MARK SCHEME

Question			Answer	Marks	Part marks and guidance	
1	a		53 500 000	**1** **1 AO1.2**		
	b		1.02×10^7	**2** **2 AO1.3b**	**B1** for answer figs102	
	c		15 nfww	**4** **3 AO1.3b** **1 AO3.1d**	**B3** for 15.07 to 15.1 nfww OR **B1** for figs 637 and **M1** for $\frac{73.3\times10^6 - \textit{their}63.7\times10^6}{\textit{their}63.7\times10^6}$ oe or $\frac{73.3\times10^6}{\textit{their}63.7\times10^6}$ oe and **M1dep** interpretation of answer to division as a percentage increase soi by answer	*their* 63.7×10^6 can be an error from their sum, *their* (b) or one of the country populations Allow **M1M1** for (England answer) 37 (Wales answer) 2300 (Scotland answer) 1300 (NI answer) 3900 ((b) answer) 620
2	a	i	9.6	**1** **1 AO1.3a**		
		ii	2500	**1** **1 AO1.2**		Condone 1 : 2500

Question			Answer	Marks	Part marks and guidance	
	b		Arc centre B radius 6 cm meeting AB and CB or AB and bisector of ADC	**2**	**B1** for any arc centre B meeting AB and BC or short arc (at least 1cm) radius 6 cm centre B	Accept dashed or dotted for all marks Freehand, all within template, max **B1** Allow beyond AB and BC for 1 or 2 marks Tolerance 5.8 to 6.2 cm
			Ruled bisector of angle ADC to reach BC with construction arcs or Bisector with construction arcs from BC to *their* arc centre B	**2**	**B1** for correct ruled bisector at least 2cm long by eye with no construction arcs or correct construction arcs with no bisector drawn	Tolerance $\pm$ 2° Construction arcs on AD and on DC and two intersecting arcs from these
			Correct region shaded	**1** **1 AO2.3a** **2 AO2.3b** **1 AO3.1d** **1 AO3.3**	**Dep** on **B1** and **B1** If 0 scored **SC1** for 6 [cm] [= 150] [m] seen	
3	**a**	**i**	Point (0.8, 120) indicated	**1** **1 AO2.1b**		
		ii	No oe **and** Correct supporting value(s) and justification	**2** **1 AO2.1b** **1 AO3.4b**	**B1** for 200 to 260 visitors expected or about 0 to 1mm and 320 or line of best fit within overlay or negative trend/correlation or marking(s) in relevant region above 2mm or 2 or more values within overlay and surrounding 2mm	Justification includes Reference to line of best fit (drawn or not) or trend or negative correlation or marking(s) in relevant region above 2mm or surrounding value**s** **See Appendix**

Question			Answer	Marks	Part marks and guidance	
		iii	Outside range of data [collected]	**1** **1 AO3.4a**		**Accept** "The data (or diagram) only goes to 5.5 (or 6)" oe **Do not accept** "by 6 to 7 it would give no visitors" oe or There is no data around 9 mm oe The line of best fit does not reach 9 mm oe **Condone** "[Because] there would be a negative number of people" **See Appendix**
	b		Total number or number of children is not known oe or The chart only shows proportions/percentages oe	**1** **1 AO2.5b**	Mark the best bit so long as no contradiction	**See Appendix**

Question			Answer	Marks	Part marks and guidance	
4			4 : 11 or exact equivalent	**3** **2 AO1.3b** **1 AO3.1d**	**B2** for $\frac{4}{15}$ nfww oe soi by 0.26[6…] to 0.27 or answer 11 : 4 or answer 4 : 15 OR **M1** for $\frac{2}{3}\times\frac{2}{5}$ OR **B1** for $\frac{2n}{3}$ evaluated where *n* is their total number of students **Alternative method:** [Spanish : Other : None] **B2** 4 : 6 : 5 soi OR Spanish : Other [: None] **M1** 2 : 3 [: 2.5]	Implied by eg $\frac{4n}{15}$ evaluated where *n* is their total number of students NB $0.2\dot{6} : 0.7\dot{3}$ scores **3** marks but $0.2\dot{6} : 0.7\dot{4}$ only scores **B2** NB $\frac{4}{15}$ from $\frac{2}{3}-\frac{2}{5}$ scores **0** **0** for just 2 : 3 without labelling
5	a	i	$-\frac{1}{4}$ oe	**2** **2 AO1.3a**	**M1** for $\frac{\pm(3-6)}{\pm(8-^{-}4)}$ or answer $\frac{1}{4}$ oe or answer $-\frac{1}{4}x$	
		ii	$y=-\frac{1}{4}x+5$ oe	**2** **2 AO1.3b**	**M1** for substitution of (-4, 6) or (8, 3) into $y = mx + c$ or into $y - y_1 = m(x - x_1)$ or intercept clearly identified as 5 (may be on diagram or in equation)	eg final answer for 2 marks $y - 3 = -\frac{1}{4}(x - 8)$ oe or $y - 6 = -\frac{1}{4}(x - {}^{-}4)$ oe Missing "*y* =" scores **M1** max.

Question			Answer	Marks	Part marks and guidance	
	b		$y = -\frac{1}{4}x - 2$ oe or FT	**2FT** **2 AO2.1a**	**B1FT** for y = *their* mx [+ a] where m is FT **B1** for $y = bx - 2$, $b \neq 0$	FT is for *their* gradient in (a)(ii) (if no answer in (a)(ii) then use (a)(i)) Condone missing "y =" if already penalised in (a)(ii), otherwise missing "y =" is **B1** max
6	**a**	**i**	<table><tr><th>×</th><th>1</th><th>2</th><th>2</th><th>3</th><th>4</th></tr><tr><td>1</td><td>1</td><td>2</td><td>2</td><td>3</td><td>4</td></tr><tr><td>2</td><td>2</td><td>4</td><td>4</td><td>6</td><td>8</td></tr><tr><td>2</td><td>2</td><td>4</td><td>4</td><td>6</td><td>8</td></tr><tr><td>3</td><td>3</td><td>6</td><td>6</td><td>9</td><td>12</td></tr><tr><td>4</td><td>4</td><td>8</td><td>8</td><td>12</td><td>16</td></tr></table>	**2** **2 AO1.3a**	**B1** for table completed with no more than 5 errors or omissions	Ignore negative signs
		ii	$\frac{9}{25}$ oe	**2** **1 AO2.1a** **1 AO2.3a**	**B1FT** for *their* correct numerator **B1** for fraction with denominator 25	Ignore attempts to convert form or simplify Accept [0].36 or 36% but not ratio or in words
	b		Spinner completed with 3 negative numbers and 2 positives or 2 negatives and 3 positives	**3** **2 AO3.1a** **1 AO3.2**	**M1** for $\frac{12}{25}$ soi eg by 12 [out of 25] **M1** for spinner with 5 numbers inserted, at least one negative	Do not accept 0 for **3** marks Not just 12 as a number on the spinner Condone 0 (as positive) for **M1**
7	**a**		8	**1** **1 AO1.3a**		

Question			Answer	Marks	Part marks and guidance	
	b		Correct curve	**2** **2 AO2.3b**	**B1FT** for 4, 5 or 6 points plotted correctly	½ square tolerance **B1** max if line ruled (between any points)
	c		$^{-}0.9$ to $^{-}0.6$ 2.6 to 2.9	**2** **2 AO2.1a**	**B1** for each If 0 scored **SC1** for ($^{-}0.9$ to $^{-}0.6$, 2) and (2.6 to 2.9, 2)	If more than two answers mark the worst two Condone for **2** marks when both answers in body but only one given on answer line
8			2.7 nfww	**5** **2 AO1.3b** **1 AO3.1d** **1AO3.2** **1 AO3.3**	Allow 2.70 to 2.71 **M2** for $4 \times 4 \times 8 \times 0.67$ or **M1** for $4 \times 4 \times 8$ AND **M1** for $\frac{1}{3} \times 4 \times 4 \times (13 - 8)$ AND **M1** for *their* 85.76 + *their* 26.7x = 158 oe	Condone for full marks minor inaccuracies from rounding if final answer given as 2.7 = 85.76 (mass of cuboid) = 128 (vol of cuboid) = 26.6 to 26.7 (vol of pyramid) eg (x =) $\frac{158 - \textit{their}85.76}{\textit{their}26.7}$

Question			Answer	Marks	Part marks and guidance	
9	a		Triangle with vertices at (1, 6), (2, 6), (2, 4)	**3** 3 AO2.3b	**B2** for triangle correct size and orientation in wrong position OR **B1** for enlargement centre (-1, 5) incorrect scale factor < 1 or for triangle with two vertices correct or for three rays from (-1, 5) to vertices of triangle A or for triangle correct size but wrong orientation	
	b	i	Height factor is square root of area factor oe in words or figures	**1** 1 AO2.5a	Mark the best bit so long as no contradiction	Must include correct reference to square or square root
		ii	16.5 to 16.6	**3** 2 AO1.3b 1 AO3.1b	**B2** for $\left(\sqrt{3}\right)^3$ oe or $\frac{1}{\left(\sqrt{3}\right)^3}$ oe soi by 5.19 to 5.20 or 0.192 to 0.193 OR **B1** for $\sqrt{3}$ or $\frac{1}{\sqrt{3}}$ oe soi by 1.73[…] or 0.577[…]	Accept $\frac{86\sqrt{3}}{9}$ oe Note that $\left(\sqrt{3}\right)^3 = 3\sqrt{3}$ and $\frac{1}{\left(\sqrt{3}\right)^3} = \frac{\sqrt{3}}{9}$

Question			Answer	Marks	Part marks and guidance	
10	a		Fds 7, 8.4, 4, 3.6, 1.4, 0.55	1	At least 3 correct; may be implied by height of 3 bars including one of the last two	
			Bars all of correct height	1	Tolerance 1 mm unless on gridlines	FT *their* scale. Heights may be indicated by a plotted point, stick etc Ignore polygon lines
			Bars all of correct width	1		Condone missing vertical lines if tops correct width
			Vertical axis with consistent linear scale starting from 0 soi and labelled 'Frequency denisity' oe	1 1 AO1.3a 3 AO2.3b	**B0** for scale 0 to 42 etc for frequency graph even if labelled frequency density	Accept abbreviations or an area key eg 1 cm^2 = 5
	b		Answer £17 to £18 inclusive with valid working and justification	4 1 AO1.3b 1 AO3.1d 1 AO3.2 1 AO3.3	**M1** for 25% of 140 = 35 or 75% of 140 = 105 **M1dep** for identification of 15 to 20 soi **A1** for answer £17 to £18 inclusive **B1dep on M1M1A1** for justification If **0** scored, then **SC1** for an answer £15 to £20	 eg implied by frequencies 25 and 43 or 97 and 115 or by answer in range 15 to 20 Justification can be based on a calculation eg $\frac{10}{18}$ of 15 to 20 bar or reasoning eg 18% spent £20 and 30/31% spent £15, so 25% is just over/about halfway.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Part marks and guidance</th><th></th></tr>
<tr><td>11</td><td></td><td></td><td>No,
with correct calculation leading to 23.77 to 23.8 identified
or with 7.32 compared with 7.25 oe
or 302 compared with 305 oe</td><td>4
1 AO1.3b
2 AO3.1d
1 AO3.3</td><td>B1 for 7250 or 7.25 seen
B1 for 305 or 0.305 seen

M1 for their 7.25 ÷ their 0.305 with consistent units and at least one attempted bound
or for their 0.305 × 24 oe
or their 7250 ÷ 24 oe</td><td>Ignore upper bound
Ignore lower bound

Their 7.25 in range 7 to 8, their 0.305 in range 0.29 to 0.31 or equivs.
Ignore other divisions or products
M0 for 7500 ÷ 300 or 7.5 ÷ 0.3</td></tr>
<tr><td>12</td><td></td><td></td><td><table><tr><td>x</td><td>10</td><td>6</td><td>[±] 15</td></tr><tr><td>y</td><td>9</td><td>25</td><td>4</td></tr></table></td><td>4
1 AO1.1
3 AO1.3a</td><td>B3 for one value correct

OR

M2 for $9 \times 10^2 = y \times 6^2$ oe
or $9 \times 10^2 = 4 \times x^2$ oe

OR

M1 for 9×10^2 or $y = \frac{k}{x^2}$ soi</td><td>Do not follow through mis-reads.</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Part marks and guidance</th><th></th></tr>
<tr><td>13</td><td></td><td></td><td>Three of these

• OC is common or shared
• OA = OB (equal) radii
• ∠OAC = ∠OBC tangent perpendicular to radius
• CA = CB tangents from a point [to a circle]

RHS, SSS or SAS as appropriate</td><td>M3

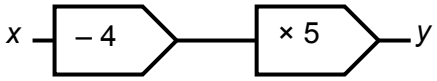
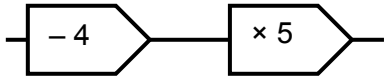
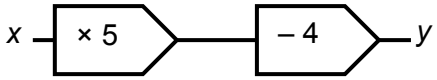
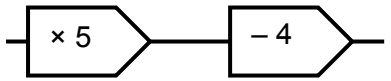
A1
4 AO2.4b</td><td>M1 for each

After M0,
B2 three pairs of these equal sides/angles with insufficient or no reasons
or
B1 for two pairs of these equal sides/angles identified with insufficient or no reasons

OR

After M1,
B1 for two further pairs of these equal sides/angles identified with insufficient or no reasons</td><td>Ignore extra facts and reasons

For B marks accept if indicated on diagram</td></tr>
<tr><td>14</td><td>a</td><td></td><td><table><tr><th>x</th><th>y</th></tr><tr><td>-5</td><td>-4</td></tr><tr><td>2.5</td><td>11</td></tr></table></td><td>2
2 AO1.3a</td><td>B1 for one correct</td><td></td></tr>
</table>

Question			Answer	Marks	Part marks and guidance	
	b		$y = 5(x-4)$ oe or  	**2** **1 AO1.1** **1 AO1.3a**	**M1** for correct operations in correct order but poor notation eg $y = x - 4 \times 5$ or $5(x-4)$ oe  (as minimum allow – 4 , × 5 if intent clear) or for correct operations in reverse order eg implied by $y = 5x - 4$  	For **2** marks and **M1** condone x and y transposed in algebraic expression or transposed in flow diagram. **M0** for wrong order and poor notation  Mark right-to-left flow diagrams in a similar way Condone correct flow diagram followed by incorrect algebra or vice-versa

Question			Answer	Marks	Part marks and guidance	
	c		$5p - 3$ as final answer	**4** **1 AO1.3b** **3 AO3.1b**	**M1** for $2p + 4 - 4$ soi **M1** for *their* $2p \times 5$ soi **M1** for *their* $10p \div 2$ **M1** for *their* $5p - 3$ **Maximum 3 marks if answer incorrect** **Alternative method:** **M1** for $2(m + 3)$ soi **M1** for $\frac{their\ 2(m+3)}{5} + 4$ soi **M1** for *their* $\frac{2(m+3)}{5} + 4 = 2p + 4$ or better **M1FT** for rearranging *their* equation to isolate m **Maximum 3 marks if answer incorrect**	Output of function A is $10p$ implies first **M1M1** Use of function A Use of function B with output of A Equating their output of B with $2p + 4$ *Their* equation must be of form $\frac{am+b}{5} + 4 = 2p + 4$ oe where $a \neq 0$ and $b \neq 0$, leading to $(m =)\frac{10p-b}{a}$ and then simplified if possible Accept another letter used consistently for m or p but not m and p interchanged
15	**a**		Correct sketch with max at (90, 1) and min at (270, -1) and crossing x-axis at 0, 180 and 360	**2** **2 AO2.3b**	**M1** for correct shape starting at (0, 0) but inaccurate at roots and max/min. Needs at least one cycle, but may have more than one.	

Question			Answer	Marks	Part marks and guidance	
	b		217° and 323°	**4** **1 AO1.3b** **1 AO3.1b** **1 AO3.2** **1 AO3.3**	**B3** for one correct even if from trials OR **M2** for [x =] ⁻37 to ⁻36.86 OR **M1** for sin x = ⁻0.6 oe If **0** scored **SC1** answers summing to 540 to 3sf	Accept answers to greater accuracy 216.8[6…] and 323.1[3…] **B3** for grads: [x =] (⁻41), 221, 319 OR **B2** for grads: [x =] one of 221, 319 OR **M1** implied for grads [x =] ⁻41 or rads: [x =] ⁻0.64[…]
16	**a**		$3y^7$	**1** **1 AO1.3a**		
	b		$\frac{7x+2}{(x-1)(x+2)}$ or $\frac{7x+2}{x^2+x-2}$ as final answer	**3** **3 AO1.3b**	**B1** for $(x-1)(x+2)$ or x^2+x-2 seen as a denominator **M1** for $3(x+2)+4(x-1)$ or $3x+6+4x-4$ soi	Condone missing final bracket. Accept not in fraction or seen in separate fractions
17			$\frac{\sqrt[3]{81}}{3}=\frac{\sqrt[3]{3^4}}{3}$ or $\frac{\sqrt[3]{81}}{3}=\frac{\sqrt[3]{3^4}}{3}$ $=\frac{3^{\frac{4}{3}}}{3}$ or $\frac{\sqrt[3]{3^3\times 3}}{3}=\frac{3\sqrt[3]{3}}{3}$ $\left[=3^{\frac{4}{3}-1}\right]=3^{\frac{1}{3}}$ or $\sqrt[3]{3}=3^{\frac{1}{3}}$	**M1** **M1dep** **A1** **3 AO2.2**	$\frac{\sqrt[3]{81}}{3}=\frac{\sqrt[3]{81}}{\sqrt[3]{3^3}}$ $=\sqrt[3]{\frac{81}{27}}$ $=\sqrt[3]{3}=3^{\frac{1}{3}}$	In left-hand methods, **M1M1** can be awarded if the denominator 3 is consistently omitted There may be other surd methods. **M1** first productive step $\sqrt[3]{81}=81^{\frac{1}{3}}$ is not sufficiently productive as a first step **M1dep** second productive step from a correct first step Conversion to decimals scores **0**

Question			Answer	Marks	Part marks and guidance	
18	a		9.8[1…] nfww	**4** **1 AO1.3b** **2 AO3.1d** **1 AO3.3**	**M3** for $\sqrt{46^2+46^2+55^2}$ or 85.18 to 85.2 or $\sqrt{7257}$ OR **M2** for $46^2+46^2+55^2$ or 7257 or $\sqrt{46^2+46^2}$ or $\sqrt{4232}$ or 65.05 to 65.1 or $\sqrt{46^2+55^2}$ or $\sqrt{5141}$ or 71.7[…] OR **M1** for $46^2 + 46^2$ or 4232 or $46^2 + 55^2$ or 5141	Accept answers rounding to 9.8 if correct working seen Condone for full marks minor inaccuracies from rounding, such as $\sqrt{7256}$ seen May be done in steps
	b		40.2 nfww	**3** **1 AO1.3a** **2 AO3.1c**	**M2** for sin […] = $\frac{55}{their\ 85.18\ to\ 85.2}$ or tan […] = $\frac{55}{their\ \sqrt{46^2+46^2}}$ or cos […] = $\frac{their\sqrt{46^2+46^2}}{their\ 85.18\ to\ 85.2}$ OR **M1** for indication of required angle	Accept 40° and answers rounding to 40.2 if correct working seen **0** for tan […] = $\frac{55}{46}$ **M2** for cosine rule with cos as subject eg diagram showing angle