GCSE
MATHEMATICS
8300/3F

Foundation Tier Paper 3 Calculator

Mark scheme

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23BG8300/3F/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 Examiner.

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 $a \leqslant$ 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.

Q	Answer	Mark	Comments
1	17	B1	

Q	Answer	Mark	Comments
2	700 or (seven) hundred(s)	B1	accept 100(s) ignore spelling, mark intention

Q	Answer	Mark	Comments
3(a)	Equilateral	B1	ignore spelling, mark intention

Q	Answer	Mark	Comments
3(b)	Chord	B1	ignore spelling, mark intention

Q	Answer	Mark	Comments
4	1, 3, 5, 9, 15, 45	B2	any order B1 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		
	Allow values given in products or 'coordinates' eg1 1 × 45, 3 × 15, 5 × 9 eg2 (1, 45), (3, 15)		 B2 B1
	Lists with repeated values cannot score B2, but ignore repeated values in any format for B1 eg1 1, 3, 5, 9, 9 eg2 1 × 45, 3 × 15, 5 × 9, 45 × 1, 15 × 3, 9 × 5		 B1 B1

Q	Answer	Mark	Comments
5(a)	$15^2 - 2 \times 63$ or 225 or 126	M1	–126 implies M1
	99	A1	

Q	Answer	Mark	Comments
5(b)	$m - k$ or $-k + m$	B1	

Q	Answer	Mark	Comments
6(a)	(5, 3)	B1	may be seen on diagram

Q	Answer	Mark	Comments
6(b)	16	B1	may be seen on diagram

Q	Answer	Mark	Comments
7	99.2(0) ÷ 5 × 24 or 19.84 × 24 or 4.8 × 99.2(0) or 2380.8(0) ÷ 5 or $\frac{11904}{25}$	M2	oe M1 99.2(0) ÷ 5 or 19.84 oe or 24 ÷ 5 or 4.8 oe or 24 × 99.2(0) or 2380.8(0) oe
	476.16	A1	
	Additional Guidance		
	(One year's broadband cost) 238.08 oe implies M1		

Q	Answer	Mark	Comments
8	69.3	B2	B1 3.8 × 6.75 × 2.7 oe or $\frac{13\,851}{200}$ or 69.25(5) or 69.2(6) or correct rounding to 1 dp of a number to 2 dp or more, other than 6.75
	Additional Guidance		
	(3.8 + 6.75 + 2.7 =) 13.25 and answer 13.3		B1

Q	Answer	Mark	Comments
9	Key is missing	B1	oe implied by correct key drawn
	Symbols are inconsistent	B1	oe eg Prawn Cocktail should have half a symbol or eg if Prawn Cocktail is right the others are wrong or eg total is incorrect
	Additional Guidance		
	Ignore irrelevant or incorrect statements		
	Examples of 'Key is missing' for B1 Not labelled what each quarter represents Hasn't said what a full circle shows Doesn't say how many people is one piece		
	Examples of 'Symbols are inconsistent' for B1 Nicki's total is 32 not 30 The pictogram has inconsistent values 4 for PC it should be 2 Prawn Cocktail is the wrong amount Prawn Cocktail is two, but there's a whole circle		
	Incorrect results displayed on chart		B0

Q	Answer	Mark	Comments
10	0.84 × 1.75 or 1.47 or 84 × 1.75 or 147	M1	oe
	9.03 – their 1.47 or 7.56 or 903 – their 147 or 756	M1	oe their 1.47 < 9.03 their 147 < 903 units must be consistent unless recovered
	their 7.56 ÷ 4 or their 756 ÷ 4 or 189	M1dep	oe dep on 2nd M
	1.89	A1	
	Additional Guidance		
	Up to M3 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Accept 189 on answer line with £ crossed out and p(ence) added		
	9.03 – 1.68 = 7.35		M0M1
	9.03 – 1.68 and 7.35 ÷ 4		M0M1M1

Q	Answer	Mark	Comments
11(a)	$10x + 4y - 6$ or $2(5x + 2y - 3)$	B3	any order B2 two terms correct B1 one term correct
	Additional Guidance		
	B1 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Further incorrect work after a B3 response is B2 eg1 $10x + 4y - 6 = 8xy$ eg2 $10x + 4y - 6$ and $10x = -10$ eg3 $10x + 4y - 6$ and $2(5x + 2y - 6)$		B2
	Further incorrect work after a B2 or B1 response is B1 eg1 $10x + 4y + 6 = 20xy$ eg2 $10x - 4y + 6$ and $10x = -2$ eg3 $10x + 4y + 6$ and $2(5x + 2y + 6)$		B1
	$10x + 4y + 6$ and $2(5x + 2y + 3)$		B2
	$10x$ and $4y$ and -6		B2

Q	Answer	Mark	Comments
11(b)	$\frac{a^2}{2}$	B1	accept any indication

Q	Answer	Mark	Comments
12	Maths Drama English (MDE) Maths Drama Spanish (MDS) Maths Drama Biology (MDB) Maths Drama Art (MDA) Maths English Spanish (MES) Maths English Biology (MEB) Maths English Art (MEA)	B3	any order of subjects and/or rows B2 5 or 6 rows correct B1 3 or 4 rows correct
	Additional Guidance		
	Accept any indication for subject		
	Allow repeats and additional rows for up to B2		

Q	Answer	Mark	Comments
13(a)	0.09 × 1400	M1	oe
	126	A1	
	Additional Guidance		
	M1 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Do not ignore further working after 126 seen		
	Do not allow a misread of 0.9 for 0.09		
	1400 – 126 = 1274 in working	M1	
	$\frac{126}{1400}$ in working	M1	
	$\frac{126}{1400}$ on answer line	M1A0	

Q	Answer	Mark	Comments
13(b)	**Alternative method 1**		
	0.67 + 0.48 = 1.15 and the sum (of the probabilities) is greater than 1 **or** 0.67 + 0.48 = 1.15 and 0.15 study both **or** 0.67 + 0.48 = 1.15 and more than the total number of students at school	B2	oe B1 1.15 oe or the sum (of the probabilities) is greater than 1 or 0.15 oe
	Alternative method 2		
	938 + 672 = 1610 and more than the total number of students at school **or** 938 + 672 = 1610 and the total (number of students) is greater than 1400 **or** 938 and 672 and 210 study both	B2	oe B1 0.67 × 1400 oe and 0.48 × 1400 oe or 938 and 672 or 1610 or the total (number of students) is greater than 1400 or 210

Additional Guidance continues on the next page

	Additional Guidance	
13(b) cont	B1 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts	
	$938 + 672 = 1610$ and $1610 > 1400$	B2
	$938 + 672 = 1610$ and students doing both as more than the total	B2
	$0.67 + 0.48 = 1.15$ and $1.15 > 1$	B2
	$67 + 48 = 115$ and students doing both as over 100	B2
	$67 + 48 = 115$ and 15% doing both	B2
	$67 + 48 = 115$ and 15 doing both	B1
	$0.67 + 0.48 = 1.15$ and needs to add to one	B1
	$67 + 48 = 115$	B1
	$0.67 + 0.48 = 1.15$ and students doing both as over 100 (must be consistent form for comparison)	B1
	$\frac{938}{1400}$ and $\frac{672}{1400}$	B1
	$0.67 + 0.48$ is more than 1	B1

Q	Answer	Mark	Comments
14	**Alternative method 1**		
	0.6 + 0.6 + 1.3 + 0.8 + 1.7 or 5	M1	oe condone one missing or incorrect distance
	their 5 × 3 or 15	M1dep	
	their 15 × 0.4(0) + 3 × 1.35 or 6(.00) + 4.05	M1dep	oe working in pence their 15 can be a truncated or rounded up decimal
	10.05	A1	SC2 6.05
	Alternative method 2		
	0.6 × 3 or 1.8 or 1.2 × 3 or 3.6 or 1.3 × 3 or 3.9 or 0.8 × 3 or 2.4 or 1.7 × 3 or 5.1	M1	
	0.6 × 3 + 0.6 × 3 + 1.3 × 3 + 0.8 × 3 + 1.7 × 3 or 1.8 + 1.8 + 3.9 + 2.4 + 5.1 or 15	M1dep	oe condone one missing or incorrect distance
	their 15 × 0.4(0) + 3 × 1.35 or 6(.00) + 4.05	M1dep	oe working in pence their 15 can be a truncated or rounded up decimal
	10.05	A1	SC2 6.05

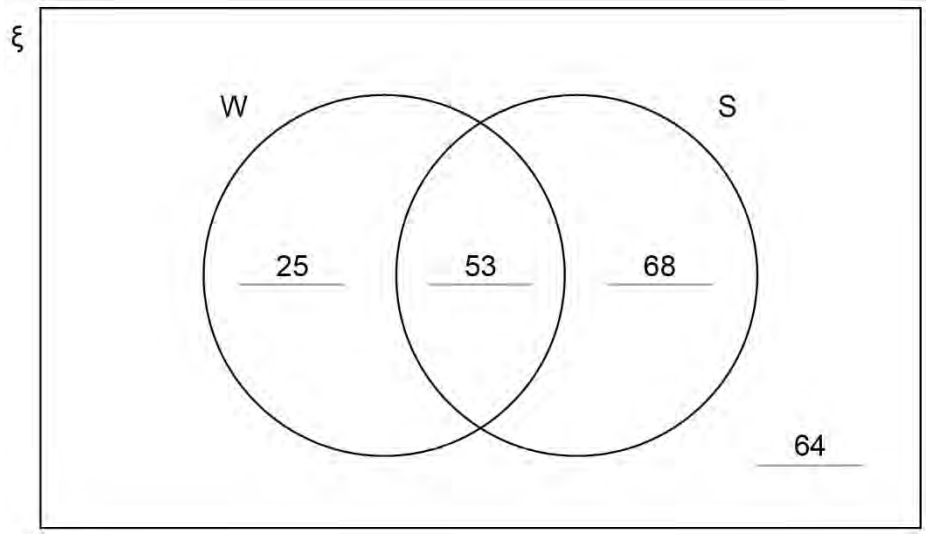
Mark scheme and Additional Guidance continue on the next page

14 cont	**Alternative method 3**		
	0.6 × 3 or 1.8 or 1.2 × 3 or 3.6 or 1.3 × 3 or 3.9 or 0.8 × 3 or 2.4 or 1.7 × 3 or 5.1	M1	
	0.6 × 3 × 0.4 or 0.72 or 1.2 × 3 × 0.4 or 1.44 or 1.3 × 3 × 0.4 or 1.56 or 0.8 × 3 × 0.4 or 0.96 or 1.7 × 3 × 0.4 or 2.04	M1dep	oe working in pence
	0.6 × 3 × 0.4 × 2 + 1.3 × 3 × 0.4 + 0.8 × 3 × 0.4 + 1.7 × 3 × 0.4 + 3 × 1.35 or 0.72 × 2 + 1.56 + 0.96 + 2.04 + 3 × 1.35 or 6(.00) + 4.05	M1dep	oe working in pence condone one missing or incorrect distance
	10.05	A1	SC2 6.05
	Additional Guidance		
	Units must be consistent unless recovered		
	All correct except for missing the return distance from A eg 0.6 + 1.3 + 0.8 + 1.7 or 4.4 4.4 × 3 = 13.2 13.2 × 0.4 + 3 × 1.35 = 9.33		M1M1M1A0
	Example using their 15 truncated or rounded up for each mile 0.6 + 1.3 + 0.8 + 1.7 or 4.4 4.4 × 3 = 13.2 13 × 0.4 + 3 × 1.35 = 9.25 or 14 × 0.4 + 3 × 1.35 = 9.65		M1M1M1A0
	3.6 + 3.9 + 5.1 (BC missing)		M1M1
	3.9 + 2.4 + 5.1 without further working (TA and AT missing)		M1M0

Q	Answer	Mark	Comments	
15	30 ÷ 6 + 18 or 5 + 18	M1	oe	
	23	A1	23 may be in either output oval	
	3 × 30 – a = their 23 or 90 – a = their 23 or 3 × 30 – their 23 (= a) or 90 – their 23 (= a)	M1	oe	
	67	A1ft	ft 90 – their 23	
	Additional Guidance			
	Answer 67			M1A1M1A1
	90 – 67 = 23 shown in working without 67 on answer line			M1A1M1A0
	For the ft marks allow decimal or fractional answers eg 30 ÷ 6 + 18 = 1.25 90 – 1.25 = 88.75			M1A0M1A1ft
	$\frac{23+a}{3}=30$			M1A1M1
	23 + a ÷ 3 = 30			M1A1M0
	Allow their 23 to come from working or the first output oval eg 12 written in the first output oval, then answer 78			M0A0M1A1ft

Q	Answer	Mark	Comments
16	**Alternative method 1**		
	$\left(\frac{3}{4}=\right)$ 0.75 or $\left(4\frac{1}{5}=\right)$ 4.2	M1	
	2.5 – 0.75 or 1.75 and 4.2 – 2.5 or 1.7	M1dep	
	$4\frac{1}{5}$ with 1.75 and 1.7 seen	A1	
	Alternative method 2		
	$\left(4\frac{1}{5}=\right)\ \frac{21}{5}$ or (2.5 =) $\frac{5}{2}$	M1	oe improper fraction
	$\left(\frac{3}{4}=\right)\ \frac{15}{20}$ and $\left(4\frac{1}{5}=\right)\ \frac{84}{20}$ and (2.5 =) $\frac{50}{20}$	M1dep	oe with common denominators
	$4\frac{1}{5}$ with 35 and 34 seen or $4\frac{1}{5}$ with $\frac{35}{20}$ and $\frac{34}{20}$ seen	A1	35 and 34 may be implied by the correct multiples of 35 and 34 dependent on the common denominator used oe with common denominators
	Additional Guidance		
	Condone $4\frac{1}{5}$ with (2.5 – 0.75 =) 1.75 and (2.5 – 4.2 =) –1.7		M1M1A1

Q	Answer	Mark	Comments
17	750 – 400 or 1100 – 750 or (1100 – 400) ÷ 2 or 350	M1	oe
	1100 + their 350 or 1450 or 1100 + 2 × their 350 or 1800	M1dep	oe
	Addition or correct total of their Level 1 to Level 5 scores	M1	their Level 4 and Level 5 scores must not be zero or blank 5500 implies M3
	4250	A1	SC2 550
	Additional Guidance		
	SC2 550 is for using Level 5 score 1800 as the highest possible score		
	Embedded answer eg 4250 + 1250 = 5500 without 4250 as their answer		M1M1M1A0

Q	Answer	Mark	Comments
18	25 in W only	B1	
	53 in the intersection	B1	
	68 in S only	B1	
	64 outside the circles	B1	
	Additional Guidance		
			B1B1B1B1

Q	Answer	Mark	Comment
19	7.5 cm ⩽ length < 8.5 cm	B2	B1 one length correct in correct position SC1 8.5 cm ⩽ length < 7.5 cm
	Additional Guidance		
	Accept $8.4\dot{9}$ for 8.5		

Q	Answer	Mark	Comments
20	mean of grouped data	B1	accept any indication

Q	Answer	Mark	Comment
21	Method to calculate the increase on the salary or the decrease to the bonus or decimal multiplier 1.06 or 0.91	M1	eg 26 000 × 0.06 or 1560 or 4000 × 0.09 or 360 oe fraction
	Method to calculate the value of the increased salary or the decreased bonus or Method to calculate the difference between the increase on the salary and the decrease to the bonus	M1dep	eg 26 000 × 1.06 or 27 560 or 4000 × 0.91 or 3640 eg their 1560 – their 360 or 1200 31 200 implies M2
	Method to calculate the decimal multiplier or percentage of the total annual pay or 1.04 or 104(%) or Method to calculate the decimal multiplier or percentage change in the total annual pay or 0.04 or 4(%)	M1	eg $\frac{31\,200}{30\,000}$ oe eg $\frac{\text{their } 1560 - \text{their } 360}{26\,000 + 4000}$ or $\frac{1200}{30\,000}$ oe
	4(%) increase	A1	
	Additional Guidance		
	For first M mark do not accept a misread of increase for decrease eg 1.09		M0
	26 000 × 1.06 = 27 560 and 4000 × 1.09 = 4360 27 560 + 4360 = 31 920 and $\frac{31\,920}{30\,000}$		M1M1M1A0
	24 440 + 4360 = 28 800 and $\frac{28\,800}{30\,000}$		M0M0M1
	100 + 6 = 106%		M0
	26 000 × 1.06%		M1M0

Q	Answer	Mark	Comment
22	27 in the box on the left side of calculation	B1	accept 3^3 for 27 throughout
	Three different prime numbers in the boxes on the right side of calculation	M1	
	27 = 3 + 5 + 19 or 27 = 3 + 7 + 17 or 27 = 3 + 11 + 13	A1	numbers in the boxes on the right side of calculation can be in any order SC2 27 = 2 + 2 + 23 or 27 = 5 + 5 + 17 or 27 = 7 + 7 + 13 or 27 = 5 + 11 + 11
	Additional Guidance		
	SC2 is for using a repeated prime number		
	27 = 3 + 5 + 17		B1M1A0
	27 = 7 + 11 + 9		B1M0A0
	27 = 1 + 3 + 23		B1M0A0
	List of prime numbers with right side boxes empty or incorrect		M0

Q	Answer	Mark	Comment
23	**Alternative method 1**		
	cos chosen or used	M1	
	$\cos w = \frac{6.7}{8.3}$ or $\cos^{-1}\frac{6.7}{8.3}$	M1dep	any letter or symbol for w accept 0.807(…) or 0.81 for $\frac{6.7}{8.3}$
	[35.9, 36.2]	A1	
	Alternative method 2		
	$\sin x = \frac{6.7}{8.3}$ or $\sin^{-1}\frac{6.7}{8.3}$ or [53.8, 54.1]	M1	any letter or symbol other than w accept 0.807(…) or 0.81 for $\frac{6.7}{8.3}$
	90 – their [53.8, 54.1]	M1dep	
	[35.9, 36.2]	A1	
	Alternative method 3		
	$\sqrt{8.3^2 - 6.7^2}$ or $\sqrt{68.89 - 44.89}$ or $\sqrt{24}$ or $2\sqrt{6}$ or [4.89, 4.9] **and** $\sin^{-1}\frac{\text{their}\,[4.89, 4.9]}{8.3}$ or $\tan^{-1}\frac{\text{their}\,[4.89, 4.9]}{6.7}$	M2	full method to work out the missing length and use it correctly to work out the value of w any letter or symbol for w
	[35.9, 36.2]	A1	
	Additional Guidance		
	Use of sine rule follows Alt method 2		
	$\sin w = \frac{6.7}{8.3}$ without $\sin^{-1}\frac{6.7}{8.3}$ or [53.8, 54.1]		M0
	$\cos w = 0.807$		M1M1
	$\cos^{-1} w = \frac{6.7}{8.3}$ or $\cos = \frac{6.7}{8.3}$ unless recovered		M1M0

Q	Answer	Mark	Comment
24(a)	$\frac{1}{5}$ (Green) and $\frac{4}{5}$ (Yellow) for Bag A	B1	oe fractions, decimals or percentages
	$\frac{3}{10}$ (Green) and $\frac{7}{10}$ (Yellow) on both sections for Bag B	B1	oe fractions, decimals or percentages

Q	Answer	Mark	Comment
24(b)	their $\frac{1}{5}$ × their $\frac{3}{10}$	M1	oe fractions or decimals ft their tree diagram with 0 < both probabilities for Green < 1
	$\frac{3}{50}$ or 0.06 or 6%	A1ft	oe ft their tree diagram with 0 < both probabilities for Green < 1
	Additional Guidance		
	Ignore incorrect simplification or conversion after correct answer seen		
	3 out of 50 or 3 : 50 without working for M1		M0A0

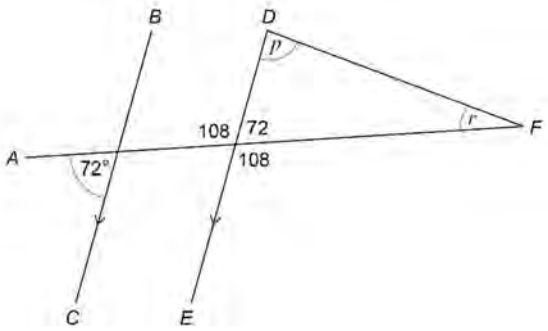
Q	Answer	Mark	Comment
25	Any correct method that would lead to an equation in x or an equation in y	M1	eg $7x - 3x = 100 - 48$ or $100 - 7x = 48 - 3x$ or $7x + 2\left(\frac{48 - 3x}{2}\right) = 100$ or $3x + 2\left(\frac{100 - 7x}{2}\right) = 48$ or $4x = 52$ or $14y - 6y = 336 - 300$ or $7\left(\frac{48 - 2y}{3}\right) + 2y = 100$ or $3\left(\frac{100 - 2y}{7}\right) + 2y = 48$ or $8y = 36$
	$x = 13$ or $y = 4.5$ or $y = 4\frac{1}{2}$ or $y = \frac{9}{2}$	A1	
	$x = 13$ and $y = 4.5$ or $y = 4\frac{1}{2}$ or $y = \frac{9}{2}$	A1	

Additional Guidance	
$(7x + 2y) - (3x + 2y) = 100 - 48$	M1
One correct value with one incorrect value (or no second value)	M1A1A0
Embedded correct values in both equations	M1A1A0
Embedded correct values in one equation only	M1A0A0

Q	Answer	Mark	Comments
26(a)	$2 \times 1.9 \times \pi$ or 3.8π or [11.9, 11.94]	M1	oe
	$2 \times 1.9 \times \pi \times 10.2$ or $3.8\pi \times 10.2$ or their [11.9, 11.94] × 10.2	M1dep	oe
	[121, 122]	A1	SC1 [115, 116]
	Additional Guidance		
	SC1 [115, 116] is from using the area of the circle		

Q	Answer	Mark	Comments
26(b)	It is equal to the area of the rectangle	B1	accept any indication

Q	Answer	Mark	Comments
26(c)	It is more than the perimeter of the rectangle	B1	accept any indication

Q	Answer	Mark	Comment
27	Angle labelled as 72 for the correct interior angle of the triangle or angle labelled as 108 for a correct exterior angle of the triangle or $3r + r + 72 = 180$ or $4r = 180 - 72$ or $4r = 108$	M1	oe 
	$\frac{180-72}{3+1}$ or $\frac{108}{4}$ or 27 or $108 \times \frac{3}{4}$ or $\frac{4p}{3} = 108$	M1dep	oe
	81	A1	