Markscheme

November 2018

Mathematics

On-screen examination

22 pages

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

Annotation	Explication	Annotation	Explication	Shortcut
	Unclear		Award 0 marks	Alt+0
	Special case		Award 1 mark	Alt+1
	Misread		Award 2 marks	Alt+2
NWS	No working shown		Award 3 marks	Alt+3
	Error carried forward		Award 4 marks	Alt+4
	Words to that effect		Award 5 marks	Alt+5
	Benefit of the doud		Award 6 marks	Alt+6
	Answer Given		Award 7 marks	Alt+7
	Highlight tool		Award 8 marks	Alt+8
	Ellipse tool		Award 9 marks	Alt+9
	On page comment tool		Award 10 marks	
	Seen		Award 11 marks	
	Caret - Omission		Award 12 marks	
	Wavy underline tool			

The markscheme may make use of the following abbreviations:

RM Assessor has the following annotations that should be used to award marks:
A0 only use to award a zero mark for an answer that has no merit e.g. awarded for the candidate that has a wrong answer with no working

NR only use when the candidate has not made any response also stamp the response with SEEN

 Marks awarded by stamping the tick

 Seen; must be stamped on all blank response areas and on concatenated responses

 unclear

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 or accept incomplete calculator display
AG Answer given

The markscheme makes use of the following abbreviations:
• Bullet notation means award 1 mark – see example below

Example 1
- 1 mark awarded and corresponding notes are aligned

b	•[1] Show clear line of reasoning in the method •[2] 4	• 45 & 49 seen **OE** *eg*, $49 = 45 + x$ •[2] **Accept** $45 + X/10 = 4.9$ **and** Ans 4	**2**

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.

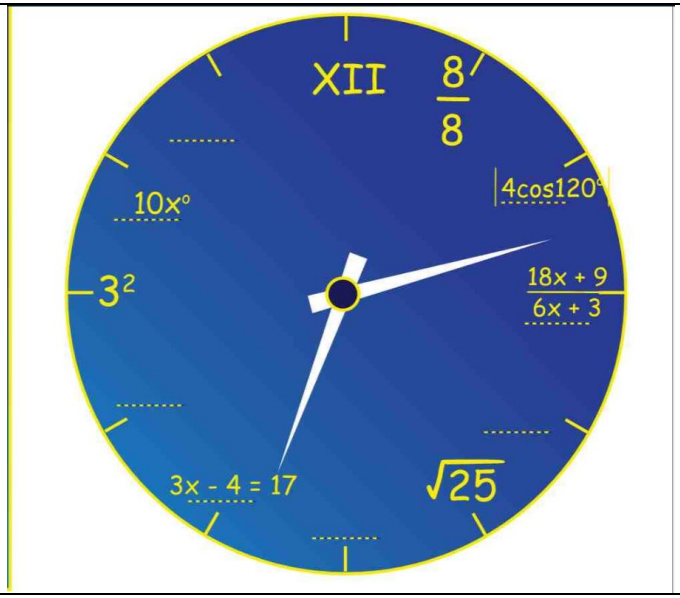
General points

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..
g) When a calculator screenshot is taken, accept not seeing the whole operation.
h) Accept seeing an equation not in-line

General note for marking open-ended response questions:

In cases in Task 2 and 3 where the markscheme is set out in a table then awarding the highest box includes all the lower boxes. So if for example you see at J4 in Task 3 that they have correctly proved their general rule, then J4 is awarded. That is the 4 (full) marks. You don't need to look at the other J criteria. It is probably best to look for the top box answer and if you don't find it look at the next box down. So if they don't get D4 then look at their attempt at a general rule and they might gain D3. If you don't see that look to see if they described a pattern and so on.

Task 1

Answers			Notes	Total
1	a	•[1] first correctly place •[2] second correctly placed •[3] third correctly placed •[4] fourth correctly placed		**4**

2	a	$\frac{16}{48}$ OE	ACCEPT 0.3 OE ACCEPT 16 out of 48	**1**
	b	•1 probability of MYP year 1 •2 (statement is) incorrect with valid reason	•1 $\frac{16}{72}$ OE •2 (statement is) false because the probabilities are different OR because the total number of students (in each grade) is different WTTE •2 ACCPET false and comparing incorrect percentages or probabilities **SC for 2 marks** (statement is) incorrect since Number of students chose gaming (or Numerators) are the same but the total of students (or denominators) are different WTTE **SC for 1 mark** incorrect because total in each grade (or Denominators) are different so probability not the same WTTE	**2**
	c **std**	•1 number of students not choosing sports •2 divide by 120 **Alternative method (AM1)** •1 probability of choosing sport •2 subtract $\frac{54}{120}$ from 1	•1 120 – 54 or 66 •2 $\frac{\text{their}66}{120}$ OE **Alternative method (AM1)** •1 $\frac{54}{120}$ OE •2 $(1-\frac{54}{120})=\frac{66}{120}$ OE $\frac{66}{120}$ OE without working award 2 marks 66 out of 120 without working award 1 mark	**2**

Answers			Notes	Total
3	a	•1 substitute correctly in Pythagoras •2 15	•1 $12^2 + 9^2$ •2 ACCEPT root(225) 15 or $\sqrt{225}$ without working award 2 marks ACCEPT seeing 15 or $\sqrt{225}$ on the diagram	**2**
	b	•1 cos 30 or sin 60 seen •2 correct use of cosine or sin ratio •3 rearranging correctly their trig ratio and $10\sqrt{3}$ $10\sqrt{3}$ AG □ **Alternative method 1 (AM1)** •1 determine the length of CD correctly •2 correct substitution in Pythagoras •3 rearranging correctly their trig ratio and $10\sqrt{3}$ $10\sqrt{3}$ AG **Alternative method 2 (AM2)** •1 correct substitution in Pythagoras •2 correct algebraic steps leading to x² = their 75 •3 and $10\sqrt{3}$ and $10\sqrt{3}$ $10\sqrt{3}$ AG	•1 cos30 or sin 60 •2 $\cos 30 = \frac{(their 15)}{AD}$ or $\sin 60 = \frac{(their 15)}{AD}$ •3 (AD =) $\frac{\text{their15}}{\cos 30}$ and $10\sqrt{3}$ **Alternative method 1 (AM1)** •1 $(\tan 30 = \frac{CD}{their 15}, CD =)\sqrt{75}$ OE •2 $(their\sqrt{75})^2 + (their 15)^2 = AD^2$ •3 (AD =) $\sqrt{300}$ and $10\sqrt{3}$ **Alternative method 2 (AM2)** •1 (2x)² = x² + 15² OR 4x² = x² + 225 OR 3x² = 225 •2 x² = 75 •3 (AD =) $5\sqrt{3}$ x 2 = $10\sqrt{3}$ Award •3 only if their result is equivalent to $10\sqrt{3}$	**3**

	c	•1 correct use of tangent ratio •2 their arctan calculated correctly •3 their value approximated correctly to the nearest degree **Alternative method 1 (AM1)** •1 correct length of AD and correct use of sin or cos ratio •2 their arcsin or arccos calculated correctly •3 their value approximated correctly to the nearest degree	•1 (tanDAE =) $\frac{20}{10\sqrt{3}}$ •2 their 49.1066…. •3 their 49 **Alternative method 1 (AM1)** •1(AE=) $\sqrt{700}$ *or* $26.475...$ OE and $(\sin DAE =)\frac{20}{\sqrt{700}}$ *or* $(\cos DAE =)\frac{10\sqrt{3}}{\sqrt{700}}$ •2 their 49.1066…. •3 their 49 •3 DO NOT ACCEPT if their value from •2 is a whole number 49.1066… without working award 1 mark 49 without working award 2 marks ACCEPT seeing 49.1066…. or 49 on the diagram	**3**

		Answers	Notes	Total
4	a	•1 multiples of 6 **and** 8 seen OR after 4 laps OR after 3 laps •2 24	•1 6,12,16 and 8,16 •1 ACCEPT 6x8 (=48) 24 without working award 2 marks	**2**
	b	•1 correct expression for the length of 6 semi-circles •2 adding 8r to their expression above •3 equating their expression with 15000 or 15 •4 taking the r as common factor from their expression •5 correct value of *r* that rounds to 560 560 AG	•1 $6\pi r$ or $3x2\pi r$ OE •2 their $6\pi r + 8r$ •3 their $6\pi r$ + their $8r = 15000$ •4 e.g. r(their6π + their8) •5 558.668.. and 560 •5 ACCEPT if they use 3.14 instead of π and get a result of 558.867… For •1 , •2 and •3 ACCEPT seeing the r=560 **SC for 3 marks** Using r=560 and calculating the length of the track as 15035.75… when using π or 15030.4 using 3.14	**5**
	c	•1 correct area of rectangle •2 adding area of one circle to their area of rectangle •3 their result correct after adding their area of rectangle to their area of circles or semicircles	•1 $4r \times 6r$ or $24r^2$ or 600 (mm^2) •2 their $600+ \pi r^2$ OR 600+78.5398… OE •2 ACCEPT seeing they add four semicircles and subtract two semi-circles •3 678.5398… or 678.5 or 679 678.5398… or 678.5 or 679 without working award 2 marks	**3**

		Answers	Notes	Total
5	a	•1 a vertical stretch/dilation/enlargement/compression of (factor) 4 OR horizontal stretch/dilation/enlargement/compression of (factor) ½ •2 a reflection about/on *x* axis. •3 a horizontal translation of 2 units left •4 a vertical translation of 1 unit upwards	•1 ACCEPT in y direction instead of vertical •1 ACCEPT in x direction instead of horizontal •2 ACCEPT seeing reflection and x-axis •2 ACCEPT mirror about/on *x* axis. •3 ACCEPT seeing left and 2 •3 ACCEPT shift 2 left or move left and 2 or 2 units in the –x direction or -2 units in the x direction •4 ACCEPT seeing up and 1 •4 ACCEPT 1 unit in the y-axis ACCEPT seeing answers in any order ACCEPT seeing multiple transformations in same box	**4**
	b	a = -2 and b = 1	(-2,1)	**1**
	c	•1 recognise axis of symmetry •2 their horizontal difference from their axis of symmetry •3 sum of their $\frac{-1}{2}$ and their -2 •4 their correct value of the other solution **Alternative method 1 (AM1)** •1 attempt to expand g(*x*) = 0 •2 correctly expanding •3 correctly factorize or substitute correctly into formula •4 their correct value of the other solution	•1 their -2 seen •2 their 1/2 seen •2 ACCEPT "half step" in context, maybe be seen on the diagram •3 (*x* =) their-2 - their½ •4 their $\frac{-5}{2}$ OE **Alternative method 1 (AM1)** •1 $-4(x^2+4x+4)+1=0$ •2 $-4x^2 - 16x - 15 = 0$ or $-4x^2 - 16x - 15 = 0$ •3 $(2x + 5)(2x + 3) = 0$ or $\frac{16 \pm \sqrt{16^2-4(-4)(-15)}}{2(-4)}$ OE	**4**

		Alternative method 2 (AM2) •[1] attempt to solve •[2] square root both sides correctly •[3] sum of their $\frac{-1}{2}$ and -2 •[4] their correct value of the other solution	•[4] their $\frac{-5}{2}$ OE **Alternative method 2 (AM2)** •[1] $-4(x+2)^2 = -1$ or $(x+2)^2 = ¼$ •[2] $x + 2 = \pm ½$ •[3] $(x =)\ -2 \pm ½$ •[4] $(c =)$ their $\frac{-5}{2}$ OE •[4] DO NOT ACCEPT if their result ≥ 0 $\frac{-5}{2}$ OE without working award 3 marks $\frac{-5}{2}$ OE with one working step award 4 marks	

		Answers	Notes	Total
6	a	the correct result before rounding AG 197 bpm	196.8	**1**
	b	•[1] multiply maximum heart beat by 80 % •[2] their 157.6 correctly rounded to the nearest beat	•[1] 0.8 x 197 or 157.6 •[1] ACCEPT 0.8 x 196.8 or 157.44 •[2] their 158 •[2] DO NOT ACCEPT if their incorrect value from •[1] is a whole number 158 without working award 2 marks 157 without working award 1 mark	**2**
	c	(k =)3		**1**
	d	•[1] substitute 11 correctly into the correct formula •[2] their result correct after substituting into the correct formula •[3] correctly approximated their result to the nearest beat	•[1] $(h_1(11)$ **=)** $70(1.04)^{11}$ •[2] 107.7(617839…) •[3] 108 (bpm) •[3] DO NOT ACCEPT if their incorrect value from •[2] is a whole number 108 with bp1 or bp 2 award 3 marks 108 without working award 2 marks 107 or 109 or 110 without working award 1 mark	**3**
	e	•[1] correct comment on safety •[2] seeing 80% of maximum heart rate •[3] comment on effectiveness of the exercise in relation to duration or time when 80% of maximum heart rate was achieved	•[1] safe because it was below maximum heart rate or below 197 WTTE •[2] reached their158 or 80% of their H •[3] ineffective because it reached 80% of max heart rate for only few minutes or ineffective because it reached their158 for only few minutes •[3] ACCEPT effective because heart rate reached 80% of maximum **SC for 1 mark** Correct description with acceptable terminology of the behaviour of the graph (e.g. increases then decreases, then increases)	**3**

Answers			Notes	Total
7	a	•[1] percentage of carbohydrates •[2] the correct result	•[1] 55% or 0.55 seen •[1] ACCEPT any 55 seen •[2] (180x55/45=) 220 (g) 220 without working award 2 marks Do not award •[2] if their result is less than 180 (g)	**2**
	b	•[1] identify the 12400 (kJ) as the total and adding ratios •[2] correct calculation towards the result •[3] their result correctly rounded to nearest kJ	•[1] identifying the 12400 (kJ) as the total and 2 + 3 + 4 = 9 or 12400/9 or seeing 1377.777… or 1378 •[2] $\frac{7\times 12400}{9}$ or 9644.44…. or their1378 x 7 or 9639 •[2] ACCEPT stating values of calories in mid-day meal and dinner meal separately eg. 5511.111….and 4133.333… •[3] their 9644 (kJ) or 9646 •[3] ACCEPT stating values of calories in mid-day meal and dinner meal separately eg. 5511 and 4133 OR 5512 and 4134 •[3] DO NOT ACCEPT if their incorrect value from •[2] is a whole number 9644 or 9646 without working award 2 marks 5511 and 4133 without working award 2 marks 5511 or 4133 without working award 1 mark 9644.44… or 9639 without working award 1 mark	**3**
	c	•[1] multiply 12 400 by 7 •[2] subtract 77 790 from 86 800 OR add 77790 to 9010 and equate with 86800 AG 9010 (kJ)	•[1] 86 800 (kJ) •[2] 86 800 – 77 790=9010 OR 77790+9010=86800 **SC for 2 marks** : $\frac{77790+9010}{7}=12400$	**2**
	d	•[1] add 1700*s* to 2700*r* •[2] equate their total to 10000	•[1] 1700*s* + 2700*r* •[2] 1700*s* + 2700*r* = 10000 OE •[2] DO NOT ACCEPT r+s=10000	**2**

	e	•1 reduce their two equations to one correct equation including one unknown •2 their value for first unknown (*r* or *s*) correct •3 substitute correctly into one of their equations to calculate the value of the other unknown •4 their calculation for the other unknown correct **Alternative method for trial and error responses (AM1)** •1 seeing two numbers with sum 5 •2 seeing two numbers which satisfy their other equation •3 their *r* or their *s* correct •4 their *r* and their *s* correct	•1 $1700s + 2700r = 10000$ OR $1700(5-r)+2700r = 10000$ $1700s + 1700r = 8500$ $1000r = 1500$ •2 $r = 1.5$ (h) OR $s = 3.5$ (h) •3 $1.5 + s = 5$ **OR** $r + 3.5 = 5$ •4 $r = 1.5$ (h) and $s = 3.5$ (h) **Alternative method for trial and error responses (AM1)** •1 trial e.g. 3 and 2 •2 trial e.g. 25 and 10 if their other equation is 2r+5s=100 •3 their 1.5 or their 3.5 •4 their 1.5 and their 3.5 1.5 and 3.5 without working award 3 marks Their 1.5 and their 3.5 without working award 1 mark	**4**

				F: Identification of factors	C: Calculations	J: Justification of accuracy and makes sense	A: Advice for Gerry	S: How advice makes sense		
7	f		**1**	Two factors mentioned from: - Total energy intake - proportion of the meals in a day - The meal is balanced or well balanced diet or healthy meal eg Fat:Carb:Protein - exercise or energy output - relevant factor not mentioned in video. Example: duration of sleep, sleep time, reducing stress ACCEPT factors seen in calculations	Any attempt for one of the following calculations: -Amount of output energy remaining for Saturday (10000-8300=1700) -Amount of intake energy remaining for Saturday (9010-6000=3010 OR 4x9010/9=4004…4. -Proportions of nutrition for the remaining meal (0.2xtheir3010 Protein, 0.25xtheir3010 Fat, and 0.55xtheir3010 Carbs) ACCEPT 12400-9010=3390 as only attempt to calculate energy intake for Saturday and hence C1	Suitable rounding used in any element (example using 3000 instead of 3010) Or Realising not accurate with invalid reason	Advice related to one of: -**Keep or continue** track of energy intake and energy burnt, or meals in the appropriate nutrition proportion or balanced diet/eating healthy - increase exercising hours to increase burning -Decrease intake energy because in many days he was more than average or eat the right amount every day	Reason supported by evidence related to information given: Examples: -Balance between burning energy and energy intake for healthy lifestyle -Meal in the appropriate nutrition proportion or balanced diet makes him perform well		**10**

			2	Four factor mentioned from the above DO NOT ACCEPT if all factors seen in calculations	One of the above calculations correct	Realising not accurate with valid reason example: because he did not keep track of all other activities he does during the week He cannot achieve his daily meals proportion since 9010-6000 is not equal to 4x9010/9	Advice related to two of the above Or A critical advice including balance like: -Should not have last day least energy intake and at the same time 1700 exercise out of 10000 needed		
			3		Two of the above calculations correct				

<table>
<tr><th colspan="2">Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>8</td><td>a</td><td>•1 two correct
•2 the other four correct

No ECF for column T allowed</td><td>Table Object
<table><tr><th>Row number (n)</th><th>Number of up triangles (U)</th><th>Number of down triangles (D)</th><th>Total number of all triangles (T)</th></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>2</td><td>3</td><td>1</td><td>4</td></tr><tr><td>3</td><td>6</td><td>3</td><td>9</td></tr><tr><td>4</td><td>10</td><td>6</td><td>16</td></tr><tr><td>5</td><td>15</td><td>10</td><td>25</td></tr></table></td><td>2</td></tr>
<tr><td></td><td>b</td><td>•1 one pattern described correctly in words
•2 second pattern described correctly in words
•3 third pattern described correctly in words

Allow ECF from their table in 8a</td><td>ACCEPT
U goes up by 2,3,4 …WTTE
D goes up by 1,2,3 …WTTE
U is the same as D but with a shift
T goes up by 3,5,7 …WTTE
Difference between U and n is D
U is the sum of n and D
it is the square numbers
it is quadratic
Quadratic sequence
Second difference constant

ACCEPT if they correctly describe in words their pattern

DO NOT ACCEPT
U+D= T
n goes up by 1
the difference is positive for any column
U or D are triangular numbers
general rules in terms of n, example: n(n+1)/2
describing same pattern for U and D as two different patterns
U or D or T is increasing</td><td>3</td></tr>
<tr><td></td><td>c</td><td>(T=) n^2</td><td>ACCEPT n × n, n * n, n^2</td><td>1</td></tr>
<tr><td></td><td>d</td><td>•1 substitute n ≥ 3 into their rule
•2 correctly calculate their value of T after substitution n ≥ 3
•3 recognizing that their result is the same as their predicted value</td><td>•1 Ex: 3 x 3
•2 Ex: 9 (for the n= 3)
•3 Same as value I predicted in table (and we find the candidate has 9 in the table for n = 3) OR same as when we continue the pattern and explains how 9 is obtained from pattern of adding 3+2 to 4</td><td>3</td></tr>
</table>

			•[3] ACCEPT seeing the 9 in the table and seeing their calculated T=9 when n=3 **SC for 1 mark** If “tested” correctly with a value from the table. For example: testing with n = 2 to get T = 4	

8	e		**Mark**	**1**	**2**	**3**	**4**	**5**	**22**
			Predictions (P)	Predict correctly two values	Predict correctly two rows or two columns up to n=6	Predict correctly all values up to n=6			
			Description (D)	Attempt to describe a pattern in words Examples: Comment on difference OR Describe correctly in words their pattern OR attempt to write down a general rule. Example: $n(n+1)$ or n^2-1 DO NOT ACCEPT T=A+B+C or T is the sum of A,B,and C DO NOT ACCEPT is multiples of 1	Describe correctly one pattern in words Examples: T increases by 5,7,9 or has second difference 2 or has second difference constant or it is quadratic or C is same as n C increases by 1 OR Write down correct general rule for A,B, or C in terms of n Without describing any pattern	Describe correctly two patterns in words Examples: T increases by 5,7,9 or has second difference 2 or has second difference constant or it is quadratic or C is same as n C increases by 1 OR Write down correct general rule for A or B in terms of n AND Describe correctly one pattern in words OR Write down correct general rule for T in terms of n Without describing any pattern OR Attempt to write down correct general rule for T in terms of n AND	Attempt to write down correct general rule for T in terms of n ex: $T=n^2-1$ AND Describe correctly two patterns in words OR Write down correct general rule for A or B in terms of n AND Describe correctly two patterns in words OR Write down correct general rule for T in terms of n AND Describe correctly one pattern in words	Write down correct general rule for T in terms of n AND Describe correctly two patterns in words ACCEPT The rule is n^2+2n but award N1	

					Describe correctly one pattern in words			
		Testing (T)	attempt to use *n* from {1,2,3} in their described pattern or general rule Testing or verifying the T=A+B+C allows only T1	Recognizing that their result is the same as value in table ACCEPT seeing their calculated T value from their general rule and the value in the table being equal				
		Verifying (V)	attempt to use $n \geq 4$ in their described pattern or general rule Using T=A+B+C does not allow V marks	Calculate correctly their value of T using their $n \geq 4$ in their general rule	Recognizing that their result is the same as their predicted value ACCEPT seeing their calculated T value from their general rule and their predicted value in the table being equal			
		Justify/ proof (J)	Weak attempt to justify their described pattern or their general rule Examples: trying at least two values and arguing as justification that they are the same or rule works	Correctly justify their general rule or pattern Examples: Add the incorrect general rules for A,B and C It is one less than square number minus 1 Assuming quadratic and solve equations correctly for coefficients	Attempt to prove the general rule for T Examples: Add incorrectly the correct general rules for A,B and C	Correctly prove the general rule for T Examples: Add correctly the correct general rules for A,B and C J4 automatically gains T2 and V3		
		Notation and terminology (N)	Notation **or** terminology is correct **OR** the notation and terminology have significant errors **OR** The general rule is correct but not in correct notation example: $U_n=n^2+2n$	The notation **and** terminology are correct **Note:** One minor error, not in general rule, can be overlooked Can be awarded only if they have a general rule ACCEPT using T_n				

				ACCEPT using Un instead of T only if they mention that $T=U_n$ ACCEPT the use of x or * for multiplication					
		Communication (L)	Very weak communication Two or three lines of communication **OR** Only calculations or algebraic steps	Weak communication More than three lines of communication but lack coherence	Good communication More than three lines of coherent communication Can be awarded only if J2 is achieved				

Table Object

Stage (n)	Number of triangles above the line (A)	Number of triangles below the line (B)	Number of triangles crossing the line (C)	Total number of triangles (T)
1	**1**	**1**	**1**	**3**
2	**3**	**3**	**2**	**8**
3	**6**	**6**	**3**	**15**
4	**10**	10	4	24
5	15	15	5	35
6	21	21	6	48
7	28	28	7	63
8	36	36	8	80

General rules:

$$C = n$$

$$A \text{ or } B = \frac{n(n+1)}{2}$$

$$T = n + n(n+1) = n^2 + 2n$$