Markscheme

May 2018

Extended mathematics

On-screen examination

24 pages

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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
	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 doubt		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 *eg*, 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

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

ECF Marks that can be awarded as **error carried forward** from previous results in the question
BOD Benefit of the doubt
MR misread
NWS no working shown
SC special case
OE or equivalent
WTTE or words to that effect
AG Answer given

Example 1
- 1 mark awarded and corresponding notes are aligned

b	• Show clear line of reasoning in the method • 4	45 & 49 seen **OE** *eg*, $49 = 45 + x$ **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.

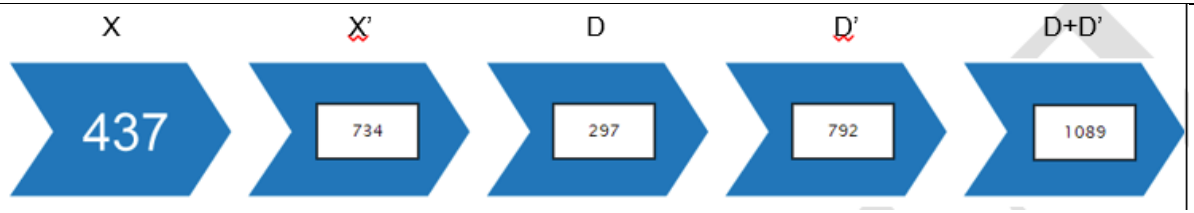
a) **ECF** applies from one part of a question to a subsequent part of the question and also applies within the same part.
b) If an answer resulting from **ECF** is inappropriate (*eg*, negative distances or sin*x* > 1) then subsequent marks should not be awarded.
c) If a question is transformed by an 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) 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.
c) Where candidates have written two solutions to a question, mark the response that deserves more marks.
d) 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 $x \div 2$
e) 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.
f) Special case marks **SC** can be allocated instead of but not in addition to the marks prescribed in the markscheme.
g) ACCEPT notation errors in intermediate steps.
h) When a calculator screenshot is taken, ACCEPT not seeing the whole operation.
i) ACCEPT seeing an equation not in-line.

General note for marking open-ended response questions:

In cases in Task 2 and 3 where the mark scheme 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 dont 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.

Question		Answers	Notes	Total
1	a	 •[1] 734 **and** their 297 correctly reversed •[2] their D correct •[3] their D and D' correctly added	•[1] 734 **and** 792 •[2] 734 – 437 = 297 •[3] 792 + 297 = 1089 •[3] 1089 with no entries in their D and their D' : award 1 mark	**3**
	b	•[1] expressing X correctly in terms of multiples of *a*, *b* and *c* •[2] expressing X´ correctly in terms of multiples of *a*, *b* and *c* •[3] subtracting and reversing all signs of their X **OR** their X´ •[4] their answer correct in terms of *a* and *c only*	•[1] 100*a* + 10*b* + (1)*c* ACCEPT not seeing this step ACCEPT inappropriate notation provided it reads correctly. Ex: 100*a+10*b+1*c DO NOT ACCEPT incorrectly read expressions. Ex: 100c+10**(**b**)**+a**)** •[2] 100*c* + 10*b* + (1)*a* ACCEPT not seeing this step •[3] 100*c*+10*b*+1*a* – 100*a* – 10*b*-1*c* OE If their X and X' are numbers, ACCEPT their X- their X' only if their result is positive •[4] 99*c* – 99*a* or 99(*c* – *a*) or 99(*a* – *c*) ACCEPT absolute value of 99(*c* – *a*) OE ***Notes continued below***	**4**

1	**b**		99c-99a or 99(c – a) without working : award 3 marks 99c – 99a or 99(c – a) with one step of working: award 4 marks •^{4} DO NOT ACCEPT unless it is in terms of a and c ACCEPT not seeing absolute value **SC 1 mark** 100a,10b, c and 100c,10b, a	

Question		Answers	Notes	Total
2		Candidates may use any appropriate algebraic notation to represent the frog and dragonfly here we have used x and y		**6**
		•[1] setting both equations correctly	•[1] $3x + 2y = 22$ and $4y – 2x = 12$ OE	
		•[2] one correct step to eliminate one variable **OR** for substitution	•[2] for example, $6x + 4y = 44$ and $12y – 6x = 36$ **OR** $y= (22 - 3x)/2$	
		•[3] correctly eliminate one variable	•[3] 80 seen or 10 seen or 16y or $8x$ OE	
		•[4] Their y correct	•[4] (y =) 5	
		•[5] Their x correct	•[5] (x =) 4 ECF substituting their incorrect y in any of their equations	
		•[6] their x and their y added correctly	•[6] (5 + 4 =) 9	
			9 without working from •[1] to •[3] : award 4 marks 9 with one of •[1] to •[3] : award 5 marks 9 with two of •[1] to •[3] : award 6 marks	
		Alternative method for trial and error responses	**Alternative method trial and error response**	
		•[1] seeing two numbers with sum 22 **OR** seeing two numbers with difference 12	•[1] e.g. 12 + 10 = 22 **OR** 20 – 8 = 12	
		•[2] seeing values of x and y that satisfy $3x + 2y = 22$	•[2] e.g. 3x6 + 2x2 = 22	
		•[3] seeing values of x and y that satisfy $4y - 2x = 12$	•[3] e.g .4x4 – 2x2 = 12	
		•[4] x or y correct	•[4] 4 or *5*	
		•[5] x and y correct	•[5] 4 and *5*	
		•[6] their values added correctly	•[6] their 9	
			9 without working from •[1] to •[3] : award 4 marks 9 with one of •[1] to •[3] : award 5 marks 9 with two of •[1] to •[3] : award 6 marks	

<table>
<tr><th colspan="2">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>3</td><td>a</td><td>•1 two inequalities correct

•2 The third inequality correct

•3 one correct constraint OR three correct constraints not including ”equal to”

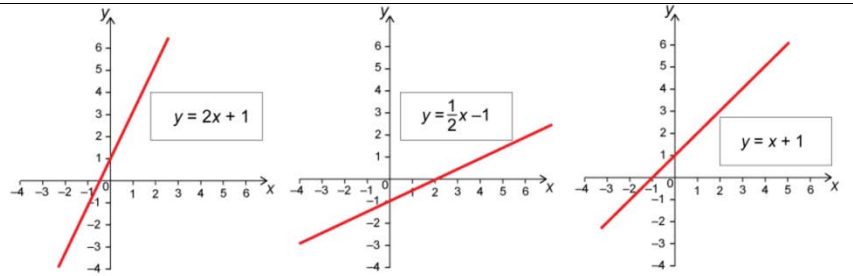
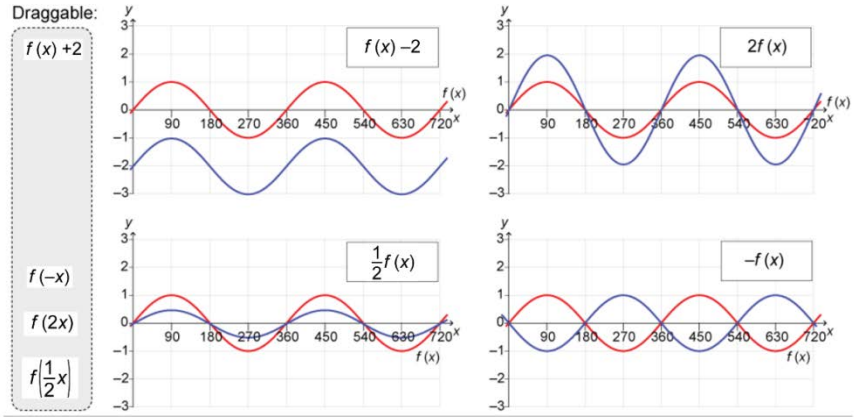
•4 the second and third constraint correct
<table>
<tr><th>Inequalities</th><th>Constraints</th></tr>
<tr><td>$x + y \leq 500$</td><td>(Number of) cookies and muffins is less than or equal 500
WTTE cannot exceed, at most</td></tr>
<tr><td>$y \geq 50$</td><td>(number of) muffins more than or equal 50
WTTE exceeds or equal 50, at least 50, a minimum of 50, not less than 50
ACCEPT between 50 and 250 OR bigger than 49 OR can exceed or equal to 50</td></tr>
<tr><td>$y \leq x$</td><td>(number of) cookies more than or equal (the number) of muffins
WTTE exceeds or equal, at least, minimum as, not less than
ACCEPT x can exceed or equal y OR y cannot exceed</td></tr>
</table></td><td>ACCEPT if they use x and y instead of cookies and muffins

DO NOT ACCEPT cost or price or value of cookie/muffin
.
•3 An example for “OR”
Cookies exceeds 100 and
muffins exceeds 50 and cookies bigger than muffins
•3 DO NOT ACCEPT ECF from the inequality</td><td>4</td></tr>
<tr><td></td><td>b</td><td>profit (on/of) one (cookie and/or muffin) OR profit per cookie and per muffin</td><td>Profit and one or per must be seen or implied

ACCEPT amount of money gained to express profit

DO NOT ACCEPT cost or price
DO NOT ACCEPT the profit of a muffin is 1.5 times the profit of cookie OE</td><td>1</td></tr>
</table>

3	**c**	•[1] evidence of working •[2] 250 (cookies) •[3] 250 (muffins)	•[1] (P =) (1x)450 + 1.50x50 **OR** (P =) (1x)250 +1.5x250 **OR** 525 **OR** 625 Incorrect substitution and correct calculation: award only 1 mark •[2] 250 (cookies)) without working: award 1 mark •[3] 250 (muffins) without working: award 1 mark 250 must be seen twice to gain •[2] and •[3] **SC 2 marks** 525 and 625 seen **or** 725 **and** 50 cookies and 450 muffins **SC 1 mark** 725 **and** 50 and 450	**3**

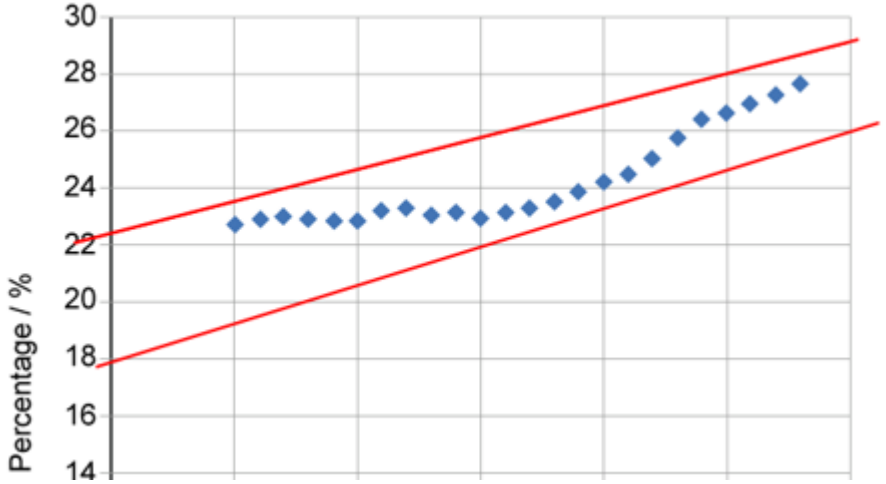
Question		Answers	Notes	Total
4	a	•[1] one equation placed correctly •[2] the other two equations placed correctly		2
	b	•[1] 1st equation placed correctly •[2] 2nd equation placed correctly •[3] 3rd equation placed correctly •[4] 4th equation placed correctly	 DO NOT ACCEPT f(-*x*) Do not award the mark if two functions are dragged on the same graph	4

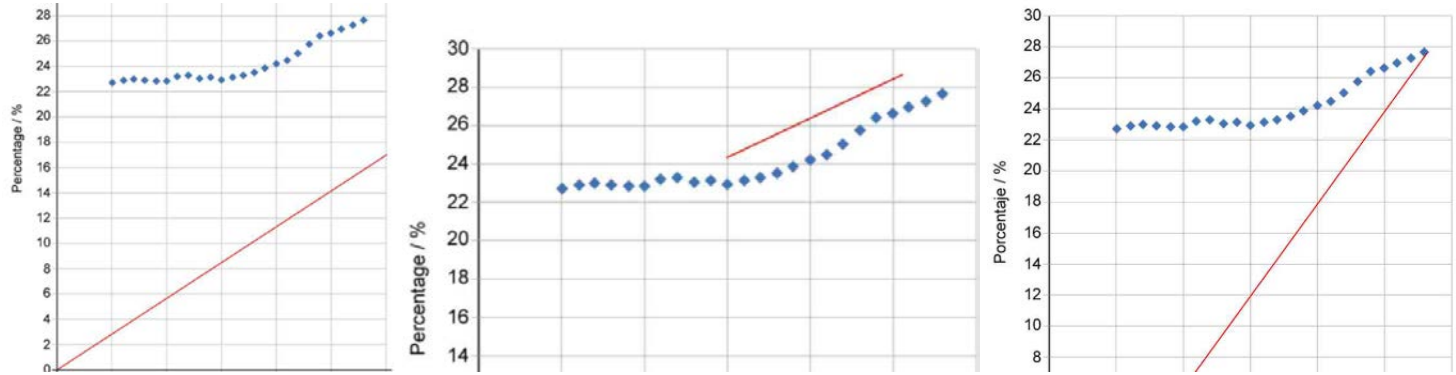
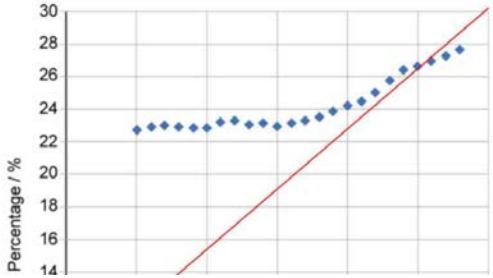
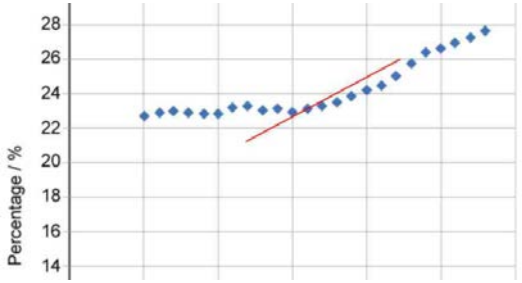
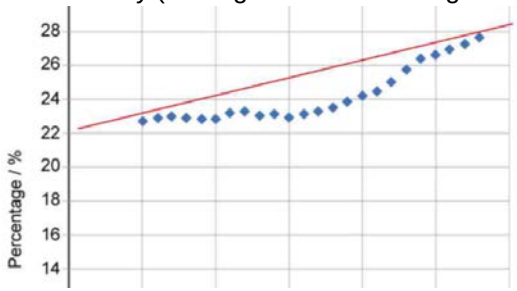
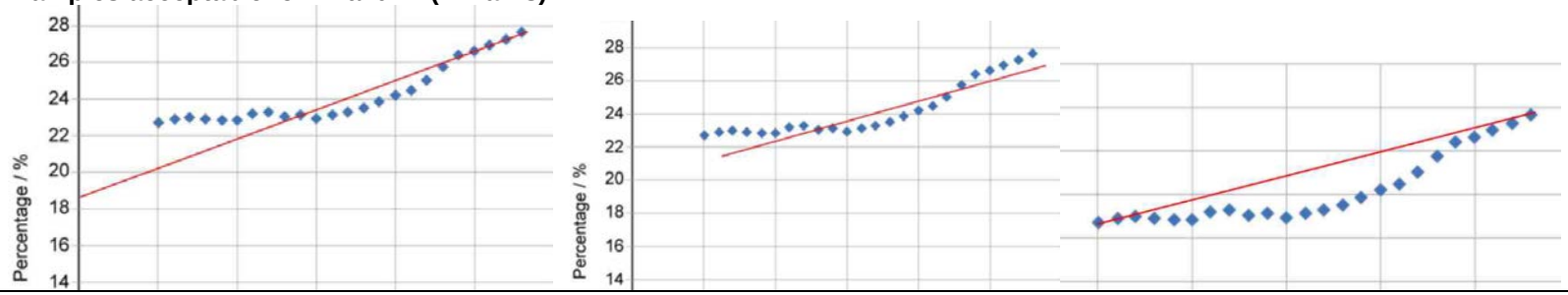
Question		Answers	Notes	Total
5	a	•1 substitutes into magnitude formula •2 (speed) = 13	•1 square root of $5^2 + 12^2$ 13 without working: award 2 marks	2
	b	adds vector S and C $\begin{pmatrix} 8 \\ 12 \end{pmatrix}$ AG	$\begin{pmatrix} 5 \\ 12 \end{pmatrix} + \begin{pmatrix} 3 \\ 0 \end{pmatrix}$ OR 5+3 **and** 12+0. ACCEPT 5+3 **and** 12	1
	c	•1 evidence of use of dot product •2 dot product correctly calculated •3 magnitude of vector R correctly calculated •4 evidence of substituting into the correct formula •5 their angle correct **Alternative method** •1 using the tan ratio twice •2 applying inverse tan for one •3 applying inverse tan for the second •4 subtracting their angles •5 angle correct ***Another alternative method below***	•1 (5 x 8 + 12 x 12) may be implied •2 184 •3 $4\sqrt{13}$ or $2\sqrt{52}$ or $\sqrt{208}$ or 14.4(22) •3 ACCEPT $\sqrt{8^2 + 12^2}$ for $4\sqrt{13}$ in calculator display only •4 ($\cos\theta$ =) 0.9813 … or $46/(13\sqrt{13})$ or $\frac{\text{their}184}{\lvert\text{their}13\rvert\lvert\text{their}4\sqrt{13}\rvert}$ •5 their 11° (.0702 …) must come from $-1 \le \cos\theta \le 1$ **SC** 5 marks $\theta = \cos^{-1}\left(\frac{5\times 8+(12\times 12}{\sqrt{5^2+12^2}\times\sqrt{8^2+12^2}}\right) = 11^o$ **Alternative method** •1 using the tan ratio twice •2 67.3801 … •3 56.3099 … •4 their 67.3801 … – their 56.3099 … •5 11^o (.0702 …) ***Another alternative method below***	5

5	**c**	**Alternative method** •[1] magnitude of vector R correctly calculated •[2] magnitude of vector C correctly calculated •[3] evidence of substituting their R, C and S into the cosine rule •[4] their cosθ correct •[5] their angle correct	**Alternative method** •[1] $4\sqrt{13}$ or $2\sqrt{52}$ or $\sqrt{208}$ ACCEPT $\sqrt{8^2+12^2}$ for $4\sqrt{13}$ in calculator display only •[2] 3 •[3] $\text{their}3^2 = \text{their}13^2 + \left(\text{their}4\sqrt{13}\right)^2 - 2(\text{their}13)(\text{their}4\sqrt{13})\cos\theta$ may be implied [4] (cosθ =) 0.9813 … or 46/(13$\sqrt{13}$) or $\frac{\text{their}(13^2+(4\sqrt{13})^2-9)}{2(\text{their}13)(\text{their}4\sqrt{13})}$ •[5] their 11° (.0702 …) must come from -1≤cosθ≤1	**5**

Question		Answers	Notes	Total
6	a	•1 (Min) 1 **and** (Max) 17 •2 correct subtraction to get their 16	•1 1 and 17 •2 16 •2 DO NOT ACCEPT a negative number 16 without working: award 2 marks **SC 1 mark** Seeing only (6,16) or -16	**2**
	b	•1 identifying any two times 12 hours apart •2 12 (hours)	•1 3 and 15. •1 ACCEPT seeing two times which are 12 hours apart •1 ACCEPT seeing two points with x-coordinates 12 hours apart •1 ACCEPT recognizing that there are two cycles in 24 hours OE •2 DO NOT ACCEPT any other value but 12 12 without working: award 2 marks	**2**
	c	•1 correct substitution •2 one correct algebraic step •3 two correct algebraic steps •4 correct use of their inverse sin •5 correct step using π or 180 •6 their times both correct	ACCEPT work in degrees instead of radians •1 $13 = 8\sin(\pi t/6) + 9$ •2 $4 = 8\sin(\pi t/6)$ •3 $\frac{1}{2} = \sin(\pi t/6)$ ACCEPT seeing •2 or •3 for both marks •2 and •3 •4 $\pi t/6 = \pi/6$. ACCEPT using π = 180 in their calculations and writing 30t = 30 or $\pi t/6 = 30$ OE ACCEPT t = 1 or t = 57(.29..) •5 $\pi t/6 = \pi$ - their π/6 ACCEPT using π = 180 in their calculations and writing 30t = 180 - their 30 **or** $\pi t/6 = 180$ - their 30 •6 their $t = 1$ (am) **and** their $t = 5$ (am) Attempts to work with e.g. $\pi t/6 = 30$ cannot be awarded •6 (t =) 1 (or (t =) 5 without working: award 1 mark (t =) 1 and (t =) 5 without working: award 2 marks (t =) 1 and (t =) 5 with only •1 seen: award 3 marks (t =) 1 and (t =) 5 with only •2 or •3 seen: award 4 marks	**6**

Question		Answers	Notes	Total
7	a	•1 $\frac{17+1}{100}$	OE	1
	b	•1 dividing 1207000 by 23858000 •2 0.05059… or 0.0506 or 5.059… (%) or 5.06(%) 5 (%) AG	•1 ACCEPT 1207/23858 •2 ACCEPT 0.0505 or 5.05(%) ACCEPT seeing cross multiplication process for 2 marks Examples: 23858 – 100% 1207 – 5.059% **SC 1 mark** 0.05 x 23 858 000 = 1 192 900 or $\cong 1207000$ **OR** 1 207 000 / 0.05 = 24 140 000 or $\cong 23858000$	2
	c	•1 0.82 written on both branches •2 0.05 and 0.95		2
	d	•1 calculating probability from one branch •2 calculating probability from the other branch •3 adding correctly their probabilities of their branches	•1 0.05 x 0.18 •2 0.95 x 0.18 •3 0.05 x 0.18 + 0.95 x 0.18 = 0.18 0.18 without working: award 1 mark ACCEPT 5% , 5/100 for 0.05 OE	3

7	**e**	•[1] dividing their probability of first branch by their result in (d) •[2] their result correctly after division	•[1] $\frac{0.05 \times 0.18}{0.18}$ •[2] 0.05 0.05 without working: award 2 marks	**2**
	f	•[1] independent (events)	ACCEPT incorrect spellings of “independent” OE ACCEPT independent even if answers for b) and e) are not correct	**1**
	g	•[1] the line is crossing twice or touching at least two points •[2] domain covering at least year 1994 to 2010 and the line is within the range shown below  	•[1] see examples below •[2] see examples below	**2**

7	g		**Examples not acceptable (0 marks): Not crossing twice, Not touching two points and not in range**  **Examples acceptable for $\bullet^1$ or $\bullet^2$ only (1 mark)** $\bullet^1$ only (Touching two points)  $\bullet^1$ only (Touching two points)  $\bullet^2$ only (In range but not touching two points)  **Examples acceptable for $\bullet^1$ and $\bullet^2$ (2 marks)** 		

7 **h**

Mark	1	2	3	4
F: Identification of Factors	One factor mentioned from: - Nature of the increase - Life expectancy - Birth rate or mortality - Rules of immigration - Gradient or rate of line or Percentage increase of immigrants seen - Percentage of immigrants - Change in population distribution (human landscape) - Economy status - Imagined factor like disaster happening in Australia DO NOT ACCEPT only saying many factors	Two factors mentioned from: - Nature of the increase - Life expectancy - Birth rate or mortality - Rules of immigration - Gradient or rate of line or Percentage increase of immigrants seen - Percentage of immigrants - Change in population distribution (human landscape) - Economy status - Imagined factor like disaster happening in Australia DO NOT ACCEPT only saying many factors		
E: Estimation	Estimation of year in range (2055 to 2300) or (in 42 to 287 years) without showing calculations **OR** Estimation not in range using their incorrect line equation or incorrect proportions or percentages	Estimation of year in range (2055 to 2300) using: equation of line not matching their line of best fit **OR** Incorrect proportion or percentage increase of immigration Ex: Estimate 2080 using 6% in 23 years, or estimate 2150 using 0.3% every year, or 2070 using 1% every 5 years	Estimation of year in range (2055 to 2300) using: equation of line matching their line of best fit but incorrect result Ex: reaching estimation 2100 from y=0.2x+20 **OR** Using appropriate proportions Ex: Estimate 2180 using 6% in 23 years, or estimate 2090 using 0.3% every year, or 2070 using 2% every 5 years	Estimation of year in range (2055 to 2300) using: correctly equation of line matching their line of best fit Ex: reaching estimation 2120 from y=0.2x+23

7	h	**Mark**	**1**	**2**	**3**	**4**
		D: Degree of Accuracy	Suitable rounding used for their estimated year DO NOT ACCEPT if they just write down a year without any reference or calculations **SC**: if they use their line equation or proportions correctly and their estimated year does not need rounding: award D1			
		J: Justification of whether it makes sense	Inaccurate with weak reason Examples: 1. Inaccurate because I used line of best fit. 2. Inaccurate because I used % which are not accurate inaccurate because the difference between what I estimated and news headline is very big **OR** Accurate with valid reason Examples: 1. Accurate because I used my line of best fit to estimate 2. Accurate because I used average % of increase 3.Accurate because I considered all data given DO NOT ACCEPT My prediction is accurate because I made the calculations DO NOT ACCEPT accurate or inaccurate without reason Can be awarded only if E1 is achieved	Inaccurate with a valid reason related to variables affecting the future Examples: 1. The prediction I made not very accurate because many factors may vary 2. Predictions using line of best fit for the future not guaranteed 3. The prediction using the line equation not very accurate because it is taking only a window or isolated time 4. The prediction using the line equation not very accurate because it assumes the future follows same pattern 5. My predictions not very accurate because the population (human landscape) can change in Australia ACCEPT Calculating using their line equation the % immigration in 2050 and showing it is not 50%		

7	h	**Mark**	**1**	**2**	**3**	**4**
		N: Comment on News headline	Comment on the news headline, with a supporting reason, seen anywhere Example: 1. Not accurate because I estimated my calculation 2300 2. It can be correct as my value estimated is close 3. Many factors affect it they cant say for sure DO NOT ACCEPT right or wrong headline without reason			
				10 marks		

<table>
<tr><th colspan="2">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td rowspan="4">8</td><td>a</td><td>•1 two correct area values
•2 third correct value and correct subtraction to get 3200 AG

OR finding the area of shaded

•1 correct area for one shaded rectangle
•2 second correct area for shaded rectangle and addition seen</td><td>Values 10000, 6400, 400 e.g. 10 000 – 6 400 - 400

OR

•1 For example: 1600 OR 2000
•2 2 x 1600 OR 2000 + 1200</td><td>2</td></tr>
<tr><td>b</td><td>60 and 4800 twice</td><td><table><tr><th>Length of AC in cm</th><th>Length of AB (L) in cm</th><th>Length of BC in cm</th><th>Shaded area (A) in cm²</th></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td>100</td><td>20</td><td>80</td><td>3200</td></tr><tr><td>100</td><td>30</td><td>70</td><td>4200</td></tr><tr><td>100</td><td>40</td><td></td><td></td></tr><tr><td>100</td><td>50</td><td>50</td><td>5000</td></tr><tr><td>100</td><td></td><td>40</td><td></td></tr><tr><td>100</td><td>70</td><td>30</td><td>4200</td></tr><tr><td>100</td><td>80</td><td>20</td><td>3200</td></tr><tr><td></td><td></td><td></td><td></td></tr></table></td><td>1</td></tr>
<tr><td>c</td><td>a suitable pattern described in appropriate terminology</td><td>Some examples:
it's quadratic
It increases and then decreases
Maximum at 50
Maximum 5000
Symmetry or symmetry about 5000 or 50
AB x BC x 2 or WTTE i.e Second column x third column x 2
ACCEPT: They are all multiples of 100</td><td>1</td></tr>
<tr><td>d</td><td>•1 attempt to express the general rule in terms of their L

•2 correct general rule for A in terms of L</td><td>•1 (A =) 200L – 2LL OR 200*L – 2L*L OR 200n - n^2

•2 (A =) 200L – $2L^2$ OR 2L(100 – L).
ACCEPT (A =)200 x L – 2 x L^2 or 2L x (100 – L)

SC 1 mark
seeing (100 – L)
or
seeing $2L^2$ or 2L
or
seeing AB x(100 - AB) x 2</td><td>2</td></tr>
</table>

8	**e**	•[1] substitute L different than (20, 30, 40, 50, 60, 70, 80) into their rule •[2] correctly calculate their value of A after substitution of L different than (20, 30, 40, 50, 60, 70, 80) •[3] recognizing that their result is the same as their predicted value	•[1] Example: use L =10 or 90 200(10) – 2(10)^2 or their own value of L •[2] Example: 1800 (for the L = 10) •[3] Same as value I predicted in table (and we find the candidate has 1800 in the table for L = 10) OR same as when we continue the pattern and explains how 1800 is obtained from pattern of constant second difference OR the same value given by the simulator •[3] ACCEPT seeing the 1800 in the table and seeing their calculated A = 1800 when L = 10 **SC 1 mark** if "tested" correctly with a value from the table. for example: tests with L = 50 to get P = 5000 and recognizing their result is same as table	**3**
	f	•[1] correctly substituting in area formula •[2] evidence of subtracting their two areas from the whole •[3] dividing by 2 600π AG	•[1] $\pi 30^2$ or $\pi 20^2$ •[2] $2500\pi - 900\pi - 400\pi$ •[3] (A =)$1250\pi - 450\pi - 200\pi$ ACCEPT •[2] and •[3] in any order •[3] ACCEPT dividing by 2 seen in formula step for •[3] •[3] ACCEPT approximated answers leading to 1884 = 600π Seeing only $1250\pi - 450\pi - 200\pi$: award 3 marks Seeing only $1250\pi + 650\pi$: award 2 marks 600 π without working : award 0 marks	3

8	g	Mark	1	2	3	4
		Predictions (P)	Predict correctly one value of A Examples: $r = 25$, A = 625π **OR** Predict correctly three values of A without corresponding r	Predict correctly three values of A Examples: $r = 25$, A = 625π $r = 30$, A = 600π $r = 35$, A = 525π DO NOT ACCEPT if corresponding r not mentioned		
		Description (D)	Attempt to describe a pattern in words. Examples 1. Increasing then deceasing 2. It is quadratic or parabola EX. Symmetrical	Describe correctly pattern in words Example: A are multiples of 5 **OR** Attempts to describe radius or diameter of the semicircles as a general rule Ex: 100 – 2r or 50 – r could be seen in the response, table or diagram	Attempt to describe pattern for A as general rule. Examples: 1 (A =) $50^2 - r^2 - (50 - r)^2$ 2.(A=) $50^2 - AC^2 - (50 - AC)^2$ **OR** Evidence of subtracting two small semicircles/circles from a larger one.	Correctly describe pattern as general rule for A Examples: 1. A = πr (50 – r) 2. A = π (50r – r^2) 3. A = $\frac{2500\pi}{2} - \frac{\pi r^2}{2} - \frac{\pi(50-r)^2}{2}$ **OR the below but award N1** (A =) πr (50 – r) (A =) π (50r – r^2) the general rule is πr (50 – r)
		Testing (T)	Attempt to use r from {5,10,15, 20} in their described pattern or general rule	Recognizing that their result is the same as value in table ACCEPT seeing their calculated A value from their general rule and the value in the table being equal even without π		
		Verifying (V)	Attempt to use r other than 5,10,15, 20 in their described pattern or general rule	Calculate correctly their value of A using their r other than 5,10,15, 20 in their general rule	Recognizing that their result is the same as their predicted value ACCEPT seeing their calculated A value from their general rule and their predicted value in the table being equal provided their calculated value includes π	

8 **g**

Mark	1	2	3	4
Justify/proof (J)	Attempt to justify their described pattern or rule or general rule Examples 1. Trying at least two values and justifying that they are the same or rule works 2. We always multiply *r* by the difference between 50 and *r* 3.The second difference is constant	Good attempt to Justify their general rule Examples: 1.The second difference is constantly 50 2.The equation is quadratic with – ve coefficient of r^2 so increasing then decreasing	Attempt to prove the general rule for the area A Example: Attempt to add areas in terms of *r*	Correctly prove the general rule for the Area A Example: Adding the areas in terms of *r* correctly J4 automatically gains T2 and V3
Notation and terminology (N)	Notation **or** terminology is correct **OR** the notation and terminology have significant errors for example 3.14 for pi **OR** The general rule is correct but not in correct notation $A = 50^2 – r^2 – (50 – r)^2/2$ Ex: The general rule is $pi(50r – r^2)$	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 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	

20 marks