Markscheme

May 2018

Mathematics

On-screen examination

27 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 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.

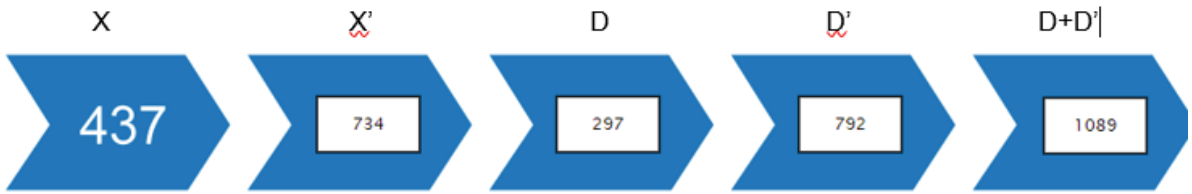
a) **ECF** applies from one part of a question to a subsequent part of the question and also applies within the same part.
b) If an answer resulting from **ECF** is inappropriate (*eg*, negative distances or sin$x$ > 1) then subsequent marks should not be awarded.
c) If a question is transformed by an 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 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.

Question		Answers	Notes	Total
1	a	 •1 437 **and** their D correctly reversed •2 their D correct •3 their D and their D' correctly added	•1 734 **and** 792 •2 (their 734 - 437=) 297 •3 (their 297 + their 792 =)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*	•1 $100a + 10b + (1)c$ •1 ACCEPT inappropriate notation provided it reads correctly. e.g.: $100*a+10*b+1*c$ •1 DO NOT ACCEPT incorrectly read expressions. e.g.: $100(a+(10b) + c$ •2 $100c + 10b + (1)a$ •2 ACCEPT inappropriate notation provided it reads correctly. e.g.: $100xc+(10b)+1x(a)$ •2 DO NOT ACCEPT incorrectly read expressions. e.g.: $100c+10(b)+a)$ **SC for 1 mark** $100a,10b, c$ and $100c,10b, a$	**2**

1	**c**	•[1] their X' - their X **OR** their X - their X' •[2] their answer correct in terms of *a* and *c only*	ACCEPT not seeing absolute value •[1] (100*c*+10*b*+1*a*) - (100*a*+10*b*+1*c*) **or** (100*a*+10*b*+1*c*) - (100*c*+10*b*+1*a*) •[1] If their X **and** X' are numbers, ACCEPT only if their result is positive •[2] 99*c* – 99*a* or 99*a* –99c OE •[2] ACCEPT non-simplified answers 100 *c* + *a* - 100*a* - *c* or (100*a* + *c*) - (100*c* + *a*) OE (100c+*a*)-(100*a*+*c*) or 99*a* – 99*c* or 99(*c* – *a*) OE without working: award 2 marks Seeing only X'-X : award 0 marks **SC for 1 mark** if their X and X' from part (b) are identical and 0 is their result in part (c) **OR** Comparing correctly their coefficients of *a* and *c* in their X **and** X'	**2**

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] $x + y = 22$ **and** $x - y = 12$	
		•[2] a correct step towards eliminating one variable	•[2] for example: 34 seen or 10 seen or $22 - y = 12 + y$ or $22 - x = x - 12$ or $2x$ seen or $2y$ seen	
		•[3] their x correct	•[3] (x =) 17	
		•[4] their y correct according to their x in any of their equations	•[4] (y =) 5	
		•[5] seeing their$2x$ and their$4y$ correct	•[5] 2 x their 17 **and** 4 x their 5 OE	
		•[6] their values above added correctly	•[6] their 54	
			54 without working: award 4 marks 54 with one of •[1] to •[5] : award 5 marks 54 with two of •[1] to •[5] : award 6 marks	
			seeing only 2 x 17 + 4 x 5 OE e.g.17 + 17 + 5 + 5 + 5 + 5 : award 5 marks seeing only 34 + 20 = 54 : award 5 marks seeing only 2 x 17 + 4 x 5 = 54 OE : award 6 marks Seeing only 17 and 5 then X = 54 : award 6 marks	
		Alternative method for trial and error responses	**Alternative method for trial and error responses**	
		•[1] seeing two numbers with sum 22 •[2] seeing two numbers with difference 12 •[3] x **or** y correct •[4] x **and** y correct •[5] seeing their$2x$ **and** their$4y$ correct •[6] their values above added correctly	•[1] trial e.g. 13 + 9 •[2] trial e.g. 15 – 3 •[3] 17 **or** 5 •[4] 17 **and** 5 •[5] 2 x their 17 **and** 4 x their 5 OE •[6] their 54	

<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 the boundary

•[4] the second and third constraint correct

<table>
<tr><th>Inequalities</th><th>Constraints</th></tr>
<tr><td>$x \geq 100$</td><td>(number of) cookies more than or equal 100
WTTE exceeds or equal 100, at least 100, a minimum of 100, not less than 100
ACCEPT between 100 and 450 OR bigger than 99 OR can exceed or equal 100</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 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 x</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

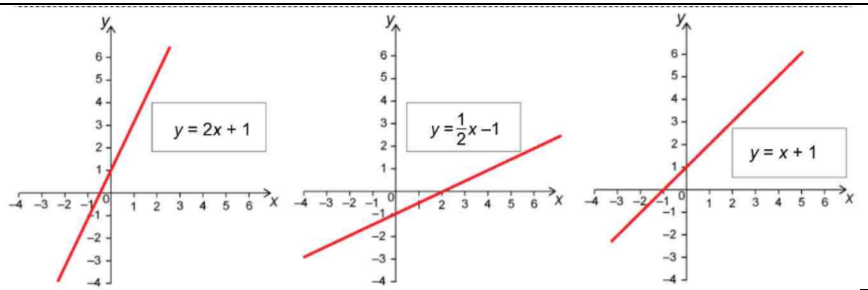
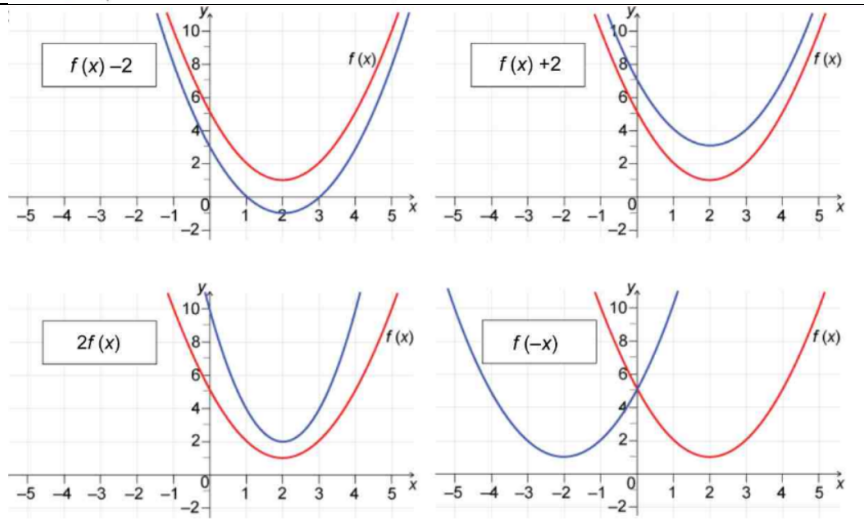
DO NOT ACCEPT cost or price

DO NOT ACCEPT the profit of a muffin is 1.5 times the profit of cookie OE</td><td>1</td></tr>
<tr><td></td><td>c</td><td>•[1] correct values substituted, seeing 450 and 50 substituted correctly

•[2] their correct answer after adding their multiplied numbers</td><td>•[1] (P =) (1x)450 + 1.50 x 50 or 450 + 75

•[2] 525 (CAD)

525 without working: award 2 marks</td><td>2</td></tr>
<tr><td></td><td>d</td><td>250 (cookies) and 250 (muffins)</td><td></td><td>1</td></tr>
</table>

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 award the mark if two functions are dragged on the same graph	4

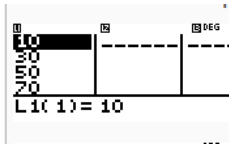
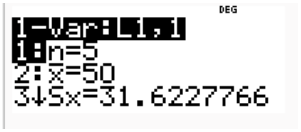
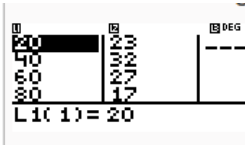
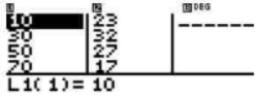
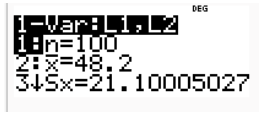
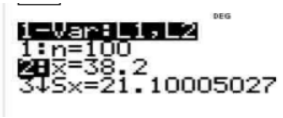
Question		Answers	Notes	Total
5	a	•1 recognizing that FCD = ECB (vertically opposite) can be seen on the diagram •2 mentioning reason for congruency	•1 ACCEPT FCD and ECB are equivalent **OR** FCD = number and ECB = same number **OR** angles FCD and ECB are congruent •1 ACCEPT BEC=DFC=140 provided the 140 is mentioned •2 ASA or Angle Side Angle or Two angles and one side in-between OE •2 ACCEPT , if ASA not mentioned, recognizing that (angle) EBC=FDC **and** BCE=DCF **and** ONLY BC=DC. Do not award •2 for AAS or AAA or SAS OE	**2**
	b	•1 identifying values of side and angle of right angled triangle •2 substituting correctly into appropriate sin or cos ratio •3 their answer correct after rearranging correctly their trig ratio **Alternative method** •1 substituting correctly into sine rule for triangle ABD with one unknown •2 rearranging their sine rule correctly •3 their answer correct after rearranging their sine rule ***Another alternative method below***	•1 30(°) **and** 480 (cm) **OR** 60(°) **and** 480 (cm) seen •2 sin(their60) = their480/AB **OR** cos(their30) = their480/AB •3 their 554(.256… cm) Seeing only sin(30 or 60) x 480(=…) OE with other trig ratios: award 1 mark Seeing only sin(30 o r60) x not480=... or sin(not 30 or 60)x480=…OE with other trig ratios: award 0 marks **Alternative method** •1 $\frac{960}{\sin 120}=\frac{AB}{\sin 30}$ or $\frac{192.(489...)}{\sin 20}=\frac{AB}{\sin 100}$ •2 $(AB=)960\times\frac{\sin 30}{\sin 120}$ or $(AB=)\,192.(489...)\times\frac{\sin 100}{\sin 20}$ •3 their 554(.256… cm) ***Another alternative method below***	**3**

5	**b**	**Alternative method** •1 identifying values of side **and** angle of right angled triangle •2 substituting correctly into tan ratio then calculate their h correctly •3 their answer correct after using Pythagoras correctly	**Alternative method** •1 30(°) **and** 480 (cm) **OR** 60(°) **and** 480 (cm) seen •2 (tan(their30) = h/their480) then (h=)their 277.13… •3 (480^2+(their277.13)^2 =) their 554(.256… cm) •3 ACCEPT 554 or (480/0.87) = 551.72 or 552 •3 DO NOT ACCEPT (480/0.86) = 558 554(.256..) or 551.72 or 552 without working: award 2 marks 554(.256..) or 551.72 or 552 with one working step: award 3 marks **SC for 1 mark** Using the area as 92395 and reach AB=517	
	c	(scale factor=) 8	ACCEPT 1/8 **or** 1:8 OE	**1**
	d	•1 squaring their scale factor •2 their area correct **Alternative method** •1 using their ratio correctly to find length AC of kite •2 their area of kite calculated correctly	•1 $(1/8)^2$ or 8^2 •2 92395 ÷ their 8² or 92395 x (their 1/8)^2 or 92395 x (120/960)^2 or1443.67… or 1444 (cm²) Dividing by 8 or multiplying by 1/8 : award 0 marks **Alternative method** •1 $(\frac{92395\times 2}{960\times 8}=)24.061...$ •2 1/2 x their 24.061…x120 or 1443.67… or 1444 (cm²) 1443.67… or 1444 (cm²) without working: award 2 marks	**2**

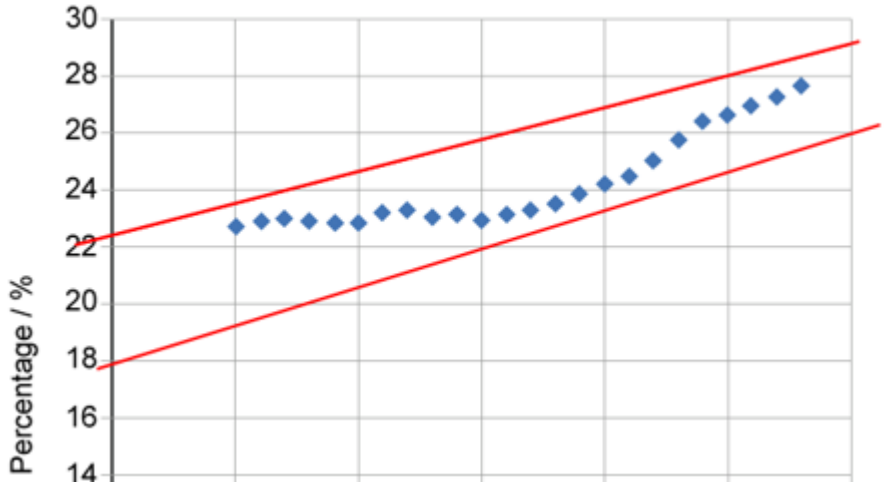
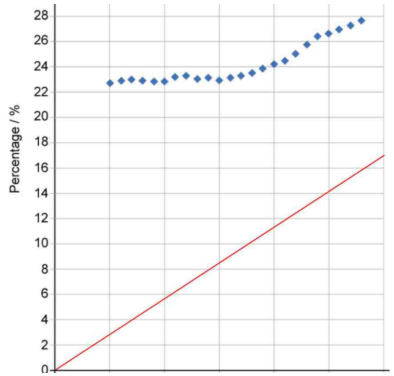
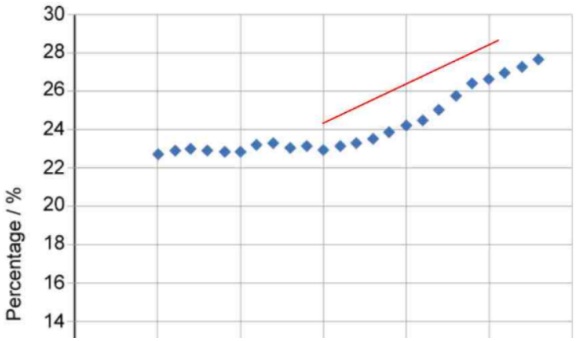
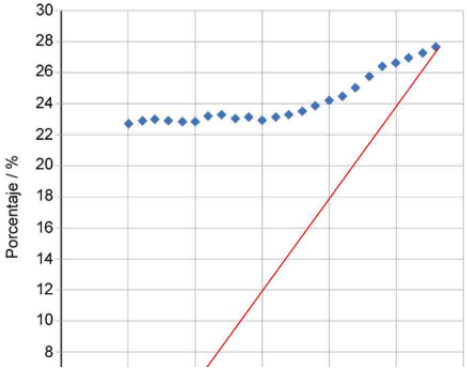
Question		Answers	Notes	Total
6	a	•1 (Min) 1 **and** (Max) 17 seen •2 correct subtraction to get their 16	•1 1 **and** 17 •2 16 •2 DO NOT ACCEPT a negative number 16 without working: award 2 marks **SC for 1 mark** Seeing only (6,16) or -16	**2**
	b	•1 identifying any two times 12 hours apart •2 12 (hours)	•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 8 (am) **or** 10 (am) seen •2 Both and only 8 (am) **and** 10 (am) seen	•1 ACCEPT [7:50, 8:10] or [9:50, 10:10] •2 ACCEPT poor notation Ex: (8,10) or 8-10 OE	**2**

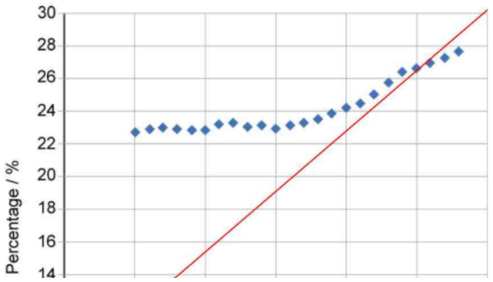
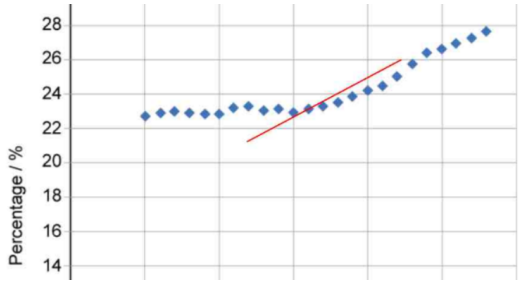
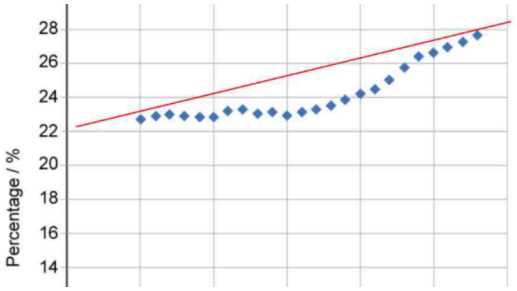
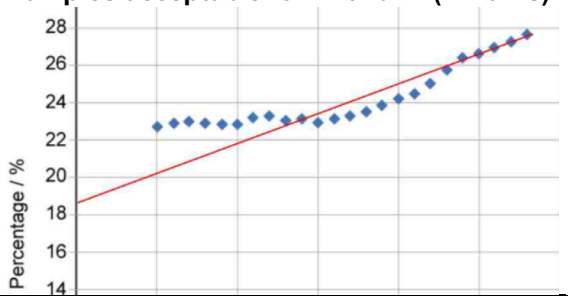
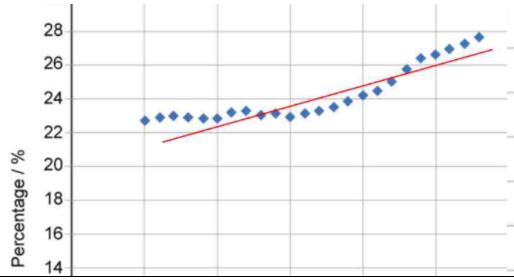
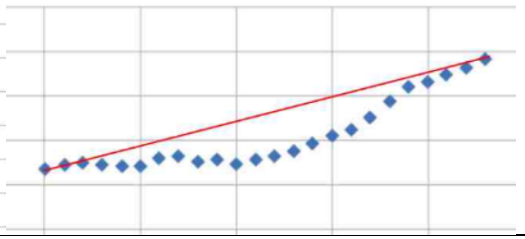
6	**d**	•[1] correct justification for *a* •[2] correct justification for *c*	•[1] vertical stretch, amplitude •[1] ACCEPT difference between middle and maximum or (max-min)/2 or half of the range •[1] ACCEPT *a* is half of 16 or 16/2 or 17-9 •[1] DO NOT ACCEPT *a* is difference between high and low tide •[2] vertical translation or shift up •[2]ACCEPT average of min and max or the principal axis or (max+min)/2 or mean of max and min or min+amplitude •[2]ACCEPT (17+1)/2 or 1+8 •[2] DO NOT ACCEPT *c* is the mean or median or midpoint of the graph •[2] DO NOT ACCEPT *c* is the y-intercept or first point OE •[2] DO NOT ACCEPT substituting with a point **SC for 1 mark** The sum of a and c is 17 (high tide) **OR** Substituting correctly with two points and solving correctly to get a = 8 and c = 9	**2**
	e	•[1] correct substitution of 17 •[2] their height correct after their calculation	•[1] 8sin (30 x 17) + 9 •[1] ACCEPT substituting with t=1 or 5 or 13 or 25. e.g.: 8sin(30)+9 •[2] 13(m) 13 without working: award 1 mark	**2**

Question		Answers	Notes	Total
7	a	$20 < A \leq 40$	ACCEPT 20 to 40 or 20-40 or [20,40] or $20 < A < 40$ ACCEPT 21 to 40 DO NOT ACCEPT 20 to 39 OE	1
	b	$\frac{10\times23+30\times32+50\times27+70\times17+90\times1}{100}$ *OR* $\frac{23}{100}\times10+\frac{32}{100}\times30+\frac{27}{100}\times50+\frac{17}{100}\times70+\frac{1}{100}\times90$ •[1] evidence of using the middle age values •[2] multiplying at least two of their middle ages by the percentage •[3] dividing by 100 •[4] adding correctly their values of middle ages multiplied by the percentage 38.2 AG ***Alternative method below***	Footnote: When a calculator screenshot is taken, ACCEPT not seeing the whole calculation. Example: award 4 marks 90+1190+1350+96 / 3820 / ans÷100 / 38.2 or (10*.23)+(30*.3 / 38.2 •[1] 10,30,50 seen •[2] any two of their10 x 23 or 230 , their30 x 32 or 960 •[3] any dividing by 100 seen •[4] evidence of adding all correctly •[4] DO NOT ACCEPT if total is not 38.2 191/5=38.2: award 0 marks $\frac{3820}{100}$ without working: award 1 mark It is the sum divided by 100: award 1 mark ***Alternative method below***	4

7	b	**Alternative method using calculator STAT input** •[1] evidence of using the middle age values •[2] data entered correctly in to columns or n =100 •[3] evidence of selecting L_1 and L_2 •[4] seeing 38.2 on the screen	**Alternative method using calculator STAT input** •[1]  or  •[2]  ACCEPT for •[1] and •[2] seeing  ACCEPT for •[2] and •[3] seeing  Seeing only  award 4 marks	
	c	$\frac{1+17}{100}=\frac{18}{100}$ •[1] seeing 1 + 17 OR 18 •[2] dividing their sum by 100	•[1] ACCEPT 0.01 + 0.17 •[2] 0.18 OE 0.18 OE without working: award 2 marks	**2**

7	**d**	•[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 e.g. 23858 – 100% 1207 – 5.059% 0.005059 or 5.059 (%) or 5.06 without working: award 1 mark **SC for 1 mark** 0.05x23,858,000=1,192,900 or $\cong 1207000$ **OR** 1,207,000/0.05=24,140,000 or $\cong 23858000$	**2**
	e	•[1] multiplying their result in (c) by 0.05 •[2] their correct result after multiplication	•[1] 0.18 x 0.05 •[1] ACCEPT their result in (c) x their result in (d) provided they are both less than 1 •[2] 0.009 OE 0.009 OE without working: award 2 marks	**2**

7	**f**	•[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**
		Examples not acceptable (0 marks): Not crossing twice, Not touching two points and not in range (0 marks)   		

7	f	**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	g	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	g	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	g	

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

Question		Answers	Notes	Total
8	a	•1 attempt to add at least 3 values of sides •2 all correct values added 70 AG	Values 20, 5, 15, 10, 5, 15 or 20, 20, 5, 10, 15 in any order •1 e.g.: 20+5+10+30 or 20+2x5 •2 20+5+15+10+5+15 OR 20+2x5+2x15+10 OR 2+10+30+10 ACCEPT 15+15+20+20 OR 2x15+2x20 20+20+20+10 OE: award 1 mark •2 DO NOT ACCEPT if sum is not 70 Calculating area: award 0 marks	**2**
	b	6 **and** 68 correctly placed		**1**
	c	a suitable pattern described for the perimeter P in acceptable terminology	ACCEPT perimeter goes up by 2 they get 2 cm more OE They are even numbers As the value of AB increases by x the perimeter increases by 2x the perimeter difference is 2 add 40 to double L sum of double L and 40 DO NOT ACCEPT 2L+40 Two L plus forty they are increasing linear relation they are increasing or decreasing by 2	**1**
	d	•1 attempt to express the general rule in terms of their L •2 correct general rule for P in terms of L	•1 Examples: 40 + 2L or P=2AB+40 or (10*6)+2*(L-10) or P=2x+40 •1 ACCEPT 2*L+any number or 40+any number*L •1 ACCEPT add 40 to double L WTTE •2 P = 40 + 2L or P=2(20 + L) •2 ACCEPT P = 40 + 2xL or P=2*(20 + L) or P=2l+40 •2 ACCEPT non-simplified answers like: P=(10x6)+2*(L-10) or P=3L+30-(L-10) or P=L+L+40 OE	**2**

8	**e**	•[1] substitute L ≥ 16 into their rule •[2] correctly calculate their value of P after substitution L ≥ 16 •[3] recognizing that their result is the same as their predicted value	•[1] Ex: 2 x 16 + 40 •[2] Ex: 72 (for the L= 16) •[3] Same as value I predicted in table (and we find the candidate has 72 in the table for L = 16) or same as when we continue the pattern and explains how 72 is obtained from pattern of adding 2 to 70 •[3] ACCEPT seeing the 72 in the table and seeing their calculated P=72 when L=16 **SC for 1 mark** If "tested" correctly with a value from the table. For example: testing with L = 10 to get P = 60	**3**
	f	•[1] correctly substituting in a perimeter formula •[2] dividing by 2 •[3] adding the three perimeters 100 π AG	•[1] 60π or 40π or 100 π or 2π30 or 2π20 or 2π50 •[2] 30π and 20π and 50 π •[3] (P =) 50π + 30π + 20π •[3] DO NOT ACCEPT if sum is not 100 π ACCEPT 157.079..+94.247..+ 62.831.. provided they compare the sum with 314.159…. ACCEPT •[1] , •[2] and •[3] in any order Seeing only 50π + 30π + 20π : award 3 marks	**3**

8 **g**

Mark	1	2	3	4
Predictions (P)	Predict correctly one value for P, either in the response box or in the table Example: r = 25, P = 110π **OR** Predict correctly three values of P without corresponding r	Predict correctly three values of P; either in the response box or in the table Example: r = 25, P = 110π r = 30, P = 120π r = 35, P = 130π DO NOT ACCEPT if corresponding r not mentioned		
Description (D)	Attempt to describe a pattern in words Examples: 1. As the r increases by 5 the P increases by 10 2. Multiples of 10 3. Adding 10 4. Divisible by 10 5. Double r and add 6. It is a line equation	Describe correctly a pattern in words Examples: 1. The number multiplied by π is add 60 to the double of r 2. As the r increases by 5 the P increases by 10pi 3. 2r+40 or 3r+60 or 60+2n where n is the row number 4. (AB=)2R+2r on the diagram	Attempt to describe P as a general rule. Examples: 1. (P =) 2r + 60 2. πD/2 + 30π + πr 3. (P=)2 π (R+r) 4. (P=) 2r + 60 x π 5. (P=) AC x π + BC x π	Correctly describe pattern as general rule Examples: 1. P = π(2r + 60) 2. P = 2π(r + 30) OE **SC** ACCEPT (P=) 2π (x + 30) or the rule is π (2r + 60) for D4 but award N1
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 P value from their general rule and the value in the table being equal even without π		

8 **g**

Mark	1	2	3	4
Verifying (V)	attempt to use $r > 20$ in their described pattern or general rule	Calculate correctly their value of P using their $r > 20$ in their general rule	Recognizing that their result is the same as their predicted value ACCEPT seeing their calculated P value from their general rule and their predicted value in the table being equal provided their calculated value includes π	
Justify/proof (J)	Weak attempt to justify their described pattern or their general rule Examples: 1. trying at least two values and arguing as justification that they are the same or rule works 2. We always add 60 to the double of *r* (even if seen before their rule) 3. As r increases by 1 the P increases by 2 4. When r=0 P is 60	Good attempt to Justify their general rule Examples: 1, As r increases by 1 the P increases by 2 **AND** when r=0 P=60 2. As r increases by 1 the P increases by 2 AND perimeter of AC is 60 3. The equation is a line with gradient 2 and *y*-intercept 60	Correctly justify the general rule Examples: 1. As r increases by 1 the P increases by 2 π AND when r=0 P=60 π 2. As r increases by 1 the P increases by 2 π AND AC(diameter)=60 3. The equation is a line with gradient 2 π and *y*-intercept 60 π **OR** Attempt to prove the general rule for the perimeter P Attempt to add perimeters in terms of *r* Examples: 1. π 30+r+30 π+ πr 2. πR+πr+ πr	Correctly prove the general rule for the perimeter P by adding the perimeters in terms of r correctly π (30+r)+30 π+ πr ACCEPT 2π(R+r) OE J4 automatically gains T2 and V3

8	g					

Mark	1	2	3	4
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 Examples: 1. P=pi (2r+60) 2.The rule is π(2*r* + 60)	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

Predictions

R	r	P
30	5	70 π
30	10	80 π
30	15	90 π
30	20	100 π
30	25	110 π
30	30	120 π
30	35	130 π
30	40	140 π
30	45	150 π
30	50	160 π