AQA

GCSE
Mathematics

8300/2 – Paper 2 Foundation Tier

Mark scheme

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
[a, b)	Accept values $a \leq$ value $< b$
3.14…	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

Questions which ask students to show working

Instructions on marking will be given but usually marks are not awarded to students who show no working.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Continental notation

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.

Question	Answer	Mark	Comments
1	$y + y$	B1	
	Additional Guidance		
2	0.32	B1	
	Additional Guidance		
3	5^4	B1	
	Additional Guidance		
4	8	B1	
	Additional Guidance		
5	$(3^6 =)$ 729 seen or $(\sqrt{841} =)$ 29 seen	M1	
	700	A1	
	Additional Guidance		
6(a)	School	B1	
	Additional Guidance		
	School and 26		B1
	26		B0

Question	Answer	Mark	Comments

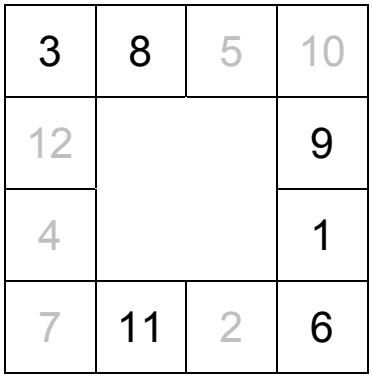
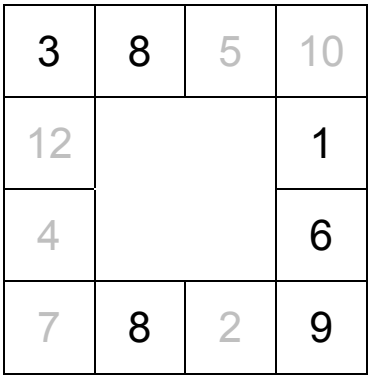
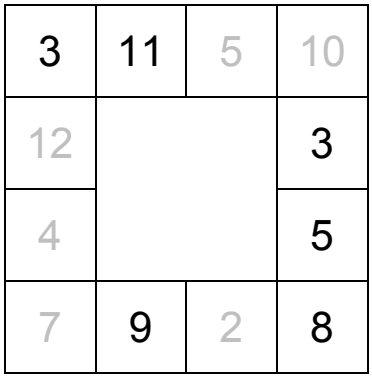
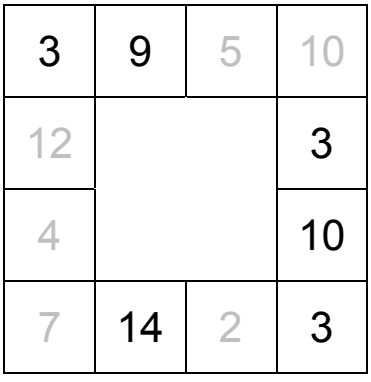
6(b)	4 in key	B1	
	$6\frac{1}{2}$ symbols in 'School'	B1ft	ft their key ≠ 1
	$2\frac{3}{4}$ symbols in 'Guides'	B1ft	ft their key ≠ 1
	Additional Guidance		
	Key: ◯ represents 4 friends Family ◯◯ Netball ◯◯ School ◯◯◯◯◯◯◗ Guides ◯◯◔		B3
	Half circle and three-quarter circle can be any orientation		
	Three-quarter circle must be an attempt at a **single** sector or arc (not a circle cut vertically or drawn smaller) but may be rotated		
	Mark intention for size and shape of symbols. Must be sectors or arcs		
	If the key is blank they can score B0B1B1 for 6.5 and 2.75 symbols		
	Ignore any symbols added to the first two rows		

7(a)	$d + 3$ or $3 + d$	B1	must be seen in (a)
	Additional Guidance		
	Condone $e = d + 3$ or $e = 3 + d$		B1
	$d = e - 3$		B0

Question	Answer	Mark	Comments

7(b)	$d - 5$	B1	must be seen in (b)
	Additional Guidance		
	Condone $f = d - 5$		B1
	$d = f + 5$		B0

7(c)	their $(d + 3)$ – their $(d - 5)$ or 3 – –5 or chooses values for d, e and f with e 3 more than d and f 5 less than d and subtracts f from e or chooses values for e and f with e 8 more than f and subtracts f from e	M1	oe eg $d + 3 - d + 5$ or $3 + d + 5 - d$ ft their expressions in (a) and (b) if both in terms of d and at least one has a numerical term may be implied by eg $f = e - 8$
	8	A1ft	correct or ft their expressions in (a) and (b) if both in terms of d and at least one has a numerical term
	Additional Guidance		
	8		M1A1
	($d = 10$,) $e = 13$ and $f = 5$ and 13 – 5		M1
	Only condone missing brackets if recovered		
	$d + 3 - d - 5$ and no recovery		M0
	$d + 3 - d - 5$ and answer 8		M1A1
	$d + 3$ in (a), $5 - d$ in (b) and $2d - 2$ in (c)		(B1B0)M1A1ft
	$3d$ in (a), $d - 5$ in (b) and $2d + 5$ in (c)		(B0B1)M1A1ft
	$3d$ in (a), $-5d$ in (b) and $8d$ in (c)		(B0B0)M0A0

Question	Answer	Mark	Comments
8	 with 1 and 9 in either order	B3	B2 for three sides adding to 26 using the given numbers with no repeats across the three sides B1 for one or two sides adding to 26 using the given numbers with no repeats across the one or two sides
	Additional Guidance		
	 Four sides add to 26 but across the four sides there is one repeat (8) so only three sides qualify		B2
	 Three sides add to 26 but across these three sides there is one repeat (3) so only two sides qualify  One side has 14, one side has repeats of 10 and 3 so these two sides do not qualify. Only one of the remaining sides adds to 26 so qualifies		B1

Question	Answer	Mark	Comments
9	**Alternative method 1**		
	5 × 12 × 2.5 or 150 or 8 × 2.5 or 20	M1	oe eg 2.5 + 2.5 + 2.5 + 2.5 + 2.5 + 2.5 + 2.5 + 2.5
	5 × 12 × 2.5 + 8 × 2.5 or 150 + 20	M1dep	
	170	A1	
	Alternative method 2		
	5 × 12 + 8 or 68	M1	
	their 68 × 2.5	M1dep	
	170	A1	
	Alternative method 3		
	[5.66, 5.67] × 12 or [67.92, 68.04] or [5.66, 5.67] × 2.5 or [14.15, 14.175]	M1	oe
	[5.66, 5.67] × 12 × 2.5 or [169.8, 170.1]	M1dep	oe
	170	A1	
	Additional Guidance		
	Use of 5.8 is an incorrect method eg 5.8 × 12 = 69.6 and 69.6 × 2.5 = 174		M0M0A0

10	8	B1	
	Additional Guidance		

Question	Answer	Mark	Comments
11	Any one of 123660 1339(65) 1442(70) 1545(75) 164880 1751(85) 185490 195795	M1	must be evaluated correctly number pairs may be shown separately eg 15 × 3 = 45 (and 15 × 5 = 75) 16 × 3 = 48 and 16 × 5 = 80
	At least two of 123660 1339(65) 1442(70) 1545(75) 164880 1751(85) 185490 195795 or 18 and 54 and 90	M1dep	must be evaluated correctly number pairs may be shown separately
	185490	A1	
	Additional Guidance		
	185490		M1M1A1
	The digits in brackets are not required for the M marks as duplication has already been shown but if seen must be correct		
	Answer 18 54 90 18 54 90		M2A1
	185490 written in first three spaces with nothing else on the answer line		M2A1
	185490 written in first three spaces followed by other numbers		M2A0
	For the final mark do not accept miscopies to the answer line		

12	315	B1	
	Additional Guidance		

Question	Answer	Mark	Comments
13(a)	1.5 × 7 + 0.5 or 10.5 + 0.5	M1	oe
	11	A1	
	Additional Guidance		
	1.5 × 7 = 10.5 and 0.5 × 7 = 3.5 and 10.5 + 3.5 = 14		M0A0
	7 × 1.5r + 0.5		M0A0
	7 × 1.5r + 0.5 and answer 11r		M0A0
	7 × 1.5r + 0.5 and answer 11 (has recovered)		M1A1

Question	Answer	Mark	Comments
13(b)	**Alternative method 1**		
	20 – 0.5 or 19.5 or $r = \frac{w - 0.5}{1.5}$	M1	oe
	their 19.5 ÷ 1.5	M1dep	oe (20 – 0.5) ÷ 1.5 is M2
	13	A1	
	Alternative method 2		
	20 – their 11 from part (a) or 9	M1	implied by '6 extra cups (of rice)'
	7 + (their 9 ÷ 1.5) or 7 + 6	M1dep	
	13	A1	
	Additional Guidance		
	13 from incorrect working eg rounding 20 ÷ 1.5 = 13 eg scaling 11 and rounding ie 20 ÷ 11 × 7 = 13		M0M0A0
	Brackets omitted ie 20 – 0.5 ÷ 1.5, unless recovered		M0M0A0
	1.5 × 13 + 0.5 = 20, unless 13 selected		M1M1A0
	1.5 × 13 = 19.5, unless 13 selected		M1M1A0
	Trial and improvement, unless answer 13		M0M0A0

Question	Answer	Mark	Comments

14(a)	2950.2745(00…)	B1	
	Additional Guidance		
	2’950.2745 or 2,950.2745		B1
	2.950.2745		B0
	Allow correct rounding or truncation once full value seen		

14(b)	10 or 10^2 or 100 or 30	M1	
	10 × 10 × 30 or 10^2 × 30 or 100 × 30	M1dep	
	10 × 10 × 30 = 3000 and Sensible or 10^2 × 30 = 3000 and Sensible or 100 × 30 = 3000 and Sensible	A1ft	ft their answer to part (a) for the decision
	Additional Guidance		
	3000 (and Sensible) with no working		M0M0A0
	Their decision must be based on part (a) unless new calculation shown in part (b)		
	10^2 × 30 = 3000 and 10^2 × 29 = 2900 and Sensible		M1M1A1
	10^2 × 30 and 10^2 × 29 and Sensible		M1M1A0
	10^2 × 29 = 2900 and Sensible		M1M0A0
	ft should be Sensible if their part (a) is 3000 to 1sf or vice versa eg (a) 295.02745 (b) 10 × 10 × 30 = 3000 and Not sensible		(B0)M1M1A1ft

Question	Answer	Mark	Comments
15(a)	Any two of (–2, –9), (–1, –7), (0, –5), (1, –3), (2, –1), (3, 1), (4, 3), (5, 5)	M1	gives at least two correct pairs of coordinates, may be in a table implied by points plotted ± $\frac{1}{2}$ small square
	At least two correct points plotted or at least two of their points plotted correctly	M1dep	implied by correct line which does not have to extend from x = –2 to x = 5 ± $\frac{1}{2}$ small square
	Correct line from (–2, –9) to (5, 5)	A1	± $\frac{1}{2}$ small square ignore ends of line outside [–2, 5]
	Additional Guidance		
	Ignore extra points that are incorrect		
15(b)	3	B1ft	correct or ft the intersection of their graph with the given graph ± $\frac{1}{2}$ small square
	Additional Guidance		
	Answer 3 with or without correct graph		B1
	Answer (3, 1)		B0
	Answer (x =) 3, y = 1		B1
	If their graph intersects the given graph at more than one point they need to give the correct x-coordinate of each point of intersection		B1ft

Question	Answer	Mark	Comments
16(a)	180 ÷ 3 or 60	M1	oe eg 60 + 60 + 60 = 180
	(180 – 28) ÷ 2 or 152 ÷ 2 or 76	M1	oe eg 76 + 76 + 28 = 180
	180 – their 60 – their 76	M1dep	oe eg 44 + 60 + 76 = 180 dep on M1M1
	44	A1	
	Additional Guidance		
	60 or 76 seen in appropriate place on diagram or in working scores one mark for each		
	Answer 44 not from wrong working		M3A1
	180 – 28 ÷ 2 unless recovered		2nd M0

Question	Answer	Mark	Comments
16(b)	No and gives correct reason	B1	eg it should be 180 – (360 ÷ 8) it should be 1080 ÷ 8 this gives the exterior (not the interior) angle it should be obtuse not acute accept any unambiguous indication of No
	Additional Guidance		
	A correct reason may be 1. showing a correct method 2. correction of her method (error and replacement shown) 3. correction of her answer (answer and replacement shown)		
	No, It should be 135 not 45 (3)		B1
	No, It should be 1080 not 360 (2)		B1
	No, because the interior angles should be 1080 not 360 (2)		B1
	No, she needs to subtract her answer from 180 (1)		B1
	No, ((8 – 2) × 180) ÷ 8 (1)		B1
	No, It should be ((n – 2) × 180) ÷ 8 (doesn't use n = 8)		B0
	Any numbers quoted must be correct but ignore other non-contradictory statements eg No, It should be 720. She's worked out the exterior angle		B0
	No, There's not 360 in an octagon or No, Angles in an octagon do not add up to 360		B0
	No, Interior angles add up to more than 360		B0
	No, It should be 135		B0
	No, It should be 1080		B0
	No, 45 is the outside angle		B0

Question	Answer	Mark	Comments
17(a)	270	B1	
	Additional Guidance		

17(b)	**Alternative method 1 (working in cm)**		
	[6.3, 6.7]	B1	implied by 1300
	[2.5, 2.9] and [1.8, 2.2] or [4.5, 4.9]	B1	implied by 540 and 400 implied by 940
	their 6.5 × 200 or 1300 and their 2.7 × 200 or 540 and their 2 × 200 or 400 or their 6.5 × 200 or 1300 and (their 2.7 + their 2) × 200 or 940 or their 6.5 × 200 or 1300 and their 4.7 × 200 or 940	M1	oe 1300 and 540 and 400 implies B2M1 1300 and 940 implies B2M1 distances must be exact if measurements not shown if only one value used for BC from the start, their 4.7 must be > 4 and < 6
	their 1300 – their 540 – their 400 or their 1300 – their 940	M1dep	oe may be implied by correct answer for their distances their 940 must be > 800 and < 1200
	Correct answer for their 6.5 and their 2.7 and their 2 with all measurements seen or Correct answer for their 6.5 and their 4.7 with all measurements seen	A1ft	ft their measurements their 4.7 must be > 4 and < 6

Mark scheme and additional guidance continues on the next page

Question	Answer	Mark	Comments
17(b) cont	**Alternative method 2 (working in cm)**		
	[6.3, 6.7]	B1	
	[2.5, 2.9] and [1.8, 2.2] or [4.5, 4.9]	B1	
	their 6.5 – their 2.7 – their 2 or their 6.5 – their 4.7 or 1.8	M1	oe if only one value used for BC from the start, their 4.7 must be > 4 and < 6
	their 1.8 × 200	M1dep	oe may be implied by correct answer
	Correct answer for their 6.5 and their 2.7 and their 2 with all measurements seen or Correct answer for their 6.5 and their 4.7 with all measurements seen	A1ft	ft their measurements their 4.7 must be > 4 and < 6
	Additional Guidance		
	Allow work in mm but note that they must multiply by 20 for the M1		
	Working may be on diagram		
	Must show measurements to score the A mark and answer must be correct for their original measurements		
	1300 – 940 and answer 360 (no measurements)		B1B1M1M1A0
	1300 – 920 and answer 380 (no measurements)		B1B0M0M0A0
	6.5, 4.6, 1300 – 920 and answer 380		B1B1M1M1A1ft
	6.5, 4.2, 1300 – 840 and answer 460		B1B0M1M1A1ft
	6.5, 2.6, 2 on diagram, 1300 – 5 × 200 (5 wrong for their values and addition not shown)		B1B1M0M0A0ft

Question	Answer	Mark	Comments
18(a)	Positive	B1	
	Additional Guidance		
	Ignore descriptive words such as 'strong' or 'weak' or 'scattered'		

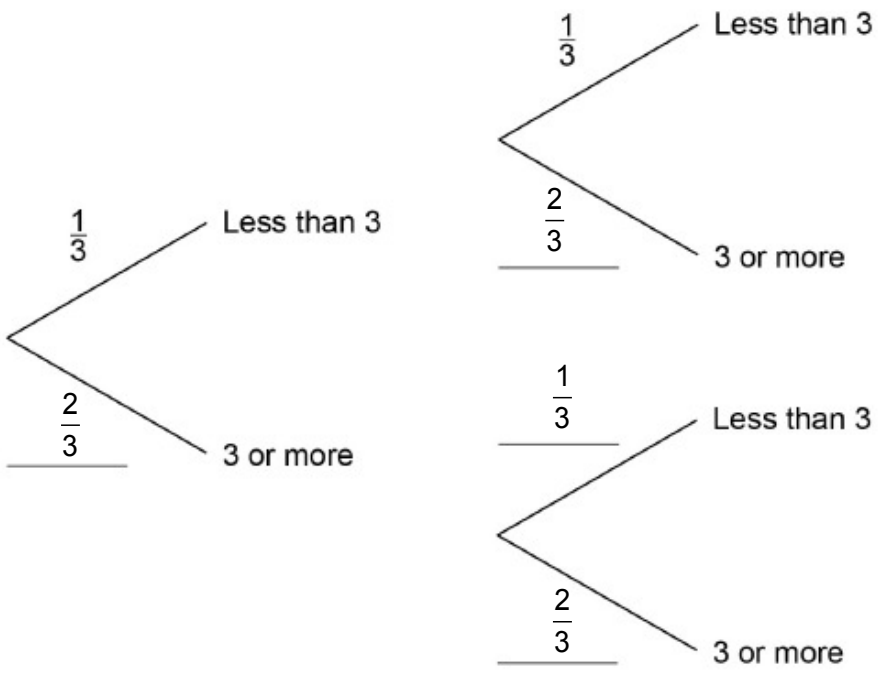
18(b)	Correct straight line which passes between (10, 35) and (10, 55) and between (70, 135) and (70, 155)	B1	line must extend from 10 to 70
	Draws a vertical line from umbrella sales of £60 to meet their line or marks a point on their line of best fit corresponding to umbrella sales of £60	M1	their line / curve must be increasing may be implied by correct value for their line / curve
	Correct value for their line	A1ft	ft their increasing line / curve allow any reading within one vertical square eg if their vertical line crosses their line of best fit in the first square above 125, allow [125, 130]
	Additional Guidance		
	No increasing line / curve drawn		B0M0A0
	Mark intention for straight line for B1		
	The line may go through the coordinates of the gates but must not go above or below		
	Ignore any parts of the line outside the range 10 to 70		

19	$x^2 - 4x$	B1	
	Additional Guidance		

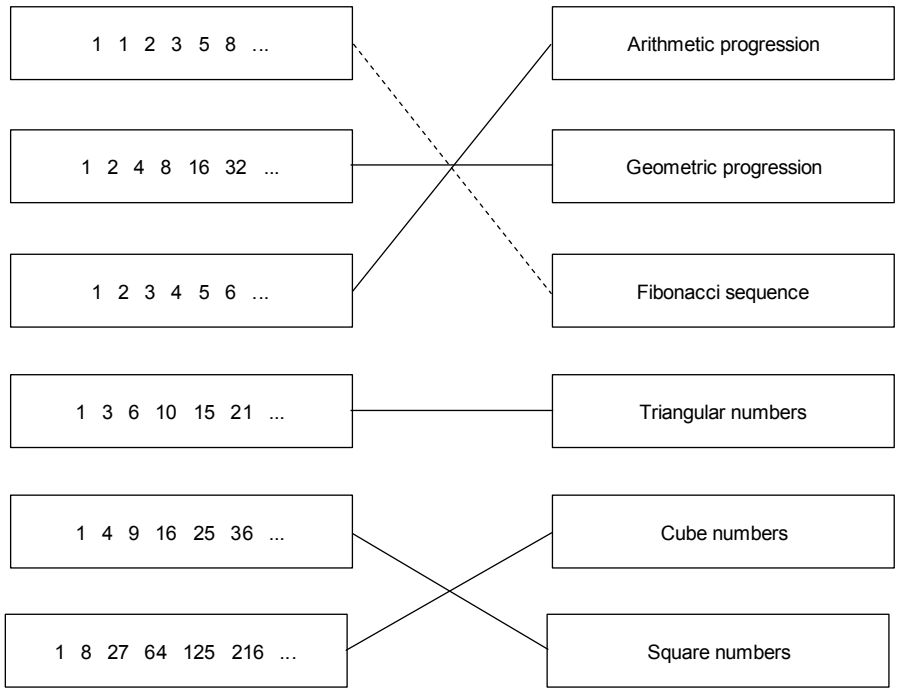
Question	Answer	Mark	Comments
20	2.5	B1	
	Additional Guidance		

21(a)	$2 \times 4.2 \times \pi$ or 8.4π	M1	oe allow [3.14, 3.142] for π
	[26.376, 26.393]	A1	may be implied by 26.4 as answer
	26.4	B1ft	ft their value to at least 2 dp rounded correctly to 1 dp
	Additional Guidance		
	26.4		M1A1B1ft
	26.3 only		M0A0B0ft
	55.4 only		M0A0B0ft

21(b)	Sector drawn correctly	B1	two radii joined at the centre of the circle
	Additional Guidance		
	Mark intention		
	Diameter drawn		B1
	Any number of sectors (eg diameter and radius drawn)		B1
	Ends of radii joined to form segment with whole sector shaded		B1
	Ends of radii joined to form segment without whole sector shaded		B0

Question	Answer	Mark	Comments
22(a)	$\frac{1}{3}$ or $\frac{2}{6}$ or 0.33… or 33.(…)% on each top branch and $\frac{2}{3}$ or $\frac{4}{6}$ or 0.66… or 0.67 or 66.(…)% or 67% on each bottom branch	B1	accept any equivalent fraction, decimal or percentage
	Additional Guidance		
	Decimals must have at least 2 decimal places so do not accept 0.3 or 0.6 or 0.7		
	Only accept the percentages shown, do not accept 30% or 60%		
	Ignore working around the edge of the diagram		
		B1	
22(b)	$\frac{1}{9}$ or 0.11… or 11.(…)%	B1	
	Additional Guidance		
	Ignore probability words such as ‘unlikely’ or ‘evens’		

	Accept equivalent answers eg $\frac{2}{18}$, $\frac{3}{27}$, $0.\dot{1}$	
	Do not accept 0.1 or 10%	

Question	Answer	Mark	Comments
23	All 5 correct	B4	B3 for 4 correct B2 for 3 correct B1 for 1 or 2 correct
	Additional Guidance		
			B4
	Two connections from a LH box is choice so is incorrect for that box		
	Connections do not have to be straight lines		

Question	Answer	Mark	Comments
24	**Alternative method 1**		
	Any one of 60 000 ÷ 420 000 or 0.14… or 14.(…)% or $\frac{1}{7}$ or 480 000 ÷ 420 000 or 1.14… or 114.(…)% or $\frac{8}{7}$ or 420 000 ÷ 60 000 or 7 or 420 000 ÷ 480 000 or 0.875 or 87.5% or $\frac{7}{8}$ or 60 000 ÷ 540 000 or 0.11… or 11.(…)% or $\frac{1}{9}$ or 540 000 ÷ 60 000 or 9	M1	oe eg 60 000 : 420 000 or 1 : 7 or 480 000 : 420 000 or 8 : 7
	Any one of 60 000 ÷ 480 000 or 0.125 or 12.5% or $\frac{1}{8}$ or 540 000 ÷ 480 000 or 1.125 or 112.5% or $\frac{9}{8}$ or 480 000 ÷ 60 000 or 8 or 480 000 ÷ 540 000 or 0.88… or 0.89 or 88.(…)% or 89% or $\frac{8}{9}$	M1	must be a matching pair (could be different forms) to award M2 (see A1 for list of matching pairs) oe eg 60 000 : 480 000 or 1 : 8 or 540 000 : 480 000 or 9 : 8

Mark scheme continues on the next page

Question	Answer	Mark	Comments
24 cont	$\frac{1}{7}$ and $\frac{1}{8}$ and No or $\frac{8}{7}$ and $\frac{9}{8}$ and No or 0.14… and 0.125 and No or 14.(…)% and 12.5% and No or 1.14… and 1.125 and No or 114.(…)% and 112.5% and No or 7 and 8 and No or $\frac{7}{8}$ and $\frac{8}{9}$ and No or $\frac{1}{9}$ and $\frac{1}{8}$ and No or 9 and 8 and No or 0.11… and 0.125 and No or 11.(…)% and 12.5% and No or 0.875 and 0.88… or 0.89 and No or 87.5% and 88.(…)% or 89% and No	A1	oe eg 1 : 7 and 1 : 8 and No

Mark scheme continues on the next page

Question	Answer	Mark	Comments
24 cont	**Alternative method 2**		
	No and any one of $\frac{60\,000}{420\,000} \times 480\,000$ and [67 200, 68 640] or $\frac{60\,000}{480\,000} \times 540\,000$ and 67 500 or $\frac{60\,000}{480\,000} \times 420\,000$ and 52 500 or $\frac{60\,000}{540\,000} \times 480\,000$ and [52 800, 53 334] or $\frac{420\,000}{480\,000} \times 540\,000$ and 472 500 or $\frac{480\,000}{420\,000} \times 480\,000$ and [547 200, 548 640] or $\frac{480\,000}{540\,000} \times 480\,000$ and [422 400, 427 200] or $\frac{540\,000}{480\,000} \times 420\,000$ and 472 500	B3	oe B2 any one of the calculations B1 any one of the fractions oe for equivalent fractions, decimals and percentages see Alternative method 1

Additional guidance continues on the next page

Question	Answer	Mark	Comments

	Additional Guidance	
24 cont	In Alt 1, for M2 the matching pair do not have to be in comparable form eg 14.3% and $\frac{1}{8}$ and No	M1M1A0
	For comparable fractions, they must be in their lowest terms or have the same numerators or the same denominators for the A1 eg Alt 1 $\frac{60\,000}{420\,000}$ and $\frac{60\,000}{480\,000}$ and No	M1M1A1
	For comparable ratios, they must be in their lowest terms or have the same LH sides or the same RH sides for the A1 eg Alt 1 60 000 : 420 000 and 60 000 : 480 000 and No	M1M1A1
	If working with percentages, condone absence of % symbol eg Alt 1 14 and 12.5 and No	M1M1A1
	Both are increases of 60 000 and it is then over different amounts so cannot be the same percentage	M0M0A0

Question	Answer	Mark	Comments
25(a)	Two different probabilities from $\frac{15}{20}$ or 0.75 or 75% or $\frac{22}{30}$ or 0.73… or 73.(…)% or $\frac{17}{40}$ or 0.425 or 0.43 or 42.5% or 43% or $\frac{54}{90}$ or 0.6 or 60% or $\frac{37}{50}$ or 0.74 or 74% or $\frac{32}{60}$ or 0.53… or 53.(…)% or $\frac{39}{70}$ or 0.557… or 0.56 or 55.7…% or 56%	B2	oe B1 for one correct probability

Additional guidance continues on the next page

Question	Answer	Mark	Comments

	Additional Guidance	
25(a) cont	Accept $\frac{108}{180}$ as one of the probabilities	
	Mark the answer line if it has two answers ignoring any incorrect probabilities in the working lines	
	Ignore any incorrect cancelling or change of form (fraction, decimal or percentage)	
	If the answer line only has one answer, check the working lines for a second answer for B2. Ignore any extra probabilities, unless incorrect, in which case award B1 max eg Working lines $\frac{15}{20}$ Answer line $\frac{54}{90}$ eg Working lines $\frac{15}{20}$, $\frac{5}{15}$ Answer line $\frac{54}{90}$	B2 B1
	If the answer line is blank, check the working lines for answers for B1 or B2. Ignore any extra probabilities, unless incorrect, in which case award B1 max eg Working lines $\frac{15}{20}$, $\frac{22}{30}$, $\frac{54}{90}$ Answer line blank eg Working lines $\frac{15}{20}$, $\frac{5}{15}$, $\frac{54}{90}$ Answer line blank	B2 B1
	Probabilities must not be given as ratios	
	Do not accept the average of the given probabilities as answer	

Question	Answer	Mark	Comments
25(b)	**Alternative method 1 (ft their part (a))**		
	Their probability with the greater number of trials and valid reason eg More throws	B1ft	ft their two different probabilities from part (a) both probabilities must have a denominator based on throws
	Alternative method 2 (independent of part (a))		
	$\frac{54}{90}$ and valid reason eg Total throws	B1	oe
	Additional Guidance		
	Accept any unambiguous indication of their probability eg the day		
	Using ratios		B0
	Ignore any non-contradictory statements		
	60% and It's for all three days		B1
	$\frac{54}{90}$ and It takes into account more throws		B1
	$\frac{17}{40}$ (with $\frac{22}{30}$ also in (a)) and Because he threw it more on Wednesday		B1ft
	$\frac{54}{90}$ and Shows the overall probability		B1
	$\frac{54}{90}$ and Probability over total throws		B1
	$\frac{54}{90}$ (with Wednesday probability in (a)) and It's the average total days, not just Wednesdays		B1ft

Additional guidance continues on the next page

Question	Answer	Mark	Comments
25(b) cont	Correct ft probability or $\frac{54}{90}$ and It's more reliable		B0
	$\frac{54}{90}$ and There's a lot of data		B0
	Correct ft probability or $\frac{54}{90}$ and He may get better with more throws		B0
	$\frac{54}{90}$ and He throws 90 times		B0
	Correct ft probability or $\frac{54}{90}$ and More hits		B0
26	**Alternative method 1**		
	22.5(0) and 4 or 27 and 8 or 31.5(0) and 12 or 36 and 16 or 40.5(0) and 20 or 45 and 24 or 30 : 16 or 45 : 24	M1	
	45 and 24 chosen	A1	eg 45 : 24 is the final ratio seen
	6	A1	

Mark scheme and additional guidance continues on the next page

Question	Answer	Mark	Comments
26 cont	**Alternative method 2**		
	18 + 4.5x and 4x seen or $\frac{18 + 4.5x}{15} = \frac{4x}{8}$	M1	any letter oe sets up correct equation
	8(18 + 4.5x) = 60x or 144 + 36x = 60x or 24x = 144	M1dep	eliminates denominators oe
	6	A1	
	Additional Guidance		
	Answer 6 that is not from incorrect method		M1A1A1
	45 and 24 followed by eg 49.5(0) and 28 (answer not 6)		M1A0A0
	Equivalent ratio to 15 : 8 that is not 30 : 16 or 45 : 24 eg 60 : 32 (answer not 6)		M0A0A0
	Final calculation $\frac{15}{8} \times 24 = 45$ (answer not 6)		M1A1A0

Question	Answer	Mark	Comments
27	**Alternative method 1**		
	$\frac{4}{3}\pi \times 30^3$ or $36\,000\pi$ or [112 757, 113 112] or $\frac{1}{2} \times \frac{4}{3}\pi \times 30^3$ or $18\,000\pi$ or [55 954, 56 839]	M1	oe allow 1.33… for $\frac{4}{3}$ allow 0.66… or 0.67 for $\frac{2}{3}$
	their [112 757, 113 112] ÷ 4000 or 9π or 28.(…) or their [55 954, 56 839] ÷ 4000 or $\frac{9\pi}{2}$ or [13.9, 14.21] or their [112 757, 113 112] ÷ (4000 × 60) or $\frac{3\pi}{20}$ or [0.46, 0.4713] or their [55 954, 56 839] ÷ (4000 × 60) or $\frac{3\pi}{40}$ or 0.23… or 0.24	M1dep	
	[13.9, 14.21] and Yes or 0.23… or 0.24 and Yes	A1	

Mark scheme and additional guidance continues on the next page

Question	Answer	Mark	Comments
27 cont	**Alternative method 2**		
	$\frac{4}{3}\pi \times 30^3$ or $36\,000\pi$ or [112 757, 113 112] or $\frac{1}{2} \times \frac{4}{3}\pi \times 30^3$ or $18\,000\pi$ or [55 954, 56 839]	M1	oe allow 1.33… for $\frac{4}{3}$ allow 0.66… or 0.67 for $\frac{2}{3}$
	4000 × 15 or 60 000	M1	
	[55 954, 56 839] and 60 000 and Yes	A1	
	Alternative method 3		
	$\frac{4}{3}\pi \times 30^3$ or $36\,000\pi$ or [112 757, 113 112] or $\frac{1}{2} \times \frac{4}{3}\pi \times 30^3$ or $18\,000\pi$ or [55 954, 56 839]	M1	oe allow 1.33… for $\frac{4}{3}$ allow 0.66… or 0.67 for $\frac{2}{3}$
	their [112 757, 113 112] ÷ 15 or 2400π or [7517, 7541] or their [55 954, 56 839] ÷ 15 or 1200π or [3730, 3790]	M1dep	
	[3730, 3790] and Yes	A1	
	Additional Guidance		
	Do not award A1 if incorrect conversion of $\frac{1}{4}$ hour seen		

Question	Answer	Mark	Comments
28(a)	8.35 and 8.45 in the correct order	B2	B1 8.35 on the left or 8.45 on the right or 8.45 and 8.35 in the wrong order accept $8.44\dot{9}$ for 8.45
	Additional Guidance		
	Do not accept 8.449… for $8.44\dot{9}$		
28(b)	41.75 and 42.25	B1ft	correct or ft their two different values from (a) their 8.35 must be in the range (8.3, 8.4] their 8.45 must be in the range (8.4, 8.5] correct order or ft order accept $42.24\dot{9}$ for 42.25
	Additional Guidance		
	(8.3, 8.4] does not include 8.3 but does include 8.4 (8.4, 8.5] does not include 8.4 but does include 8.5		
	Answer of 8.35 and 8.44 in part (a) leading to 41.75 and 42.2		B1ft
	Answer of 8 and 9 in part (a) leading to 40 and 45		B0ft