>  <b>At least two</b> of the following <b>items</b> are seen:</p> <ul style="list-style-type: none"> <li>describe a pattern or rule in words</li> <li>test <u>the general rule</u> (at least T1)</li> <li>verify <u>the general rule</u> (at least V1)</li> </ul> <p><b>AND</b>  <b>For coherence</b>, they identify the processes correctly.  <b>At least two</b> from the following:</p> <ul style="list-style-type: none"> <li>test</li> <li>verify</li> <li>justify</li> </ul> <p>Ex:</p> <ul style="list-style-type: none"> <li><b>For test:</b> they say "test" and they substitute in the general rule for <math>V</math> value(s) of <math>n \leq 4</math> only</li> <li><b>For verify:</b> they say "verify" and they substitute in the general rule for <math>V</math> value(s) of <math>n \geq 5</math> only</li> <li><b>For justify:</b> They say "justify" and they write a justification</li> </ul> <p><b>Note for coherence:</b>  If they say "test and verify" and they substitute in the general rule value(s) of <math>n \leq 4</math> <u>followed by</u> value(s) of <math>n \geq 5</math>, consider it as only one identified process</p>