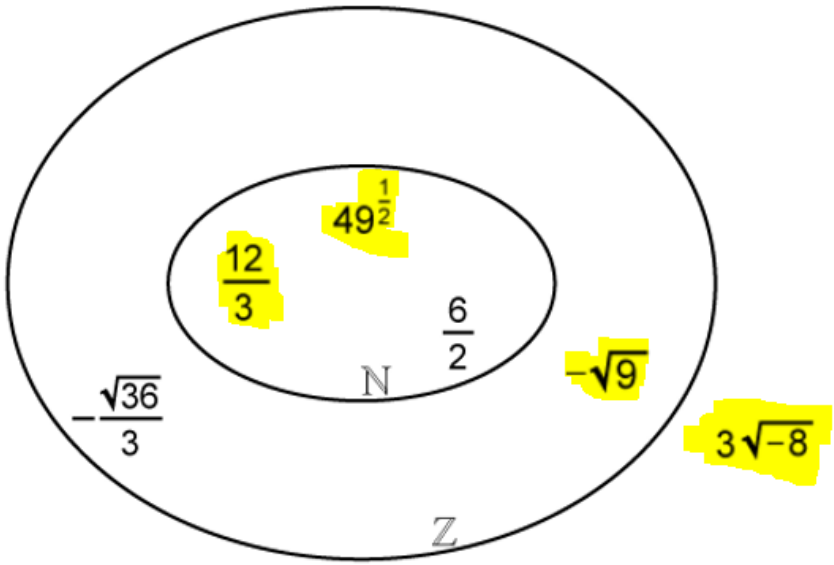
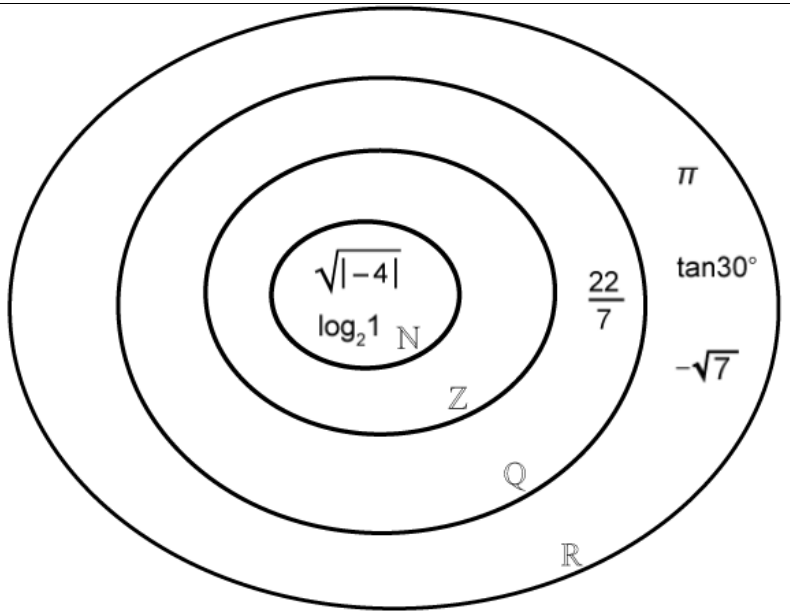
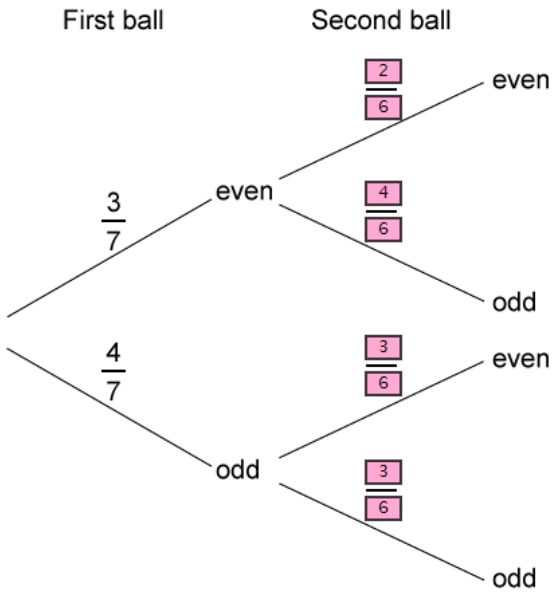
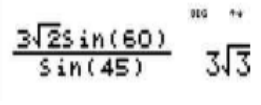
Question		Answers	Notes	Total
1	a	•[1] two correctly placed •[2] four correctly placed	The correct places are  (insert Venn diagram)	2
	b	•[1] two correctly placed •[2] four correctly placed •[3] six correctly placed	The correct places are	3

			 (Insert correct diagram)	
	c	$\square' \cap \square$		**1**

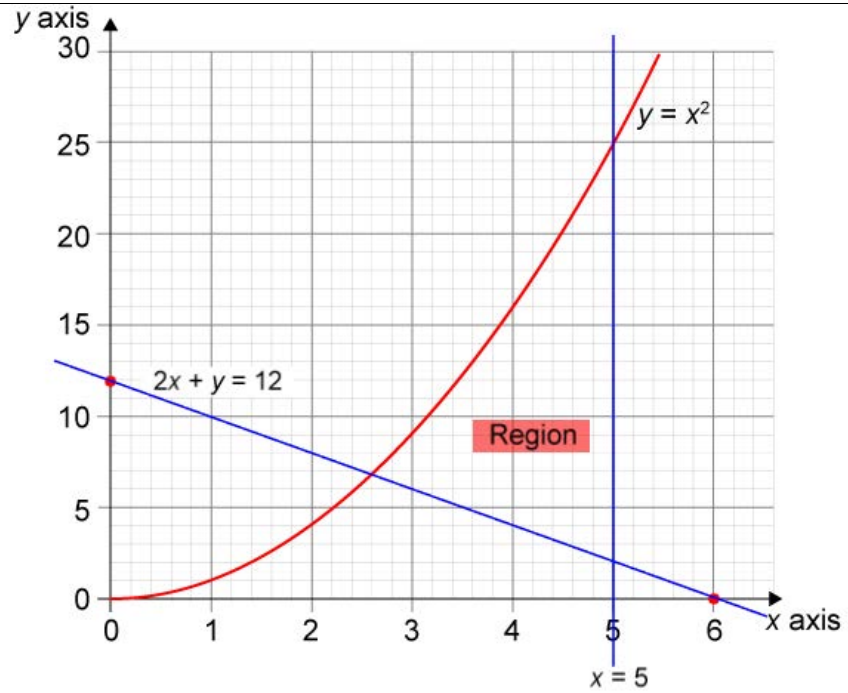
Question		Answers	Notes	Total
2	**a**	•[1] substituting 7 into $g(x)$ •[2] Substituting their value for $g(7)$ into $f(x)$ AG 3	•[1] $2(7)-1 \text{ or } 13$ •[2] $\sqrt{13-4} \text{ or } \sqrt{9}$	**2**
	b	•[1] substituting $g(a)$ into $f(x)$ **and** equating with 4 •[2] calculating value of $g(a)$ correctly or one correct step of simplification for equation involving only one unknown a •[3] calculating their value of a correctly	•[1] $\sqrt{g-4}=4$ or $\sqrt{2a-1-4}=4$ •[2] $g=20$ or $2a-1=20$ or $16=2a-5$ •[3] $a=\frac{21}{2}$	**3**

Question		Answers	Notes	Total
3	a	•[1] two correct values •[2] four correct values	 ACCEPT: fractions cancelled down	**2**
	b	•[1] the numerator (branch of intersection even-even) seen •[2] adding the two multiplications of probabilities (even-even and odd-odd) •[3] calculating the value above correctly •[4] dividing by their calculated addition of multiplied probabilities AG $\frac{1}{3}$	•[1] $\frac{3}{7}\times\frac{2}{6}$ •[2] $\frac{3}{7}\times\frac{2}{6}+\frac{4}{7}\times\frac{3}{6}$ •[3] $\frac{3}{7}$ •[4] $\frac{\frac{3}{7}\times\frac{2}{6}}{\frac{3}{7}}$ AG $\frac{1}{3}$	**4**

	c	$\frac{3+b}{2} = 5$ *or* $3 + b = 10$ AG 7	Accept (3 + 7)/2 = 5 Do not accept 3 + 7/2 = 5 Accept explanation in words provided the numbers are written. e.g. The average of 7 and 3 is 5	**1**
	d	• [1] setting equation for range **OR** showing understanding of concept of range •[2] setting equation for mean **OR** showing understanding of concept of mean •[3] simplifying correctly equation for mean •[4] attempt to solve using substitution **OR** elimination •[5] their value for a or c correct •[6] the other value for a or c correct	•[1] c – a = 34 **OR** difference between their a and c is 34 •[2] $\frac{a-12-9+0+3+7+7+10+15+c}{10} = 2.7$ •[3] a + c = 6 •[4] Attempt to solve simultaneously, adding **OR** substitution **OR** $2c = 40$ **OR** 2*a* = –28 •[5] $c = 20$ •[6] $a = -14$ ALLOW ECF from one of their equations (a =) –14 without working award 2 marks (c =) 20 without working award 2 marks (a =) –14 with one correct step award 3 marks (c =) 20 with one correct step award 3 marks	**6**

Question		Answers	Notes	Total
4	a	•1 correct substitution into sine rule •2 substituting both sine of angles with their exact values AG $3\sqrt{3}$	•1 $\frac{AB}{\sin\frac{\pi}{3}}=\frac{3\sqrt{2}}{\sin\frac{\pi}{4}}$ •2 substitute $\sin\frac{\pi}{3}=\frac{\sqrt{3}}{2}$ and $\sin\frac{\pi}{4}=\frac{\sqrt{2}}{2}$ or $\frac{1}{\sqrt{2}}$ Accept a calculator screen shot which shows $3\sqrt{3}$  	**2**
	b	•1 finds AOB or OBA •2 correctly substitutes into a trig rule •3 correct attempt to solve their equation for *r* •4 their exact value of *r* after solving	•1 $\angle AOB=\frac{2\pi}{3}(2.09439....)$ or $\angle OBA=\frac{\pi}{6}$ •2 second mark is for substituting correctly in the cosine rule or sine rule or cos ratio •3 one correct algebra step •4 $r=3$ Do not award if their value of *r* is not in exact form	**4**
		$\angle AOB=\frac{2\pi}{3}$ $r^2+r^2-2\times r^2\cos\frac{2\pi}{3}=(3\sqrt{3})^2$ $r^2+r^2+r^2=(3\sqrt{3})^2$	$\angle AOB=\frac{2\pi}{3}$ $\frac{r}{\sin\frac{\pi}{6}}=\frac{3\sqrt{3}}{\sin\frac{2\pi}{3}}$ $r=\frac{3\sqrt{3}\times\frac{1}{2}}{\frac{\sqrt{3}}{2}}$	$\angle OBA=\frac{\pi}{6}$ $\cos\frac{\pi}{6}=\frac{1.5\sqrt{3}}{r}$ $r=\frac{1.5\sqrt{3}}{\frac{\sqrt{3}}{2}}$ Examples of answers for 4b	**2**

4	**c**	•[1] substituting their value of angle AOB into arc length formula correctly •[2] adding their arc length to $3\sqrt{3}$	•[1] $\frac{2\pi}{3}\times(\text{their}3)$ $\frac{2\pi}{3}\times(\text{their}3)$ ACCEPT $\frac{120}{360}\times 2\pi\times(\text{their r})$ •[2] $\frac{2\pi}{3}\times\text{their}(3)+3\sqrt{3}$ or $2\pi+3\sqrt{3}$	**2**

Question		Answers	Notes	Total
5	a	•[1] $2x + y = 12$ one intercept correct **OR** the line passes through two correct points •[2] $2x + y = 12$ y-intercept correct **AND** crossing the line x = 5 at (5,2) •[3] $x = 5$ line correctly drawn •[4] Their correct closed region (Most of the icon "region" has to be in the correct region in order to award the mark)	 To award the intercept (or intersection with x = 5) mark the line has to be ±0.5 unit accurate Accept equations placed incorrectly •[4] **ECF** can be awarded for a region to the left of x = 5 and above their 2x + y = 12 and below $y = x^2$	**4**
	b	function maximum is 40 (at point (5,25)	Don't need coordinates. Only the 40	**1**

<table>
<tr><th colspan="2">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>6</td><td>a</td><td>•[1] calculation of tax for 30 % band
•[2] their amount of tax for 30 % band calculated correctly
•[3] calculation of tax for 41 % band
•[4] their amount of tax for 41 % band calculated correctly from a subtraction followed by multiplication
•[5] their amount of total tax paid calculated correctly</td><td>
<table>
<tr><td>Annual income bands in EUR</td><td>Tax rate</td><td>Calculation of tax</td><td>Amount of tax EUR</td></tr>
<tr><td>0 < income ≤ 6000</td><td>0 %</td><td>0</td><td>0</td></tr>
<tr><td>6000 < income ≤ 12 000</td><td>5.5 %</td><td>(12 000 – 6000) x 5.5 %</td><td>330</td></tr>
<tr><td>12 000 < income ≤ 25 000</td><td>14 %</td><td>(25 000 – 12 000) x 14 %</td><td>1820</td></tr>
<tr><td>25 000 < income ≤ 70 000</td><td>30 %</td><td>(70000-25000)x30%</td><td>13500</td></tr>
<tr><td>Above 70 000</td><td>41 %</td><td>(80000-70000)x41%</td><td>4100</td></tr>
<tr><td></td><td></td><td>Total tax paid on 80 000 EUR</td><td>19750</td></tr>
</table>
</td><td>5</td></tr>
</table>

Question		Answers	Notes	Total
6	b			10

	(1 mark)	(2 marks)
Identify Factors (F)	Identify two elements from: Income, taxes, expenses, the relocation place **OR** family	Identify more than two elements from: Income, taxes, expenses, the relocation place **OR** family
Calculation Home (H) For scenario 1	Attempt to calculate monthly **OR** yearly net saved value Example: Calculate Total Tax correctly: Tax: 330+1820+15000x0.3(=6650) **OR** Calculate Total expenses correctly (400+900+500)x12(=21600) **OR** 40000-their calculated taxes-their calculated yearly expenses	Correctly calculating scenario 1 monthly net saved value **OR** yearly net saved value (Saved value=40000-21600-6650=)11750 **OR** 979.166… monthly Accept the result with rounding eg. 12000 yearly **OR** 1000 monthly
Calculation Relocate (R) For scenario 2	Attempt to calculate monthly **OR** yearly net saved value in DKK Example: Expenses:(4000+7000+4500+2000)*12+1500=210000+1500 =211500 **OR** Calculate correctly total expenses excluding home travel (4000+7000+4500+2000)*12 = 210000 **OR** Assuming a certain number of times to visit home but making an error in calculation eg. (4000+7000+4500+2000+their2x1500=17500+2x1500=20500 Accept 17500+1500 = 19000 **OR** 400000- 90000-their yearly incorrect expenses	Correctly calculating scenario 2 monthly net saved value **OR** yearly net saved value **in euro** (Saved value=400000-their211500-90000=)98500 yearly **OR** 98500/12=8208 monthly =**13133€ yearly 1094€ monthly** Accept the result with rounding eg. **13000€ yearly OR 1100€ monthly** Accept any number of trips home (Allow for candidates that confuse 'return' for 'one way' only) Final answer must be in euro.
Justify accuracy of calculations (J)	Weak unsupported justification **OR** Sensible rounding used **OR** Recognizing that these are approximate calculations and not accurate Do not accept: My calculations are accurate with any justification	Recognizing the calculation is not accurate with good reasoning: because many of the monthly expenses are estimates because medical expenses can vary because the number of journeys home vary because exchange rate can vary

		Decision (D)	Relocate **OR** do not relocate with weak supporting justification Examples: I will relocate because I will make more money I will not relocate because I don't want to move Relocate **or** do not relocate without justification **OR** with irrelevant justification award 0 marks	Relocate **or** do not relocate with good supporting justification (balanced reflection) Examples: I will relocate because I will make more money even if I come to visit home once a month I will not relocate because even though I will be making xxx more money, it is not much compared to staying with family. I will relocate because I will make more money and I will gain new experiences by moving	

DKK	euro
4000	533
7000	933
2000	267
90000	12000
400000	53333
1500	2

<table>
<tr><th colspan="2">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td rowspan="3">7</td><td>a</td><td>•1 any correct area
•2 the corresponding other correct area
•3 show appropriate operation either adding OR subtracting
800 AG</td><td>SC seeing only:
1800 – 1000 = 800 award 2 marks
OR
600 + 200 = 800 award 2 marks
60 x 10 + 30 x 8 – 40 = 800 award 1 mark for 60 x 10</td><td rowspan="2">3</td></tr>
<tr><td></td><td colspan="2"><table><tr><td>Example method 1.
• 30 x 60 (= 1800)
• 4 x 10 x 25 = (1000)
• (30 x 60) – 4 x 10 x 25
Total 800 AG</td><td>Example method 2.
• 60 x 10 (= 600)
• 10 x 10 x 2(= 200)
• 60 x 10 + 10 x 10 x 2
Total 800 AG</td><td>Example method 3
• 10 x 25 (= 250) and 10 x 25 (= 250)
• 10 x 30 (=300)
• 250 + 250 + 300
Total 800 AG</td><td>Example method 4
• 10 x 10 x 3 (= 300)
• 10 x 25 x 2 (= 500)
• 300 + 500
Total 800 AG</td></tr></table></td></tr>
<tr><td>b</td><td>$\tan\theta = \frac{30}{60}$</td><td>Accept $\tan\theta = \frac{15}{30}$</td><td>1</td></tr>
<tr><td>c</td><td>•1 using tan ratio to determine correct value of θ
•2 using correct ratio to set equation in x
•3 rearranging x on one side correctly</td><td>•1 $(\arctan\frac{1}{2} =)\ 26.565...\text{deg}$
•2 $\sin(\text{their}\,\theta) = \frac{3}{x}$ OR $\frac{3}{\sin(\text{their}\theta)} = \frac{x}{\sin 90}$ OR $\frac{3}{x} = \text{their}0.447...$
•3 $x = \frac{3}{\sin(\text{their}\ \theta)}$ OR $x = \frac{3}{\text{their}\ 0.447...}$</td><td>5</td></tr>
</table>

		•4 the correct value of *x* •5 rounding their result correctly to 1 dp Alternative method •1 using Pythagoras to determine correct value of $\sin\theta$ •2 using correct ratio to set equation in x •3 rearranging *x* on one side correctly •4 the correct value of *x* •5 rounding their result correctly to 1 dp	•4 (*x* =) $3\sqrt{5}$ **OR** 6.708… (cm) •5 (*x* =) 6.7 (cm) 1 dp 6.7 without working award 4 marks (*x* =) $3\sqrt{5}$ **OR** 6.708… (cm) without working Award 3 marks Alternative method •1 $\sin\theta = \frac{1}{\sqrt{5}}$ **OR** 0.447…. •2 $\frac{3}{x} = \text{their}\,\frac{1}{\sqrt{5}}$ **OR** $\frac{3}{\text{their}\sin\theta} = \frac{x}{\sin 90}$ **OR** $\frac{3}{x} = \text{their } 0.447...$ •3 $x = \frac{3}{\text{their } \sin\theta}$ **OR** $x = \frac{3}{\text{their } 0.447...}$ •4 (*x* =) $3\sqrt{5}$ **OR** 6.708… (cm) •5 (*x* =) 6.7 (cm) 1 dp Seeing only $\frac{3}{\sin 26.565..} = 6.708..$ award 4 marks Seeing only $\frac{3}{\sin\text{their}\theta} =$ their value not rounded **OR** exact value that doesn't need rounding award 3 marks 6.7 without working award 4 marks	

	d	•[1] calculating their base of the triangle correctly •[2] using trigonometric ratio correctly to set equation involving H •[3] rearranging their equation correctly to have H on one side •[4] calculating correctly Area of triangle using their height and their *x* •[5] adding the quadruple of 44 to quadruple of their area of triangle •[6] their correct total rounded to nearest cm^2	•[1] (Base of triangle = 25-their 6.7 =)18.3 •[2] $\frac{1}{2}=\frac{H}{25-3\sqrt{5}}$ or $\frac{H}{\text{their } 18.3}$ **OR** $\frac{H}{\sin(\text{their } 26.565...)}=\frac{\text{their } 18.3}{\sin(90-\text{their } 26.565...)}$ •[3] $(H=)\frac{1}{2}\times$ their 18.3 OR $\frac{25-3\sqrt{5}}{2}$ OR 9.146... •[4] $(T_1=)\frac{1}{2}\times$ their $18.3\times$ their $9.146...=83.6...$ Accept 83.7… •[5] 4 x 44 + 4 x 84 •[6] 512 (cm^2)	**6**
	e	•[1] dividing by total area of flag •[2] calculating their percentage correctly	•[1] Seeing 60 x 30 or 1800 in denominator •[2] $(\%\text{ represented}=)\frac{\text{their blue total area}}{\text{their total area}}\times 100$ 28.444.. OR 28 % without working award 2 marks	**2**

Question		Answers	Notes	Total
8	a	•1 one suitable pattern •2 two suitable patterns	For example: goes up 1,2,3 OR triangle numbers OR goes up by one more than the previous increase OR quadratic progression (ACCEPT non-linear) OR comment on differences eg second is constant OR first goes up by one Do not accept: As the number of males increases the number of handshakes goes up	**2**
	b	•1 correct general rule with poor notation •2 correct general rule with correct notation Alternative with differences •1 one correct equation for difference •2 correct general rule with correct notation	•1 (m^2-m)/2 OR m^2/2-m/2 •2 $(h=)\frac{m(m-1)}{2}$ OR $(h=)\frac{m^2}{2}-\frac{m}{2}$ Answer must be in terms of m	**2**
	c	•1 substitute $m \geq 5$ into their rule •2 correctly calculate their value of h after substitution $m \geq 5$ •3 recognise that their result is the same as their predicted value	•3 ACCEPT seeing the 15 in the table and seeing h=15 from their calculation **SC** if "tested" correctly award 1 mark Tested correctly is when they apply the steps of verification mentioned in the left column on a value of $m \leq 5$	**3**

	d	Mark	Predictions (P)	Description (D)	Testing (T)	Verifying (V)	Justify/proof (J)	Notation and terminology (N)	Communication (L)	
		1	Correctly predict one term for any two sets of data *s* or *b* or *k* or *G* (when $m \geq 6$)	Attempt to describe a pattern Ex: they are all increasing or Recognize that pattern for *s* and *b* are the same or recognise that $h = k/2$	Attempted to test their described pattern or general rule of *k* or *b* or *s* or *G* for $m \leq 5$ ex: substitutes in their rule value of $m \leq 5$	Attempt to verify their general rule of *k* or *b* or *G* for $m \geq 6$ ex: substitute in their rule value of $m \geq 6$	Attempt to justify any of their described patterns or general rules Ex: refer to difference between terms or test at least two values for *s* and say it works or after stating the rule they say every time it is male times male	The notation or terminology is correct **OR** The notation and terminology have significant errors	Lines of reasoning are incomplete **OR** incoherent. Ex: Only two lines of calculations **or** algebraic steps	
		2	Correctly predict one row for the five sets of data (when $m \geq 6$) **OR** Correctly predict four values in the columns of *s* or *b* or *k* or *G* (when $m \geq 6$)	Recognize that pattern for *s* and *b* are the same **and** recognise that $h = k/2$	Correctly calculating their value of *k* or *b* or *s* or *G* using their value of $m \leq 5$ and recognizing that their result is the same as the table value (ACCEPT seeing their calculated value and their predicted value in the table being equal)	Correctly calculate their value of *k* or *b* or *G* using their value of $m \geq 6$	Justify any of the general rules correctly Ex: The second difference is constant Ex: The *s* (or *b*) are the square numbers Ex: *h* are the triangle numbers **OR** Attempt to justify the general rule for Greeting (*G*) Ex: Attempt to add any of their rules for *b*, *s*, *k* or *h* together or test at least two values for *G* and say it works.	The notation of a general rule and terminology describing pattern is correct **OR** Correct general rule in correct notation but not simplified Ex: $G = m(m\text{-}1)/2 + m(m\text{-}1) + m^2 + m^2$	Lines of reasoning are coherent **OR** answer is organised using a logical structure.	**24**

		3	Correctly predict two rows for the five sets of data (when $m \geq 6$) **OR** Correctly predict eight values in the columns of s or b or k or G (when $m \geq 6$)	Correctly describe pattern in words for bows (b) **AND** recognise it is the same as for smiles (s) Ex: They are the square numbers or the second difference is constant or it is quadratic or second degree or $s = m \times f$		Recognise that their result for G is the same as their predicted value (ACCEPT seeing their calculated value and their predicted value in the table being equal) Allow V3 only if they verify **their rule for G** correctly.	Justify any of the general rules correctly Ex: The second difference is constant Ex: The s (or b) are the square numbers **AND** Attempt to justify the general rule for Greeting (G) Ex: Attempt to add any of the rules for b, s or k together or test at least two values for s and say it works **OR** Justify correctly the general rule for Greeting (G) Ex: Add correctly their rules for b, s, h and k together	The notation of their general rule for G and terminology used are correct and their general rule is simplified as $G = \frac{7}{2}m^2 - \frac{3}{2}m$ or $\frac{1}{2}m(7m-3)$ Award only if D5 is achieved	Lines of reasoning are coherent **AND** answer is organised using a logical structure Award only if J2 is achieved	
		4		Correctly describe pattern as general rule for kisses (k) or bows (b)or smiles (s) **OR** recognise that $s = m^2$ and b the same writing only $s = m^2$ award D3			Justify any of the general rules correctly Ex: The second difference is constant Ex: The s (or b) are the square numbers **AND** Justify correctly the general rule for Greeting (G)			

							Ex: Add correctly the rules for *b*, *s, h* and *k* together			
		5		Attempt to describe pattern as general rule for *G* Ex: the rule is $\frac{7}{2}m^2 - \frac{3}{2}m$ **OR** adding correct rules incorrectly *G*= *m*(*m*-1)/2 + *m*(*m*-1) + m^2 OR four rules correct and recognising that the four rules must be added					
		6		Correctly describe the pattern for *G* as a general rule *G* = *m*(*m*-1)/2 + *m*(*m*-1) + m^2 + m^2 **OR** *G* = $\frac{7}{2}m^2 - \frac{3}{2}m$ or $\frac{1}{2}m(7m-3)$ **OE**					

Prediction table below

Table 3

Number of males (m)	Number of females (f)	Number of handshakes (h)	Number of kisses (k)	Number of bows (b)	Number of smiles (s)	Total number of greetings (G)
1	**1**	**0**	**0**	**1**	**1**	**2**
2	**2**	**1**	**2**	**4**	**4**	**11**
3	**3**	**3**	**6**	**9**	**9**	**27**
4	**4**	**6**	**12**	**16**	**16**	**50**
5	**5**	**10**	**20**	**25**	**25**	**80**
6	6	15	30	36	36	117
7	7	21	42	49	49	161
8	8	28	56	64	64	212
9	9	36	72	81	81	270
10	10	45	90	100	100	335
11	11	55	110	121	121	407
12	12	66	132	144	144	486
13	13	78	156	169	169	572
14	14	91	182	196	196	665
15	15	105	210	225	225	765