GCSE
MATHEMATICS
8300/1F

Foundation Tier Paper 1 Non-Calculator

Mark scheme

June 2019

Version: 1.0 Final

196G83001F/MS

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.

Further copies of this mark scheme are available from aqa.org.uk

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	reflex	B1	
2	$x = 2$	B1	
3	6	B1	
4	$12 \times \frac{1}{2}$	B1	
5(a)	382.4 or 362.42 or 15.82	B1	implied by correct answer of 380.32 384.48 or 344.52 implies B1 (both additions or both subtractions)
	380.32	B1ft	ft correct evaluation of their 382.4 – 2.08 or their 362.42 + 17.9 or their 15.82 + 364.5
	Additional Guidance		
	Do not apply a misread or allow follow through if this results in a subtraction of either two 2 decimal place values or two 1 decimal place values		
5(b)	18.72	B1	oe eg 18.720

Question	Answer	Mark	Comments
6	(2, 5) or (8, 5)	B2	B1 correct point indicated on grid or (x, 5) or (2, y) or (8, y), where x can be x or blank or any number other than 13 and y can be y or blank or any number
	Additional Guidance		
	Mark answer line first, then if no marks scored, check grid for B1 plot		
	No tolerance on values of 2 or 8 for B2 but allow half a square tolerance on plotting for B1		
7	7 + 5 or 12 or 17 or 36	M1	
	19 or 19.00	A1	19.0 is M1A0
	Additional Guidance		
	Ignore names if used		
	Condone £19p or £19.00p		M1A1
8(a)	29	B1	
	Additional Guidance		
	Accept words		

Question	Answer	Mark	Comments
8(b)	$\frac{4}{50}$	B1	oe fraction, decimal or percentage eg $\frac{2}{25}$ 0.08 8%
	Additional Guidance		
	Ignore attempts to simplify or convert a correct fraction		B1
	Ignore probability words unless contradictory, eg $\frac{4}{50}$ unlikely		B1
	4 out of 50 or 4 in 50 or 4 : 50 is B0 however, condone 4 out of 50 or 4 in 50 with a correct fraction, decimal or percentage (together on answer line) but do not accept 4 : 50 with a correct fraction, decimal or percentage (together on answer line)		B1 B0
	$\frac{4}{50}$ seen, but answer 4		B0

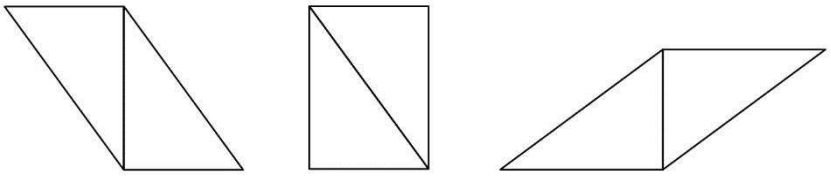
Question	Answer	Mark	Comments
8(c)	$8 + 10 + 14 + 7$ or $50 – 4 – 7$ or $50 – 11$ or 39	M1	allow one error (but not omission) in the 4 frequencies being added frequencies may be seen as numerators of fractions (as probabilities) – ignore denominators as long as they are all the same and all probabilities are < 1 in subtraction method, both frequencies must be correct Condone 51 for 50 for M1
	$\frac{39}{50}$	A1	oe fraction, decimal or percentage eg 0.78 78%
	Additional Guidance		
	Ignore attempts to simplify or convert a correct fraction		M1A1
	$\frac{8}{100}+\frac{10}{100}+\frac{14}{100}+\frac{6.5}{100}$ (frequencies have one error and no omissions, seen as probabilities, with same denominator)		M1A0
	$1 – \frac{11}{50}$ or $1-\frac{7}{50}-\frac{4}{50}$ is correct for M1 (allow $\frac{50}{50}$ in place of 1)		at least M1
	also accept the above with any consistent denominator eg $\frac{52}{52}-\frac{11}{52}$		M1A0
	$\frac{39}{50}$ then 39 as final answer		M1A0
	39 out of 50 or 39 in 50 or 39 : 50 is M1A0 however, condone 39 out of 50 or 39 in 50 with a correct fraction, decimal or percentage (together on answer line) but do not accept 39 : 50 with a correct fraction, decimal or percentage (together on answer line)		M1A1 M1A0
	Ignore probability words unless contradictory, eg $\frac{39}{50}$ unlikely		M1A0
	Numbers may be shown on the diagram but must then be added (or subtracted from 50 as appropriate) to score M1		
	$\frac{39}{51}$ (or denominator other than 50)		M1A0

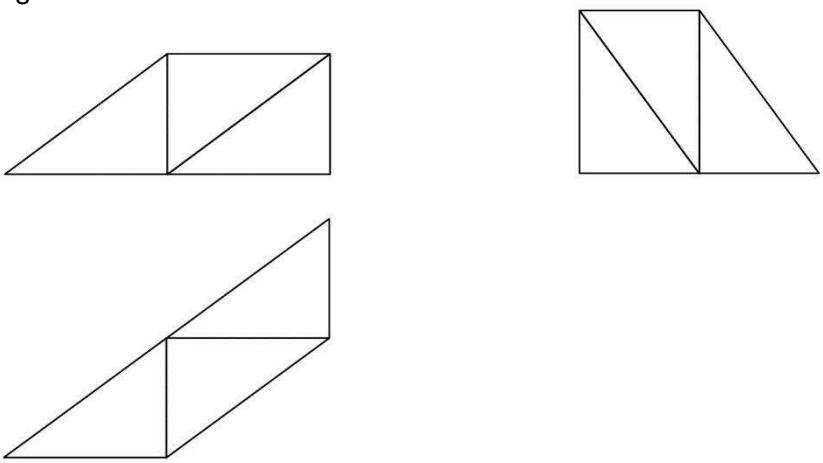
Question	Answer	Mark	Comments
9(a)	1, 2, 3, 6, 9, 18	B2	B1 the 6 correct values, some or all repeated, with no incorrect values or 5 or 6 correct values with up to 2 incorrect values or 4 correct values with 0 or 1 incorrect values or 3 correct values with 0 incorrect values
	Additional Guidance		
	Use of products or 'coordinates' is B1 max for at least 2 correct products with 0 or 1 incorrect products eg 1 × 18, 2 × 9, 3 × 6 eg 1 × 18, 2 × 9, 3 × 6, 4 × 4		 B1 B1
	Lists with repeated values cannot score B2, but ignore repeated values in any format for B1 eg 1, 2, 3, 3 eg 1 × 18, 2 × 9, 3 × 6, 18 × 1, 9 × 2, 6 × 3		 B1 B1
	If a prime factor 'tree' or similar is used, factors must be identified		

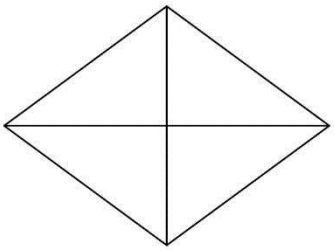
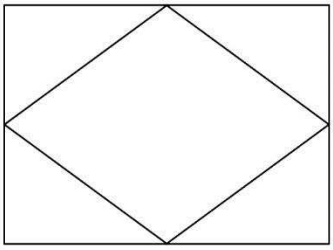
Question	Answer	Mark	Comments
9(b)	60	B2	B1 any common multiple of 12 and 15 eg 120, 180 B1 at least the first two multiples correct for each of 12 and 15 (ignore errors after first two) B1 $(12=)\ 2(\times)2(\times)3$ and $(15=)\ 5(\times)3$ and $2(\times)2(\times)5(\times)3\ ((\times)3)$ (or the equivalent work seen in a correct Venn diagram)
	Additional Guidance		
	Answer 60 with error(s) seen may be B0 or B1 but cannot be B2 These error(s) may occur after the 60 – but cannot be ignored		
	If they have listed both multiples and factors, they must choose multiples to score		
	For B2, 60 must be chosen and not just at the end of a list of multiples		

Question	Answer	Mark	Comments
10(a)	**Alternative method 1**		
	820 ÷ 50 or 82 ÷ 5	M1	oe eg 1640 ÷ 100 eg counting up in 50s to at least 800 (allow one error) eg counting down in 50s to less than 50 (allow one error)
	16.4 or 16+ or over 16	A1	oe eg 16 r 20 or 16 with 20 left allow 16 if 17 is final answer
	17	A1ft	ft rounding up from a decimal, fraction or remainder with M1 awarded
	Alternative method 2		
	850	M1	
	850 ÷ 50	M1dep	oe eg 85 ÷ 5 eg counting up in 50s to try to achieve 850 (allow one error) eg counting down in 50s to at least 50 (allow one error)
	17	A1	
	Additional Guidance		
	Incorrect remainders or decimals or fractions cannot score the second mark eg 820 ÷ 50 = 16.2 answer 17		M1A0A1ft
	Remainder or decimal not shown, leading to answer of 17 will score full marks eg 820 ÷ 50 = 16. answer 17		M1A1A1ft
	A1ft cannot be scored if their division does not yield a remainder eg 820 ÷ 50 = (exactly) 14 answer 14		M1A0A0ft
	800 ÷ 50 or 16 implies M1 from Alt 1		
	800 ÷ 50 = 16 so 17 needed (oe)		M1A1A1
	If 82 ÷ 5 is attempted, allow 16 r 2 or 16 with 2 left over for the first A1		

Question	Answer	Mark	Comments
10(b)	13 × 450	M1	Accept repeated addition of thirteen 450s
	Correct vertical method of long multiplication with 4500 correct or Correct vertical method of long multiplication with at least one of 650 and 5200 correct or Correct set up of grid method with at least three of the four or six products correct or Correct set up of Gelosia method with at least three of the six products correct or 10 × 450 = 4500 and 3 × 450 = 1350 attempted with at least one correct or 13 × 400 = 5200 and 13 × 50 = 650 attempted with at least one correct	M1dep	oe Allow a placeholder space to be present instead of a physical zero in vertical method
	5850	A1	
	Additional Guidance		
	For repeated addition method, to score M1dep, answer must end in 50 with a 6 carried into the hundreds column		
	Students may choose to multiply 13 by 45 using any method, for the method marks. We do not need the zero to be recovered for either method mark, so 13 × 45 scores at least M1 eg 13 × 45 = 585 scores M2 even if answer line gives 585 eg 13 × 45 vertical method with 450 correct or at least one of 65 and 520 correct eg 13 × 45 using grid method with 40 and 5 rather than 400, 50 and 0, with three of the four products correct eg 13 × 45 using Gelosia method with no zero column, with at least three (of the now four) products correct		M2 M2 M2 M2

Question	Answer	Mark	Comments
11(a)	Correct shape drawn in any orientation	B1	
	Additional Guidance		
	eg 	B1	
	Mark intention with regard to vertices on dots and use of straight lines		
	Condone wrong size triangles drawn, as long as they are right-angled, scalene and congruent		
	Internal lines must be drawn to show position of triangles		
	Allow students to extend grid with dots but shapes not on (extended) grid cannot score		

Question	Answer	Mark	Comments
11(b)	Correct shape drawn in any orientation	B1	
	Additional Guidance		
	eg 		
	Mark intention with regard to vertices on dots and use of straight lines		
	Condone wrong size triangles drawn, as long as they are right-angled, scalene and congruent		
	Internal lines must be drawn to show position of triangles		
	Allow students to extend grid with dots but shapes not on (extended) grid cannot score		

Question	Answer	Mark	Comments
11(c)	Correct shape drawn in any orientation	B1	
	Additional Guidance		
	eg 		
	Condone an arrangement which produces an internal rhombus eg 		
	Mark intention with regard to vertices on dots and use of straight lines		
	Condone wrong size triangles drawn, as long as they are right-angled, scalene and congruent		
	Internal lines must be drawn to show position of triangles		
	Allow students to extend grid with dots but shapes not on (extended) grid cannot score		

Question	Answer	Mark	Comments
12	**Alternative method 1**		
	300 ÷ 10 or 30	M1	oe
	their 30 × 6.5 or their 30 × 6 + their 30 ÷ 2 or 300 – their 30 × 3.5 or 300 – (their 30 × 3 + their 30 ÷ 2)	M1dep	oe
	195	A1	SC2 105
	Alternative method 2		
	300 ÷ 100 or 3	M1	oe
	their 3 × 65 or 300 – their 3 × 35	M1dep	oe
	195	A1	SC2 105
	Alternative method 3		
	Correct method to work out any multiple of 5% of 300 up to 95%	M1	eg 50% = 300 ÷ 2
	Fully correct build-up method to work out 65% of 300	M1dep	eg 300 ÷ 2 + 3 × 300 ÷ 20 or 150 + 3 × 15 (no errors seen)
	195	A1	SC2 105
	Alternative method 4		
	65 ÷ 100 or 0.65 or 65 × 300 or 19 500	M1	
	$300 \times \frac{65}{100}$ or 300 × their 0.65 or their 19 500 ÷ 100	M1dep	oe
	195	A1	SC2 105
	Additional Guidance is on the following page		

Question	Answer	Mark	Comments

12 cont	**Additional Guidance**	
	In Alt 3, either a correct method or a correct value must be seen for the first M1 Note that 300 × 50% is not allowed as a correct method	
	If Alt 3 is to be used, the percentage that is attempted must be stated eg 20% = 300 ÷ 5	
	Do not ignore further working for the A mark eg 300 – 195	M1M1A0

13	125	B1	

14	5 × 7 × 10	M1	
	350	A1	
	Additional Guidance		
	Ignore further "method" for M1 eg 5 × 7 × 10 ÷ 2 = 175 however 5 × 7 × 10 × 5 × 7 × 10 or 350^2 is M0A0		M1A0
	ignore units		

15	cylinder	B1	

Question	Answer	Mark	Comments
16(a)	No and correct reason or No and correct description of correct method or No and 280(°)	B1	eg No, he has done B from A No, the North line should go from B
	Additional Guidance		
	Ignore non-contradictory, irrelevant responses alongside a correct response		
	Answer must either include 'No' or 'Kemal is wrong' oe		
	Ignore diagram if B1 scored from answer lines		
	No, it is 280	B1	
	No, should start / measure from B	B1	
	No, it's from the wrong point	B1	
	Kemal is wrong, he started from A (and went to B)	B1	
	No and a correct method/drawing shown in either box	B1	
	No, the bearing should be reflex	B1	
	No, he did A to B (not A from B)	B1	
	No, should be anticlockwise	B0	
	No, measured the wrong way around	B0	
	No, bearing would be 260	B0	
	(It should be) 280 (not sufficient to imply 'no')	B0	
	No, he measured from A which is 100 but you're meant to measure from B which is 170	B0	
	Bearing should start from B (should is not sufficient to imply 'no')	B0	
	Not measured from B	B0	
	Started from A (and went to B)	B0	
	No, it's from the wrong place	B0	

Question	Answer	Mark	Comments
16(b)	No and correct reason	B1	eg No, it's North East No, NW is 315(°)
	Additional Guidance		
	Reasoning may be seen on diagram. The angles do not need to be accurate if intention is clear.		
	No, you've gone anticlockwise		B1
	No, NW lies between 270 and 360 (but 045 is between 0 and 90)		B1
	No, D is NE of C		B1
	Do not accept incorrect statements eg No, North West is 225°		B0
	No, C is SW of D (true but not referencing what Nina says)		B0
	045 is NE		B0
	D is NE of C		B0
	No, it will be larger		B0

Question	Answer	Mark	Comments
16(c)	Line drawn due South from *E* (any length) or [4.3, 5.1]	M1	mark intention on 'south' mark intention on 'line' accept a cross on coast roughly south of E
	their value × 100	M1	[430, 510] implies M2 eg 1.3 × 100
	[450, 490] and correct for their value	A1	SC1 600 [450, 490] scores M1M1A1 unless error seen
	Additional Guidance		
	Line drawn or no line drawn and 4.6 × 100 = 465 (within range but not correct for their value)		M1M1A0
	No line drawn and 4.2 × 100 = 420		M0M1A0
	600 may score up to M2, only award SC1 if M0 scored		
	If line goes North as well as South of E, working must choose the South direction length (in range) for at least 1st M1 (but 2nd M1 could still be scored)		
	If line does not reach coast or goes beyond coast, full marks can still be awarded for a correct method with correct answer within range		
	Ignore units throughout eg 4.8 × 100 = 480 cm		M1M1A1
17(a)	28 : 12 or 14 : 6 or 56 ÷ 8 and 24 ÷ 8 (may be done in stages) or 3 and 7 seen	M1	
	7 : 3	A1	
17(b)	1.25 : 1	B1	oe eg $\frac{5}{4}:1$

Question	Answer	Mark	Comments
17(c)	180 ÷ (1 + 9) or 18 or 162	M1	
	18 and 162	A1	
	Additional Guidance		
	162 and 18		M1A0
	Build-up method will score 2 or 0 eg 1 : 9 2 : 18 does not score M1 for 18		

Question	Answer	Mark	Comments
18	Valid statement about proportion	B1	eg there were more 41s or over than 40s or under
	Valid statement about average	B1	eg the average listening time of the 41s or over was higher
	Valid statement about spread	B1	eg the listening times of the 41s or over were more spread out
	Additional Guidance		
	Do not allow incorrect values supporting statements (eg a miscalculation) but repeating the values in context is acceptable		
	Condone irrelevant statements with correct statements		
	Student statements may not be in the same order as the measures in the table		
	Accept 'older people' for 41s or over and 'younger people' for 40s or under similarly accept over 40s to stand for 41s and over (oe)		
	Proportion of the audience statements		
	There were more over 41s	B1	
	They are mostly over 41	B1	
	There were 58% more over 41s than 40s and under	B1	
	The proportion / % / percentage of over 41s is higher	B1	
	Over 41s are a higher proportion than 40s and under	B1	
	Less 40 and under than over 41	B1	
	The 40 and unders were 21%, the over 41 were 79%	B1	
	The 40s and under were 21% which is less than half/quarter	B1	
	The 40s and under were 21%	B0	
	The difference is 58%	B0	
	Additional Guidance continues on the next page		

Question	Answer	Mark	Comments
18 cont	**Average listening time statements**		
	The over 41s had a higher mean	B1	
	Over 41s listened for 5.1h more (on average)	B1	
	Over 41s listened longer (on average) than the 40s and under	B1	
	41+ longer listening (on average)	B1	
	(More/most) 40s and under listened less than the over 41s (on average)	B1	
	Average listening 5.1 hours difference	B0	
	Spread of listening time statements		
	The over 41s had a higher range	B1	
	More of a time gap in the over 41s than the 40s and under	B1	
	Over 41s have a higher spread	B1	
	40s and under times are closer together than over 41s	B1	
	Over 41s have a wider listening time range	B1	
	The 41 and over listening time gap was high, the under 40 listening time gap was low	B1	
	40 and under is 4.5, 41 or over is 13.9	B1	
	40 and under listen to the radio 4.5 hours, 41 or over listen to the radio 13.9 hours	B0	
	The difference in range is 9.4	B0	
	Listening times were quite close together	B0	
	The 41 and over listening times gap was high	B0	

Question	Answer	Mark	Comments
19(a)	5	B1	
	Additional Guidance		
	Condone 10 – 5 = 5		B1
	Condone $x = 5$		B1
	$\frac{10}{2}$		B0
19(b)	–10	B1	

Question	Answer	Mark	Comments
19(c)	Unsimplified expression in a, b and c which would evaluate to 23	M1	eg $2(4a - 2b) + a + c$ or $8a - 4b + a + c$ or $11(a + c) - (4a - 2b)$ or $11a + 11c - 4a + 2b$
	Simplified expression in a, b and c which would evaluate to 23	A1	eg $9a - 4b + c$ $7a + 2b + 11c$ SC2 Values assigned to a, b and c which satisfy original equations and expression given which has value 23 eg $a = 3, b = 1, c = 0$ and $7a + 2b + c$
	Additional Guidance		
	There are infinitely many correct solutions. Allow solutions where the coefficients are not integers if initial working is shown. eg $3(4a - 2b) - \frac{7}{3}(a + c) = \frac{29}{3}a - 6b - \frac{7}{3}c$	M1A1	
	$5a - 2b + c + 10 = 23$	M1A1	
	Condone '= 23' after the expression		
	Answer using only two variables eg $2.3(4a - 2b)$	M0A0	

20(a)	9.7×10^{-4}	B1	
	Additional Guidance		
	Condone $9.7 . 10^{-4}$ or $9.7 \cdot 10^{-4}$	B1	
	Ignore zeroes before the '9' eg 00009.7×10^{-4}	B1	
	$9.7 \times 10^{4-}$	B0	

Question	Answer	Mark	Comments
20(b)	300 000 and 4000 or $(10^5 \div 10^3 =)\ 10^2$ or $(10^5 \div 10^3 =)\ 100$ or $7.5 \times 10^{(1)}$ or 75×10^0 or $\frac{3 \times 10^2}{4}$ or $\frac{300}{4}$	M1	
	75	A1	
	Additional Guidance		
	If the answer is given in standard form and as 75 the student must indicate that 75 is their chosen answer or it must be the final answer given eg1 $7.5 \times 10^{(1)} = 75$ on the answer line eg2 $75 = 7.5 \times 10^{(1)}$ on the answer line		M1A1 M1A0
	$\frac{300}{4}$ or 75 from incorrect working scores zero eg1 $3 \times 10^5 = 30\,000$ and $4 \times 10^3 = 400$ and $30\,000 \div 400 = \frac{300}{4} = 75$ eg2 $\frac{30\,000}{400} = 75$		M0A0 M0A0
	For the method mark, ignore incorrect work from a correct expression eg $0.75 \times 10^2 = 7.5 \times 10^3$		M1A0
	If the student attempts two methods (simplifying the powers and attempting to convert to ordinary numbers) mark both methods and award the higher mark		

Question	Answer	Mark	Comments
21(a)	$\frac{1}{6}$ on '1' and $\frac{1}{3}$ or $\frac{2}{6}$ on '2 or 3' and $\frac{1}{2}$ on each of 'Odd' and 'Even'	B2	oe fraction, decimal or percentage B1 $\frac{1}{6}$ on '1' and $\frac{1}{3}$ or $\frac{2}{6}$ on '2 or 3' or $\frac{1}{2}$ on each of 'Odd' and 'Even' or all correct unsimplified probabilities with one or more simplification errors eg $\frac{3}{6}$ on 'Odd' simplified to $\frac{1}{3}$
	Additional Guidance		
	Accept decimals or percentages rounded or truncated correctly to at least 2 significant figures		
	Only withhold a mark for simplification errors if B2 would otherwise be awarded		
	Ignore extra branches added		
	Ignore attempts to work out combined probabilities to the right of the tree diagram		
	If an answer line is blank, the student may have written their answer elsewhere on the branch		

Question	Answer	Mark	Comments
21(b)	**Alternative method 1: P(1) + P(4, 5 or 6) × P(Odd)**		
	$\frac{1}{2}$ × their $\frac{1}{2}$ or $\frac{1}{4}$	M1	oe
	their $\frac{1}{4}$ + their $\frac{1}{6}$	M1dep	oe
	(P(win) =) $\frac{10}{24}$ or $\frac{5}{12}$	A1ft	oe ft their tree diagram
	Lose (and P(Lose) = $\frac{14}{24}$ or $\frac{7}{12}$ oe)	A1ft	ft correct decision for their $\frac{5}{12}$ (and their $\frac{7}{12}$) with M2 scored
	Alternative method 2: 1 – P(2 or 3) – P(4, 5 or 6) × P(Even)		
	$\frac{1}{2}$ × their $\frac{1}{2}$ or $\frac{1}{4}$	M1	oe
	their $\frac{1}{4}$ + their $\frac{1}{3}$ or P(lose) = $\frac{7}{12}$	M1dep	oe ft their tree diagram
	(P(win) =) $\frac{10}{24}$ or $\frac{5}{12}$	A1ft	oe ft their tree diagram
	Lose (and P(Lose) = $\frac{14}{24}$ or $\frac{7}{12}$ oe)	A1ft	ft correct decision for their $\frac{5}{12}$ (and their $\frac{7}{12}$) with M2 scored
	Additional Guidance is on the following page		

Question	Answer	Mark	Comments

	Additional Guidance	
21(b) cont	Check the tree diagram for working	
	Any 'their' or ft probability must be > 0 and < 1 for marks to be awarded	
	For the second A1ft, the ft can be from an incorrect tree (which may score 4 marks) or an arithmetic error (which scores 3 marks, M1M1A0A1ft)	
	Accept equivalent fractions or decimals within calculations and equivalent fractions, decimals or percentages for final probabilities	
	Accept decimals or percentages rounded or truncated correctly to at least 2 significant figures	
	Condone $\frac{1}{2} \times$ their $\frac{1}{2}$ as part of a longer, incorrect multiplication eg $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{6}$	M1M0A0A0
	Condone decimals used within fractions eg P(Win) = $\frac{2.5}{6}$	at least M1M1A1
	For the method marks, condone incorrect mathematical notation eg $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4} + \frac{1}{6} = \ldots$	at least M1M1 (may go on to score 3 or 4 marks)
	For the second A1ft, if the student gives a value for P(Lose), their P(Win) + their P(Lose) must equal 1 However, allow a comparison to $\frac{1}{2}$ unless it is clearly an incorrect value for P(Lose)	

Question	Answer	Mark	Comments
22	**Alternative method 1**		
	$3 \div \frac{20}{100}$ or 3×5 or 15 or 3×6	M1	oe
	18	A1	
	Alternative method 2		
	$1.2x = x + 3$	M1	oe equation
	18	A1	
	Additional Guidance		
	Trial and improvement scores 0 or 2 unless M1 can be awarded for 15		
	15 seen scores M1		

Question	Answer	Mark	Comments
23	$(3^{12} =)$ 531 441 or $(3^5 =)$ 243 or $(3^{12} \div 3^5 =) 3^7$ or $(3^{12} \div 3^5 =)$ 2187 or $(3^2 \times 3 =) 3^3$ or $(3^2 \times 3 =)$ 27 or $3^{12} \div 3^5 \div 3^2 \div 3$ or $\frac{3^{12}}{3^5} \times \frac{1}{3^2 \times 3}$	M1	
	$3^7 \div 3^3$ or $3^7 \div 27$ or $3^{(12-5-2-1)}$ or $\frac{3^{12}}{3^8}$ or 3^4 or 2187 ÷ 27	M1dep	oe in the form $3^n \div 3^{(n-4)}$
	81	A1	
	Additional Guidance		
	3^4 and 81 on the answer line in either order		M1M1A1
	81 in working and 3^4 on the answer line		M1M1A0

Question	Answer	Mark	Comments
24(a)	$-a$	B1	
24(b)	$\frac{1}{c}$	B1	

Question	Answer	Mark	Comments
25	**Alternative method 1: areas**		
	$\pi \times 10^2$ or 100π	M1	implied by [314, 314.2]
	$\pi \times (8 \div 2)^2$ or $\pi \times 4^2$ or 16π or $\pi \times (8 \div 2)^2 \div 2$ or $\pi \times 4^2 \div 2$ or $16\pi \div 2$ or 8π	M1	implied by [50.2, 50.3] or [25.12, 25.14] 92π or 84π or 92 : 8 or 8 : 92 or 84 : 16 or 16 : 84 implies M1M1
	(their $100(\pi)$ – their $8(\pi)$) ÷ their $8(\pi)$ or $92(\pi) \div 8(\pi)$ or their $100(\pi) \div$ their $8(\pi)$ (– 1) or $12\frac{1}{2}$ (– 1) or 12.5 (– 1)	M1dep	dep on M2 absence of π must be consistent condone $16(\pi)$ as their $8(\pi)$ in first calculation only, ie condone (their $100(\pi)$ – their $16(\pi)$) ÷ their $16(\pi)$ or $84(\pi) \div 16(\pi)$, but not their $100(\pi) \div$ their $16(\pi)$ (– 1)
	$11\frac{1}{2}$ or 11.5	A1	condone $\frac{23}{2}$
	Alternative method 2: scale factor		
	$\frac{10}{8 \div 2}$ or $\frac{10}{4}$ or $\frac{5}{2}$ or $\frac{10 \times 2}{8}$ or $\frac{20}{8}$ or 2.5	M1	oe scale factor of lengths eg $\frac{2}{5}$ or 0.4 accept 2 : 5 or 5 : 2 oe ratio π may be present, but must be consistent in numerator and denominator
	(their $\frac{5}{2}$)^2 or $\frac{25}{4}$	M1dep	oe scale factor of areas eg $\frac{4}{25}$ accept 4 : 25 or 25 : 4 oe ratio
	2 × their $\frac{25}{4}$ (– 1) or $\frac{25}{2}$ (– 1) or $12\frac{1}{2}$ (– 1) or 12.5 (– 1)	M1dep	oe eg 2 ÷ their $\frac{4}{25}$ (– 1)
	$11\frac{1}{2}$ or 11.5	A1	condone $\frac{23}{2}$
	Additional Guidance is on the following page		

Question	Answer	Mark	Comments

	Additional Guidance	
25 (cont)	Accept, for example, $\pi 8$ or $\pi \times 8$ or $8 \times \pi$ for 8π	
	An answer of 11.5π with no incorrect working	M1M1M1A0
	Consistent use of πd^2 for the area of a circle gives the area of the circle as 400π, the area of the semicircle as 32π and the area of the shaded part as 368π. This also gives the answer 11.5, but scores zero	M0M0M0A0
	Irrespective of where their answer comes from and the presence of other measures such as circumference, students can gain the first two marks of alternative method 1 if it is clear that the methods or values given are for area eg 1 Big area = 100π, little area = 8π, big circumference = 20π, little circumference = 4π, $20 \div 4 = 5$ eg 2 100π, 8π, 20π, 4π	M1M1M0A0 M0M0
	Do not award the second mark if the value of 8π comes from πd This is implied by, eg, 'Area of circle = 20π, area of semi-circle = 8π'	M?M0 M0M0
	$\frac{100(\pi)-16(\pi)}{16(\pi)}$ (which may give an answer of 5.25)	M1M1M1A0
	$\frac{100(\pi)}{16(\pi)}$ (which may give an answer of 6.25)	M1M1M0A0

Question	Answer	Mark	Comments
26(a)	Plots the points (1, 60), (2, 30), (3, 20) and (4, 15)	M1	$\pm \frac{1}{2}$ small square
	Correct smooth curve through correct four points	A1	$\pm \frac{1}{2}$ small square
	Additional Guidance		
	Ignore any calculations and mark the graph only		
	Points cannot be implied by a bar chart or vertical line graph, but condone crosses at the top of a vertical line graph for M1 and the correct curve superimposed for M1A1		
	For M1, ignore the curve outside the domain $1 \leqslant t \leqslant 4$ For A1, whether or not the curve extends outside the domain $1 \leqslant t \leqslant 4$ it must not have a positive gradient at any point		
	If there is no curve, for M1 there must be no other points with x-coordinate 1, 2, 3 or 4		
	The curve should be a single line with no feathering		
	Unless it affects the shape of the curve (in which case A1 cannot be awarded), ignore incorrect evaluations of 60 ÷ a non-integer value eg 60 ÷ 1.5 = …		

Question	Answer	Mark	Comments
26(b)	Vertical line from $3\frac{1}{2}$ minutes to their graph	M1	$\pm \frac{1}{2}$ small square implied by mark at correct place on the graph or on the vertical axis (but not on the horizontal axis) or by correct reading from their graph
	Correct reading from their graph for t = 3.5	A1ft	ft their graph $\pm \frac{1}{2}$ small square
	Additional Guidance		
	Correct reading for their graph, with or without evidence of using graph		M1A1
	No graph in (a)		M0A0
	To score any marks, their graph must be decreasing in the domain $1 \leqslant t \leqslant 4$, but may be a straight line or series of connected straight lines		
	Answer from 60 ÷ 3.5 with no graph, or which does not match graph		M0A0
	Reading from 3.3		M0A0

Question	Answer	Mark	Comments
27	**Alternative method 1 – add 6 to both sides first**		
	$x + 6 = 2y$ or $-x - 6 = -2y$ or $\frac{x+6}{2}$ or $\frac{x}{2} + 3$ or $\frac{1}{2}(x + 6)$	M1	oe
	$y = \frac{x+6}{2}$ or $y = \frac{x}{2} + 3$ or $y = \frac{1}{2}(x + 6)$	A1	allow order reversed do not allow further incorrect work eg attempts to divide only the 6 by 2 Condone $y = (x+6) \div 2$ for M1A1
	Alternative method 2 – divide both sides by 2 first		
	$\frac{x}{2} = y - \frac{6}{2}$ or $\frac{x}{2} = y - 3$ or $\frac{x+6}{2}$ or $\frac{x}{2} + 3$ or $\frac{1}{2}(x + 6)$	M1	allow $\frac{2y}{2}$ for y
	$y = \frac{x+6}{2}$ or $y = \frac{x}{2} + 3$ or $y = \frac{1}{2}(x + 6)$	A1	allow order reversed do not allow further incorrect work eg attempts to divide only the 6 by 2 Condone $y = (x+6) \div 2$ for M1A1
	Alternative method 3 – flow diagram		
	$y \rightarrow 2y \rightarrow 2y - 6$ $\leftarrow x + 6 \leftarrow x$	M1	allow $2 \times y$ or $y \times 2$ for $2y$ ignore any operations seen on arrows
	$y = \frac{x+6}{2}$ or $y = \frac{x}{2} + 3$ or $y = \frac{1}{2}(x + 6)$	A1	allow order reversed do not allow further incorrect work eg attempts to divide only the 6 by 2 Condone $y = (x+6) \div 2$ for M1A1
	Additional Guidance		
	Allow 0.5 for $\frac{1}{2}$ throughout		

Question	Answer	Mark	Comments
28	$x^2 + 5x - x - 5$	M1	three or four terms with three correct $x^2 + 4x + k$ implies M1
	$x^2 + 4x - 5$	A1	
	Additional Guidance		
	Further work, eg $x^2 + 4x - 5 = 5x - 5$		M1A0
	$y = x^2 + 4x - 5$ or $x^2 + 4x - 5 = 0$		M1A0
	$x^2 + 4x - 4$		M1A0
	$x^2 + 4x$		M1A0
	Condone $1x$ for x eg $x^2 + 5x - 1x - 5$		at least M1
	Terms may be seen in the grid method or in a list where a plus sign can be implied		