MARK SCHEME

Question			Answer	Marks	Part marks and guidance	
*1			$\frac{1}{11}$ final answer	2	**M1** for $\frac{30}{330}$ oe or correct cancelling shown After 0 scored, **SC1** for *their* fraction written in simplest form	For M1, condone 1 correct stage of cancelling common factors in numerators and denominators SC1 dep on a fraction that reduces
*2			64	3	**M2** for 160 ÷ 2.5 oe isw Or **M1** for 160 and 2.5 oe seen or for attempt at 160 divided by *their* time interval isw or for clear attempt to find gradient of line joining (0900, 0) to (1130, 160) or *their* dist divided by 2.5 oe isw	For M1, *their* time interval is in range 2 to 3 or 2h 30m or 1.5 or 3.5 accept 150 mins used

Question			Answer	Marks	Part marks and guidance	
*3			A - Yes with appropriate reasoning involving rounding and correct simplification to 3 : 8 or 3 :11 or 8 : 11 or ratios reversed OR B - Yes it is approximately correct oe and simplification of 6400 : 16200 to 32 : 81 OR C - Yes with a correctly evaluated calculation using e.g. ratio 3 : 8 with a comparison comment OR D - Yes and e.g. 16200 ÷ 8 **and** 6400 ÷ 3 correctly evaluated	3	**M2** eg for showing 6000 : 16000 and reducing to 3 : 8 or for appropriate rounding at some stage in correctly simplifying ratio leading to 3 : 8 isw or reduces 6400 : 16200 to 32 : 81 isw or reduces 6400 : 22600 to 32 : 113 isw or for ratio calculation leading to one of the following values seen 6075, 6163 to 6165, 16436 to16440, 17066 to 17067 or 22 275 or 23 463 to 23 467 seen isw or for 2025 **and** 2133 to 2134 seen isw or 2025 **and** 2054 to 2055 seen isw or 2133 to 2134 **and** 2054 to 2055 seen isw Or **M1** for 6000 or 16 000 or 20 000 or 22 000 or 23 000 seen or for appropriate rounding of one number at some stage in simplifying ratio or for intention to find $\frac{3}{8}$ of 16 200 or for $\frac{8}{3}$ of 6400 or $\frac{3}{11}$ of (16 200 + 6400) or $\frac{8}{11}$ of (16 200 + 6400) isw or for 6400 ÷ 3 **and** one of 16 200 ÷ 8 or (6400 + 16 200) ÷ 11 seen isw or 16 200 ÷ 8 **and** (6400 + 16 200)÷ 11 seen isw	For all marks accept method with equivalent fractions or decimals [3sf or better] Allow equivalent methods working with the totals e.g. 3 : 11, condone 22600 rounded to 22000 For 3 or M2, allow clear 'reverse' methods working from e.g. 3 : 8 to 6000 and 16000 Accept clear working if not in ratio form e.g. 3.2 and 8.1 shown not in ratio The figures in the part marks column are guidance on accuracy required for 3 marks or M2 SEE APPENDIX

Question			Answer	Marks	Part marks and guidance	
4	(a)		1250	1		
	(b)		3	1		
	(c)		3rd graph indicated only	1		Accept any clear indication of correct graph
*5	(a)		$\frac{y+3}{7}$ or $\frac{-y-3}{-7}$ final answer	2	**M1** for $y + 3 = 7x$ or $\frac{y}{7} = x - \frac{3}{7}$ or for correct FT completion to answer after incorrect first step has been shown	For M1, accept the 'negative terms' versions
	(b)	(i)	$x(x – y)$ final answer	1		Condone omission of final bracket Condone [1]x([1]x – [1]y)
		(ii)	$(x + 6)(x + 2)$ final answer	2	**M1** for $(x + a)(x + b)$ where $ab = \pm 12$ or $a + b = \pm 8$ or for $x(x + 6) + 2(x + 6)$ seen or $x(x + 2) + 6(x + 2)$ seen	a, b integers For 2 marks, condone solutions after correct factors For 2 marks or M1, condone omission of final bracket
*6			69, 76, 76, 79	4	In any order **B3** for 4 values with a mode of 76 and a range of 10 OR **B1** for the sum of the 4 values is 300 soi **B1** for at least 2 values with a mode of 76 **B1** for a range of 10 for their given values	Mark final answer in working if answer line blank Integers only for all B marks Condone if 300 shown in working and then *their* final values do not sum to 300 May be from 2, 3 or 4 values on answer line May be from 2, 3 or 4 values on answer line

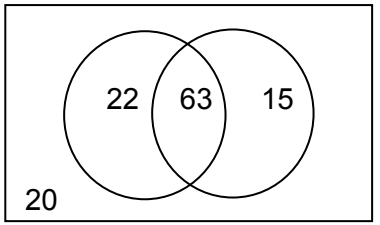
Question			Answer	Marks	Part marks and guidance	
*7	(a)		22 : 15	2	**M1** for any equivalent ratio or for two correct ratios with a common number of children seen implied by 22*k* and 15*k* seen (*k* > 1 and an integer) Or for $\frac{11}{3}:\frac{5}{2}$ or for 11 : 7.5	15*k* : 22*k* implies M1 Accept 3.66 to 3.67 : 2.5
	(b)		258	3	**M2** for $\frac{36}{2}$ × 5 + $\frac{36}{3}$ × 11 [+36] oe or ((2 × 11) + (3 × 5)) × 36 ÷ 6 [+36] oe or $\frac{6}{6+15+22}\times x = 36$ oe or **M1** for $\frac{36}{2}$ × 5 or $\frac{36}{2}$ × 7 soi or $\frac{36}{3}$ × 11 or $\frac{36}{3}$ × 14 soi oe	M2 implied by 222 [+36] not spoiled 90 + 132 [+ 36] Implied by 90 or 126 or 132 or 168 seen
8	(a)		360 ÷ 5 **and** 360 ÷ 6 [Ext angle =] 72 **or** 60 seen 60 + 72 [= 132] or 360 – (108 + 120) [=132]	M1 B1 A1	or for ((5 – 2) × 180) ÷ 5 oe **and** ((6 – 2) × 180) ÷ 6 oe or [Int angle =] 120 **or** 108 seen with no errors seen	M1 allow 540 ÷ 5 and 720 ÷ 6 but not for just 108 and 120 Allow recovery of missing brackets from answers nfww for B1 do not allow if e.g. 60 is shown as int angle of hexagon

Question			Answer	Marks	Part marks and guidance	
	(b)		[ext angle =] 180 – 132 oe or $\frac{180(n-2)}{n}$ = 132 oe	**M1**	Or [Int angle =] ((7 – 2) × 180) ÷ 7 oe	M1 implied by 48 or 128 to 129
			360 ÷ (180 – 132) oe soi Or for 360 ÷ 8 oe **and** 360 ÷ 7 oe Or for 48 × 7 **and** 48 × 8	**M1**	Or [Int angle =] ((8 – 2) × 180) ÷ 8 oe	M1 implied by 135 Division can be implied from a correct conclusion e.g. 360 is not a multiple of 48 gets M1A1 M1 Implied by 45 and 51 to 52
			No and correct conclusion	**A1**		e.g. explains that 360 ÷ 48 gives non - integer answer or 128 is 7 sided polygon and 135 is 8 sided polygon so No
***9**			160 and assumed that sample of 50 is representative oe	**3**	**B2** for 160 or **M1** for $\frac{8}{50} \times 1000$ oe **AND** **B1** for assumed that sample of 50 is representative oe	Accept: Representative, not biased, random Ignore extra comments after correct comment given SEE APPENDIX
10	**(a)**		$x > 4$	**2**	**M1** for a correct first step e.g. $3x > 10 + 2$, $3x - 12 > 0$	For M1, condone wrong inequality symbol or equals

Question			Answer	Marks	Part marks and guidance	
	(b)		$\frac{3}{10}$ oe isw	3	**M1** for correct first step e.g. $6x + 4x + 2 = 5$ **M1** for $6x + 4x = 5 - 2$ or FT their $ax = b$ to $x = \frac{b}{a}$	Embedded answer scores M2 max If not shown, M1 implied by $\pm 10x = b$ or $ax = \pm 3$ e.g. M1 for $2x = 7$ leading to $x = \frac{7}{2}$ oe
11	(a)	(i) (ii)	Draws vector $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$ and Draws vector $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$	2	**B1** for each	In (a), penalise first instance only where direction arrow is omitted Condone good freehand mark intention Could be part of correct vector triangle
	(b)		They are different in direction oe	1	Accept correct comments that mention the directions of the vectors	Accept any comment implying the directions of the 2 vectors are different e.g. 'They are not parallel' 'They are going in different directions' 'They are going in opposite *x*–directions' 'Vector A is a [vertical] reflection of vector B' 'One goes left, the other goes right' 'One goes in positive direction the other goes in negative direction' 'One has –2 and the other has 2' Condone 'They are going in opposite directions' Do not accept mention of just 1 vector only unless the reason clearly implies a comparison e.g. Do not accept 'Vector **a** goes right' 'One of them has a minus sign'

Question			Answer	Marks	Part marks and guidance	
	(c)		-3	2	**M1** for $k\left(\begin{pmatrix}2\\1\end{pmatrix}-\begin{pmatrix}-2\\1\end{pmatrix}\right)=\begin{pmatrix}-12\\0\end{pmatrix}$ oe	M1 implied by answer $\begin{pmatrix}-3\\0\end{pmatrix}$
12			120	5	**M4** for 72 ÷ (0.5 × 1.2) oe **Or** **M1** for 72 ÷ 0.5 **A1** for 144 **M1** for *their* 144 ÷ 1.2 **A1FT** for *their* 144 ÷ 1.2 correctly evaluated	A1 implies previous M1 FT rot to integer, implies previous M1
13	(a)		$0.\dot{7}$	1		Condone poor notation e.g. 0.777…, $0.\dot{7}\dot{7}$, 0.7^{r}
	(b)		35 [and] 11 or 70 [and] 22 final answer	3	**B2** for $\frac{315}{99}$ or $3\frac{18}{99}$ Or **B1** for $\frac{18}{99}$ Or **M1** for 318.18... or 18.18… seen	For 3 marks, accept in either order B2 implied by answer 315 and 99
14	(a)		8 × 6 × 4 [= 192]	1		Allow in stages
	(b)		No and shows 104	3	**M2** for (8 × 6) + (8 × 4) + (6 × 4) oe Or **M1** for any correct product seen oe isw	M1 implied by 48 or 24 or 32 seen
15	(a)	(i)	$6\sqrt{2}$ final answer	2	**M1** for $\sqrt{25\times 2}$ or better seen	
		(ii)	$\frac{5\sqrt{6}}{3}$ final answer	2	**M1** for $\frac{10}{\sqrt{6}}\times\frac{\sqrt{6}}{\sqrt{6}}$ oe	For 2 marks accept $1\frac{2}{3}\sqrt{6}$

Question			Answer	Marks	Part marks and guidance	
	(b)		Identifies both errors **and** explains the correct steps e.g. Square not multiply by 2 oe negative power does not make answer negative it should be the reciprocal oe $\frac{1}{16}$	**2** **1**	**B1** for each with no incorrect statement for either	Accept implication of error by a description of correct step e.g. should be squared should be reciprocal, should be 1/*n*, should be 1/64 Descriptions must be in words do not accept numeric examples alone SEE APPENDIX isw attempt to convert to decimal
16	**(a)**		104 Angle at centre is twice angle at circumference	**2**	**B1** for 104	With no incorrect statement Must use underlined terms. Accept reverse: angle at circumference is half angle at centre Accept arc for circumference but not edge
	(b)		128 Opposite angles in a cyclic quadrilateral [are supplementary oe]	**2**	**B1** for 128	With no incorrect statement Must use underlined terms Condone opp angles in cyclic quad = 180
17	**(a)**		$\frac{x+4}{x+1}$ final answer nfww	**4**	**M1** for $(x + 4)(x – 4)$ AND **M2** for $(x – 4)(x + 1)$ Or **M1** for $x(x + 1) – 4(x + 1)$ seen or $x(x – 4) + 1(x – 4)$ seen or for $(x + a)(x + b)$ where $a + b = –3$ or $ab = – 4$	nfww please check working not just answer

Question			Answer	Marks	Part marks and guidance	
	(b)		4 and –60	**2**	**B1** for each	For 2 marks or B1, accept answers embedded in expression provided no contradiction seen
18			$\frac{22}{85}$ oe	**5**	isw conversion to other forms **M1** for (85 +78 +20) – 120 oe soi Or for 120 – 20 – 78 oe **B2FT** for correctly completed diagram with 85 – *x*, *x* [*their 63*], 78 – *x,* 20 correctly placed FT *their x* (can be algebraic or *x* is an integer 0 < *x* < 78) Or **B1FT** for attempt at Venn diagram with 85 – *x* or 78 – *x* or 20 correctly placed FT *their x* (can be algebraic or *x* is an integer 0 < *x* < 78) **B1** for $\frac{n}{85}$ or $\frac{22}{n}$ (both proper fractions) seen	For 5 marks accept 0.2588.. or 0.259 or 25.88…% to 25.9% M1 implied by 63 or 22 seen  For B1, condone omission of rectangle for universal set
19	**(a)**		U shaped parabola with minimum value indicated at (2, –3)	**3**	**B1** for U shape curve **B1** for turning point at (2, *k*) **B1** for turning point at (*k*, –3)	Be generous for the U shape condone broken line Values must be shown but could be marked on axes. Mark intention Accept turning point = (2, –3) written in working provided no contradiction on sketch If point (2, –3) only plotted on graph and no sketch then B0B1B1

Question			Answer	Marks	Part marks and guidance	
19	(b)		4, 16, 12	5	**B4** for $a = 4$ and $b = 16$ **OR** **B3** for $c = 12$ and either $a = 4$ or $b = 16$ **OR** **M1** for $(x + 3)(x + 1)$ seen isw **A1** for $x^2 + x + 3x + 3$ or better seen isw **B1** for $c = 12$ **OR** **B1** for $c = 12$ soi **M1** for $(-1)^2a - 1b + 12 = 0$ oe **and** $(-3)^2a - 3b + 12 = 0$ oe	Alt method uses simultaneous equations with $c = 12$ Allow recovery for omission of brackets if negatives correctly dealt with
20			397.5 [million]	7	**B6** for [area of field =] 39.75 oe **OR** **B2** for [AC =] 13 or $\sqrt{169}$ Or **M1** for $5^2 + 12^2$ oe **M2** for ½×5×12 + ½×3×*their* 13×sin 30 oe Or **M1** for ½ × 5 × 12 oe or ½ × 3 × *their* 13 × sin 30 oe **B1indep** for sin 30 = 0.5 oe soi	For 7 marks, condone 397 500 000 For B6, accept $\frac{159}{4}$ or better for 39.75 Check diagram for B marks and M marks *their* 13 must be *their* AC written or indicated and is not 3, 5 or 12 M2 can be given for adding costs if correct total area method is implied [30] or [9.75 oe] 9.75 implies M1B1

Question			Answer	Marks	Part marks and guidance	
21	(a)		$2n$ is even and adding 1 gives an odd number oe	1	Must interpret the $2n$ as even or not odd and then the +1 giving odd oe	Accept '$2n$ is a multiple of 2' for $2n$ is even Accept 2 times any number is even oe for $2n$ is even (as n is defined as an integer in the stem of question) Accept 'next number' or 'odd' for +1 Do not accept e.g. $2n$ = even $2n$ +1 is odd (does not interpret the 1)
	(b)		$(2n + 3)^2 - (2n + 1)^2$ oe	M2	Allow $(2n + a)^2 - \{2n + (a \pm 2)\}^2$ where a is odd Or **M1** for $2n - 1$ or $2n + 3$ used with $2n + 1$ Allow $\{2n + (a \pm 2)\}$ used with $(2n + a)$ where a is odd	Could use alternate correct expressions for consecutive **odd** numbers. Allow M and A marks if correct. Could reverse the algebraic terms *their*$(2n + 1)^2 - (2n + 3)^2$ leading to $-8n - 8$, allow method and accuracy marks if correct. If brackets omitted allow recovery for M2 if correct expansion
			$4n^2 + 12n + 9 - 4n^2 - 4n - 1$	M2	**Dep on M2** for expanding brackets in *their* expressions. Or **M1indep** for one correct expansion of *their* brackets	If seen alone and completely correct then implies previous M2 Allow $4n^2 + 12n + 9 - (4n^2 + 4n + 1)$
			$8n$ or $8n + 8 = 8(n + 1)$ Or $8n + 8$ is a multiple of 8 oe	A1	With no errors or omissions seen. Correct for *their* two consecutive odd number expressions After **0** scored, Allow **SC1** for two correctly evaluated numeric examples of subtracting consecutive odd squares isw	Accept $-8n$ or $-8n - 8$ oe if subtraction is reversed NB: M2M1A1 not possible – must earn all method marks for A mark e.g. $7^2 - 5^2 = 24$ **and** $3^2 - 5^2 = -16$