GCSE
MATHEMATICS
8300/2F

Foundation Tier Paper 2 Calculator

Mark scheme

June 2023

Version: 1.0 Final

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

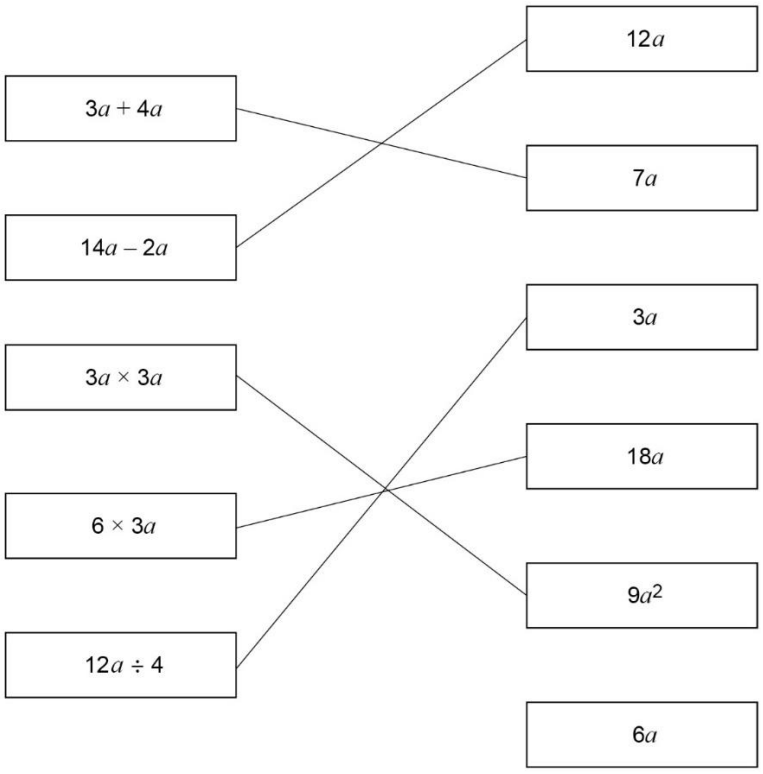
Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

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(a)	35	B1	
	Additional Guidance		
	Mark the answer line. If this is blank, the answer may be seen on the diagram		

Q	Answer	Mark	Comments
1(b)	–2	B1	
	Additional Guidance		
	Mark the answer line. If this is blank, the answer may be seen on the diagram		

Q	Answer	Mark	Comments
2	All 4 correct	B4	B1 for each box correctly matched
	Additional Guidance		
			
	Connections do not have to be straight lines		
	The line from the second box on the left was given so do not count it		
	Two or more lines from one box on the left is choice so incorrect for that box		

Q	Answer	Mark	Comments
3(a)	A and (A =) 14 and (B =) 12	B2	B1 (A =) 14 or (B =) 12 14 and / or 12 may be on the diagram accept 140 and 120
	Additional Guidance		
	Ignore reference to areas of any shapes and perimeters of the other shapes		
	Ignore units, including for 140 and 120		
	If answer line blank, accept A clearly indicated in working		
	Accept 14 on the answer line in place of A with 12 seen for B		B2

Q	Answer	Mark	Comments
3(b)	D	B1	

Q	Answer	Mark	Comments
3(c)	C and E	B1	either order

Q	Answer	Mark	Comments
3(d)	Any correct reflection of shape with corresponding mirror line shown	B2	B1 any correct reflection of shape with no or incorrect mirror line
	Additional Guidance		
	Mark intention for mirror line and shape		
	Ignore internal lines		
	For B2, if there is more than one shape and / or more than one mirror line, apply the rules of choice		
	For B1, any one correct reflection of the shape (even with other incorrect shapes) will score B1		

Q	Answer	Mark	Comments
4(a)	(4, 3)	B1	accept $\overset{x}{4}, \overset{y}{3}$
	Additional Guidance		
	Mark the answer line. If this is blank, the answer may be seen on the diagram but must be the coordinates for *P*		
	Do not allow *x* and *y* within the coordinates eg (4*x*, 3*y*)		B0

Q	Answer	Mark	Comments
4(b)	(x, –3) where $x \neq 4$	B1	accept eg $\overset{x}{5}, \overset{y}{-3}$
	Additional Guidance		
	Do not allow *x* and *y* within the coordinates eg (5*x*, –3*y*)		B0

Q	Answer	Mark	Comments
5(a)	5 ÷ 0.75 or 500 ÷ 75 or 6.6(…) or 6.7 or 75 × 6 or 450 or 0.75 × 6 or 4.5 or 75 × 7 or 525 or 0.75 × 7 or 5.25	M1	oe eg build up or build down
	6	A1	
	Additional Guidance		
	Incorrect work seen is A0 eg 75 × 6 = 450 and 75 × 7 = 575 Answer 6		M1A0
	Do not allow 5 ÷ 75 or 500 ÷ 0.75 unless recovered		
	Build up must be fully correct method, no errors, 75, 150, 225, 300, 375, 450, (525)		
	Build down must be fully correct method, no errors, 425, 350, 275, 200, 125, 50		

Q	Answer	Mark	Comments
5(b)	**Alternative method 1** Comparing the cost of 24 bottles		
	2.5 × 0.1 or 0.25 or 1 – 0.1 or 0.9	M1	oe eg 2.5 ÷ 10 discount or multiplier for shop X implied by 2.5 × 6 × 0.1 or 1.5 or 2.25
	(2.5 – their 0.25) × 6 or 2.5 × their 0.9 × 6 or 2.25 × 6 or 13.5	M1dep	oe eg 15 × 0.9 or 15 – 1.5 shop X
	7 × 2 or 14	M1	oe shop Z
	X with 13.5 and 14 seen	A1	oe
	Alternative method 2 Comparing the cost of 1 bottle		
	2.5 × 0.1 or 0.25 or 1 – 0.1 or 0.9	M1	oe eg 2.5 ÷ 10 discount or multiplier for shop X implied by 2.5 ÷ 4 × 0.1 or 0.06(25) or 2.25
	(2.5 – their 0.25) ÷ 4 or 2.5 × their 0.9 ÷ 4 or 2.25 ÷ 4 or 0.56(25) or 0.563	M1dep	oe eg 0.62(5) × 0.9 or 0.62(5) – 0.06(25) shop X
	7 ÷ 12 or 0.58(3…)	M1	oe shop Z
	X with 0.56(25) or 0.563 and 0.58(3…) seen	A1	oe
	Alternative method 3 Comparing the cost of 12 bottles		
	2.5 × 0.1 or 0.25 or 1 – 0.1 or 0.9	M1	oe eg 2.5 ÷ 10 discount or multiplier for shop X implied by 2.5 × 3 × 0.1 or 0.75 or 2.25
	(2.5 – their 0.25) × 3 or 2.5 × their 0.9 × 3 or 2.25 × 3	M1dep	oe eg 7.5 × their 0.9 or 7.5 – 0.75 shop X
	X with 6.75 (and 7) seen	A2	A1 6.75 oe

Question 5(b) continues on the next page

<table>
<tr><td rowspan="10">5(b) cont</td><td colspan="2">Additional Guidance</td></tr>
<tr><td>Up to 3 marks may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts</td><td></td></tr>
<tr><td>Use the scheme that favours the student
eg 0.56 and 0.58 followed by 13.44 and 13.92 and X (mark by Alt 2)</td><td>M3A1</td></tr>
<tr><td>Ignore incorrect money notation eg 13.5 or 14.0</td><td></td></tr>
<tr><td>All schemes can be oe in pence and allow work in a mix of pounds or pence for up to 3 marks</td><td></td></tr>
<tr><td>Condone eg answer 13.5 with 14 seen</td><td>M3A1</td></tr>
<tr><td>For 0.1 × 2.5, accept 10% × 2.5 but do not accept 10% of 2.5 unless recovered</td><td></td></tr>
<tr><td>Allow variations
eg Shop X £15, Shop Z £14,
Shop X is £1 more but the discount is £1.50
Shop X cheaper</td><td>
M1
M1M1
A1</td></tr>
<tr><td colspan="2">Where the student compares eg 2, 3, 4, 6, 48 or 96 bottles apply the principles of Alt 2 – some relevant figures given below (after offer)
<table>
<tr><th>Shop</th><th>Cost of 2</th><th>Cost of 3</th><th>Cost of 4</th><th>Cost of 6</th></tr>
<tr><td>X</td><td>1.12(5) or 1.13</td><td>1.68(75) or 1.69</td><td>2.25</td><td>3.37(5) or 3.38</td></tr>
<tr><td>Z</td><td>1.16(6…) or 1.17</td><td>1.75</td><td>2.33(3…)</td><td>3.5</td></tr>
</table></td></tr>
</table>

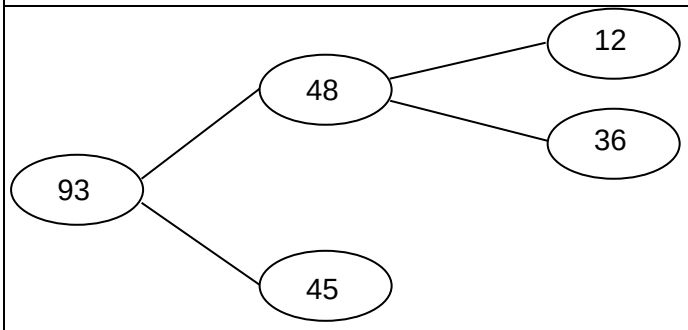
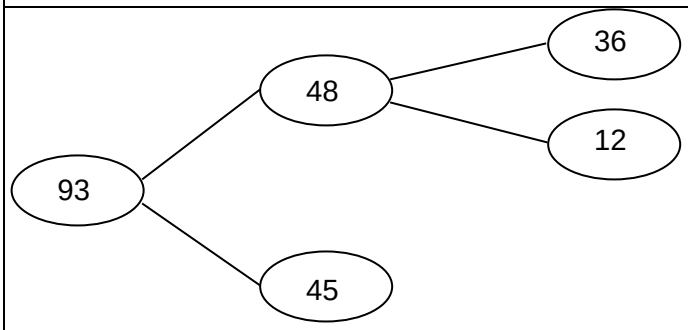
Q	Answer	Mark	Comments
6	All five extra sets ie AC or CA but not both and AD or DA but not both and BC or CB but not both and BD or DB but not both and CD or DC but not both	B2	list in any order B1 any three or four of the five correct

Additional Guidance	
Mark the grid unless blank	
Ignore extras, repeats and reversals for B1 but not for B2	

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="11">7(a)</td><td>Two even and two odd numbers
and
the numbers all different
and
the sum of the four numbers is 46</td><td>B2</td><td>any order
B1 two even and two odd numbers
and
the sum of the four numbers is 46
or
the numbers all different
and
the sum of the four numbers is 46
or
two even and two odd numbers
and
the numbers all different
and
the sum of the four numbers is [36, 56]</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td>11 + 8 + 6 + 21</td><td></td><td>B2</td></tr>
<tr><td>30 + 10 + 3 + 3</td><td>(not all different)</td><td>B1</td></tr>
<tr><td>8 + 12 + 10 + 16</td><td>(no odds)</td><td>B1</td></tr>
<tr><td>10 + 16 + 1 + 11</td><td>(not 46 but in range)</td><td>B1</td></tr>
<tr><td>15 + 10 + 15 + 10</td><td>(not all different and not 46)</td><td>B0</td></tr>
<tr><td>3 + 5 + 7 + 29</td><td>(no evens and not 46)</td><td>B0</td></tr>
<tr><td colspan="2">Negatives are acceptable for B1 or B2</td><td></td></tr>
<tr><td colspan="2">0 is an even number for B1 or B2, but a blank box does not imply 0</td><td></td></tr>
<tr><td colspan="2">Fractions and / or decimals are acceptable for four different numbers that sum to 46 for B1</td><td></td></tr>
<tr><td colspan="2">Mark the boxes</td><td></td></tr>
</table>

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="10">7(b)</td><td>3 × 10
or
6 × 5</td><td>B2</td><td>either order
B1 uses a factor of 12
and
the product of the two numbers is [24, 36]
or
uses a factor of 40
and
the product of the two numbers is [24, 36]
or
the product of the two numbers is 30</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">3 × 9</td><td>B1</td></tr>
<tr><td colspan="2">7 × 5</td><td>B1</td></tr>
<tr><td colspan="2">30 × 1</td><td>B1</td></tr>
<tr><td colspan="2">15 × 2</td><td>B1</td></tr>
<tr><td colspan="2">Fractions and / or decimals are acceptable for non-factors for B1</td><td></td></tr>
<tr><td colspan="2">Mark the boxes</td><td></td></tr>
</table>

Q	Answer	Mark	Comments
7(c)	36 ÷ 2	B2	B1 any square number > 1 or any prime number
	Additional Guidance		
	Allow squares to be written in index form for B2 or B1 eg 6^2 ÷ 2		B2
	2 ÷ 36		B1
	÷ 9		B1
	72 ÷ 4		B1
	Mark the boxes		

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="7">8(a)</td><td>45 in No (Played)</td><td>B1</td><td></td></tr>
<tr><td>36 in No (More than one game played?)</td><td>B1</td><td></td></tr>
<tr><td>12 in Yes (More than one game played?)</td><td>B1ft</td><td>ft 48 – their 36
their 36 must be a positive integer less than 48</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">Mark the frequency tree</td><td></td></tr>
<tr><td colspan="2"> 
</td><td>B1B1B1</td></tr>
<tr><td colspan="2"> 
</td><td>B1B0B1ft</td></tr>
</table>

Q	Answer	Mark	Comments	
8(b)	**Alternative method 1**			
	0.68 × 93 or 63.2(4)	M1	oe	
	64	A1		
	Alternative method 2			
	$\frac{63}{93}$ = 0.67(…) or $\frac{64}{93}$ = [0.68, 0.69]	M1	other trials can be ignored	
	64	A1		
	Additional Guidance			
	Answer only 64			M1A1
	0.69 × 93 or 64.1(7) or 64.2 with answer 64 (without seeing 0.68 × 93 or 63.2(4))			M0A0
	For 0.68 × 93, accept 68% × 93 but do not accept 68% of 93 unless recovered			

Q	Answer	Mark	Comments	
9(a)	6 × 4 or 24 or 11 × (12 – 4) or 11 × 8 or 88	M1	oe	
	112	A1		
	Additional Guidance			
	112.00(p)			M1A1
	112.0			M1A0

Q	Answer	Mark	Comments
9(b)	**Alternative method 1** Works in min or hrs for 9 episodes and 1 episode		
	9×50 or 450 or $9 \times \frac{50}{60}$ or $\frac{450}{60}$	M1	oe eg $9 \times \frac{5}{6}$ or $\frac{45}{6}$ or $\frac{15}{2}$ or 7.5
	$60 + 42$ or 102 or $\frac{102}{60}$ oe fraction or 1.7	M1	552 or 9.2 implies M1M1
	9 hours 12 minutes	A1	SC2 9 h 32 min or 6 h 32 min or 9 h 20 min
	Alternative method 2 Works in min or hrs for 9 episodes and converts to hrs and min		
	9×50 or 450 or $9 \times \frac{50}{60}$ or $\frac{450}{60}$	M1	oe eg $9 \times \frac{5}{6}$ or $\frac{45}{6}$ or $\frac{15}{2}$ or 7.5 implied by 7 h 30 min
	7 h 30 min	M1	ft conversion of their 450 to hours and minutes if their $450 > 60$ or their $\frac{450}{60}$ to hours and minutes if their $\frac{450}{60} > 1$
	9 hours 12 minutes	A1	SC2 9 h 32 min or 6 h 32 min or 9 h 20 min
	Additional Guidance		
	7 h 50 min + 1 h 42 min = 9 h 32 min		SC2
	4 h 50 min + 1 h 42 min = 6 h 32 min		SC2
	9.2 h = 9 h 20 min		SC2

Q	Answer	Mark	Comments
10(a)	1020 ÷ 5 (× 2) or 204 (× 2)	M1	oe
	408	A1	SC1 612
	Additional Guidance		
	$\frac{408}{1020}$ on answer line		M1A0
	Condone 408 out of 1020		M1A1
	For 0.4 × 1020, accept 40% × 1020 but do not accept 40% of 1020 unless recovered		

Q	Answer	Mark	Comments
10(b)	$\frac{4}{7}$	B1	oe fraction
	Additional Guidance		
	Conversion to decimal or percentage		B0

Q	Answer	Mark	Comments
10(c)	220 ÷ 250 (× 100) or 0.88	M1	oe
	88	A1	SC1 12
	Additional Guidance		
	Build-up methods must be correct or show correct method for each step		

Q	Answer	Mark	Comments
11(a)	8 in W only	B1	
	21 in (H U W)'	B1ft	ft 29 – their 8 their 8 must be < 29
	Additional Guidance		
	15 in W only 21 in (H U W)'		B0 B1
	15 in W only 14 in (H U W)'		B0 B1ft

Q	Answer	Mark	Comments
11(b)	$\frac{7}{60}$ or [0.116, 0.117] or [11.6, 11.7]%	B1	oe fraction
	Additional Guidance		
	Ignore conversion attempt to decimal, fraction or percentage (but not ratio) after correct probability seen		
	Do not allow eg 7 in 60 or 7 out of 60 unless the correct probability seen		
	Do not allow ratio		
	Ignore words if correct probability seen		

Q	Answer	Mark	Comments
11(c)	Valid explanation	B1	eg needs brackets around 35 – 19
	Additional Guidance		
	Any calculations shown must be correct		
	Ignore irrelevant, non-contradictory statements		
	It gives 25.5 and it should be 8	B1	
	(It gives the wrong answer,) it should be 8	B1	
	He shouldn't divide (by 2) first	B1	
	He needs brackets around the takeaway	B1	
	He needs to subtract first	B1	
	He should do 35 – 19 and then divide by 2	B1	
	(35 – 19) ÷ 2 (may correct the given calculation by adding brackets)	B1	
	$\frac{35-19}{2}$ (implies the brackets)	B1	
	This gives 25.5 (or 51) when he needs 8 or 16	B1	
	35 – 19 = 16 16 ÷ 2 = 8 (needs to say that this is what he should do)	B0	
	This gives 25.5 (or 51) which is too much (needs to compare with 8 or 16)	B0	
	He hasn't used BIDMAS	B0	
	It gives the wrong answer	B0	
	35 – 19 ÷ 2 = 8	B0	
	35 – 19 ÷ 2 = 25.50	B0	
	He needs brackets	B0	

Q	Answer	Mark	Comments
12	Ticks Both of them and gives valid reason for Kai eg references both values being divided (or multiplied) **by 3** and gives valid reason for Jo eg references both values being divided (or multiplied) **by 6**	B2	oe valid reason eg1 $9 \div 3 \times 2 = 6$ and $9 \div 1.5 \times 1 = 6$ or eg2 $9 \div 6 = 1.5$ and $3 \div 2 = 1.5$ and $1.5 \div 1 = 1.5$ B1 ticks Kai only and gives valid reason for Kai or ticks Jo only and gives valid reason for Jo or ticks Both of them and gives valid reason for Jo **or** Kai

Additional Guidance	
Ticks Both of them and gives correct reason for Kai or Jo and refs both values being divided (or multiplied) **by 2** (to link Jo and Kai)	B2
Accept a build-up method to imply multiplying by 3 or by 6 eg all three of 3 : 2 and 6 : 4 and 9 : 6 or all six of 1.5 : 1 and 3 : 2 and 4.5 : 3 and 6 : 4 and 7.5 : 5 and 9 : 6	
Condone eg $3 : 2 \times 3 = 9 : 6$ to imply both values are multiplied by 3	
If evaluating $6 \div 9 = 0.66$ and $2 \div 3 = 0.66$ and $1 \div 1.5 = 0.66$, accept 0.66(…) or 0.67	
3 is a factor of 9 and 2 is a factor of 6 (with no reference to × 3)	B0
$9 : 6 = 3 : 2$ or $\frac{9}{6} = \frac{3}{2}$ (not evaluated to 1.5 or shown ÷ 3)	B0
9 : 6 simplifies to 3 : 2 and 1.5 : 1 (with no reference to ÷ 3 or ÷ 6)	B0
3 : 2 and 1.5 : 1 are both equivalent to 9 : 6 (with no reference to × 3 or × 6)	B0

Q	Answer	Mark	Comments
13	Correct method or evaluation for the 25% or the 15% or correct multiplier for the increase or the decrease seen	M1	eg 28 × 0.25 or 7 or 40 × 0.15 or 6 or 1.25 or 0.85 oe
	Correct method or evaluation for either calculation	M1dep	eg 28 + 28 × 0.25 or 35 or 40 × 0.85 or 34
	Correct method or evaluation for **both** calculations	M1dep	
	35 with 34 seen	A1	oe eg 28 increased by 25% with 35 and 34 seen
	Additional Guidance		
	28 × 1.25 or 35		M1M1
	40 × 0.85 or 34		M1M1
	28 × 1.25 or 35 **and** 40 × 0.85 or 34		M1M1M1
	Build-up methods must be correct or show correct method for each step eg 1 10% = 2.8, 5% = 1.4, 25% = 7 eg 2 10% = 2.8, 5% = 2.8 ÷ 2 = 1.8, 25% = 7.4 (error in build-up but method shown for that step) eg 3 10% = 2.8, 5% = 1.8, 25% = 7.4 (error in build-up and method not shown for that step)		 M1 M1 M0
	35 and 34 seen and 35 chosen by eg circling		M3A1
	For 28 × 0.25, do not accept 28 × 25% unless recovered		

Q	Answer	Mark	Comments
14	$3(4a + 5b)$	B1	
	Additional Guidance		
	Condone missing final bracket ie $3(4a + 5b$		B1
	Allow multiplying back out to check their answer		
	Further incorrect work after a correct response is B0 eg $3(4a + 5b) = 27ab$		B0
	$3(a4 + b5)$		B0
	$3 \times (4a + 5b)$		B0

Q	Answer	Mark	Comments
15	–3, –2, –1, 0, 1	B2	any order B1 four correct and none incorrect or five correct and one incorrect
	Additional Guidance		
	–2, –1, 0, 1		B1
	–3, –2, –1, 0, 1, 2		B1
	–3, –2, –1, 1		B1
	–2, –1, 0, 1, 2		B0

Q	Answer	Mark	Comments
16	$3n + 4$ or $4 + 3n$	B2	oe eg $7 + (3n – 3)$ B1 $3n$ (+ …) or $3n$ (– …)
	Additional Guidance		
	Ignore LHS of formula given eg $T_n = 3n + 4$		B2
	Condone $n = 3n + 4$ or nth term $= 3n + 4$		B2
	Allow a multiplication sign eg $3 \times n + 4$ or $n \times 3 + 4$		B2
	Allow other variables eg $3x + 4$		B2
	$3x$		B1
	$n3$ …		B1
	$n3 + 4$		B1
	$3n$th $+ 4$		B1
	$3n$th		B0
	$3n + 4n$		B0

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="6">17</td><td>45 × 8 or 360</td><td>M1</td><td>oe
number of 2p coins
may be embedded</td></tr>
<tr><td>45 × 8 × 2
or 360 × 2
or 720 or 7.2(0)</td><td>M1dep</td><td>oe
value of 2p coins
implied by 1170 or 11.7(0)</td></tr>
<tr><td>17.7(0) – their 7.2(0) – 45 × 0.1(0)
or
1770 – their 720 – 45 × 10
or
6(.00) or 600</td><td>M1dep</td><td>oe
value of 5p coins
implied by 7.2 : 6 oe ratio not in simplest form
or 6 : 7.2 oe ratio</td></tr>
<tr><td>6 : 5</td><td>A1</td><td>accept 1.2 : 1 or $\frac{6}{5}$: 1 or $1\frac{1}{5}$: 1
or 1 : 0.83(…) or 1 : $\frac{5}{6}$</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="3">Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts</td></tr>
<tr><td colspan="3">Allow working in pence or pounds throughout</td></tr>
<tr><td colspan="3">Must work consistently in pence or pounds for the third mark (or recover)</td></tr>
<tr><td colspan="3">Ignore units in the ratio eg 6p : 5p or £1.20 : £1</td><td>M3A1</td></tr>
<tr><td colspan="3">720 may be seen in a ratio with the value of the 10p coins
eg 720 : 450 or 7.2 : 4.5</td><td>M2</td></tr>
<tr><td colspan="3">600 may be seen in a ratio with the value of the 10p coins
eg 600 : 450 or 6 : 4.5</td><td>M3</td></tr>
<tr><td colspan="4">For information:
<table>
<tr><td>Coin</td><td>10p</td><td>2p</td><td>5p</td></tr>
<tr><td>Number</td><td>45</td><td>360</td><td>120</td></tr>
<tr><td>Value</td><td>£4.50</td><td>£7.20</td><td>£6.00</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="3">18(a)</td><td colspan="3">All values correct | B2 | B1 1 or 2 rows correct</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">
<table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th></tr>
<tr><td>2x</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td></tr>
<tr><td>3x</td><td>3</td><td>6</td><td>9</td><td>12</td><td>15</td><td>18</td></tr>
<tr><td>x^2</td><td>1</td><td>4</td><td>9</td><td>16</td><td>25</td><td>36</td></tr>
</table>
</td><td>B2</td></tr>
</table>

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="5">18(b)</td><td>$\frac{8}{18}$ or $\frac{4}{9}$
or 0.44(4…) or 44(.4…)%</td><td>B1ft</td><td>oe fraction, decimal or percentage
ft their table with ⩾ 12 values
must be using 18 for the total number of possible scores</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">Ignore simplification or conversion attempt (not ratio) after correct probability seen</td><td></td></tr>
<tr><td colspan="2">Ratio answer eg 8 : 18, even alongside a correct probability is B0</td><td></td></tr>
<tr><td colspan="2">ft decimals or percentages must be correct to the same accuracy as in the scheme
eg 10 winning values in their table
$\frac{10}{18}$ or 0.55(5…) or 0.56 or 0.556 or 55(.5…)% or 56% or 55.6%</td><td>B1ft</td></tr>
</table>

Q	Answer	Mark	Comments	
18(c)	711 × their $\frac{8}{18}$	M1	oe ft their probability from (b) or if no probability in (b), ft their table with ⩾ 12 values where 0 < their probability < 1 probabilities, if rounded in (c), must be truncated or rounded to at least 2 sf	
	316	A1	SC2 395	
	Additional Guidance			
	Answer 316			M1A1
	$\frac{316}{711}$ on answer line			M1A0
	Condone 316 out of 711			M1A1
	Do not treat estimating by rounding as a misread eg1 700 used instead of 711 eg2 (b) 0.44 (c) 0.4 × 711 (rounded to 1sf in (c) for the probability) eg3 (b) 0.4 (c) 0.4 × 711 (follows through their (b))			 M0A0 M0A0 M1A0
	Do not allow ft for a ratio from (b) but may ft their (a) instead			
	For 0.44 × 711, accept 44% × 711 but do not accept 44% of 711 unless recovered			
	The method mark may be implied by a ft answer (decimal or truncated to the nearest integer or rounded up to the nearest integer) eg1 (b) $\frac{7}{18}$ (c) 276.5 or 276 or 277 (correct ft method implied using (b)) eg2 (a) completed table has 7 winning values (b) no probability shown (c) 276.5 or 276 or 277 (correct ft method implied using (a))			 M1A0 M1A0

Q	Answer	Mark	Comments
19(a)	360 ÷ 8 or 135 seen	M1	oe eg 45 × 8 = 360 or $180 - \frac{(8-2)\times 180}{8}$ may be on diagram
	45	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	45 seen but not chosen as answer, even if linked to the wrong angle		M1A0

Q	Answer	Mark	Comments
19(b)	It is less than the answer to part (a)	B1	

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="9">20</td><td>$\begin{pmatrix}4\\-3\end{pmatrix}$</td><td>B2</td><td>B1 $\begin{pmatrix}4\\...\end{pmatrix}$ or $\begin{pmatrix}...\\-3\end{pmatrix}$
SC1 $\begin{pmatrix}-4\\3\end{pmatrix}$</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">(4, –3) or $\begin{pmatrix}-3\\4\end{pmatrix}$</td><td>B0</td></tr>
<tr><td colspan="2">Ignore words if a vector is also seen
eg1 Reflection $\begin{pmatrix}4\\-3\end{pmatrix}$
eg2 4 right 3 up and $\begin{pmatrix}4\\3\end{pmatrix}$
eg3 4 right 3 down
eg4 Rotate 4 left and 3 up and $\begin{pmatrix}-4\\3\end{pmatrix}$</td><td>B2
B1
B0
SC1</td></tr>
<tr><td colspan="2">Condone any type of brackets</td><td></td></tr>
<tr><td colspan="2">Condone missing brackets for B2 or B1 or SC1 but must have two numbers in a column</td><td></td></tr>
<tr><td colspan="2">Condone ‘fraction line’ for B2 or B1 or SC1 but must have two numbers in a column</td><td></td></tr>
<tr><td colspan="2">$\begin{pmatrix}4x\\-3y\end{pmatrix}$ or $\begin{pmatrix}x4\\-y3\end{pmatrix}$ or $\begin{pmatrix}x+4\\y-3\end{pmatrix}$ or $\begin{pmatrix}4\text{ right}\\3\text{ down}\end{pmatrix}$ or $\begin{pmatrix}4\text{ r}\\3\text{ d}\end{pmatrix}$ or $\begin{pmatrix}4\ \rightarrow\\3\ \downarrow\end{pmatrix}$</td><td>B0</td></tr>
</table>

Q	Answer	Mark	Comments
21	**Alternative method 1** Compares 70% of volume of hemisphere with volume of water		
	$\frac{4}{3} \times \pi \times 12^3$ or 2304π or [7216, 7239.2] or $\frac{2}{3} \times \pi \times 12^3$ or 1152π or [3581, 3638]	M1	oe eg $\frac{4}{3}\pi \times 1728$ allow without any multiplication signs eg $\frac{4}{3}\pi 12^3$
	$0.7 \times$ their 1152π or 806.4π or [2506, 2547]	M1dep	oe $0.7 \times$ their [3581, 3638] or $\frac{4032}{5}\pi$ must be using volume of hemisphere
	325×8 or 2600	M1	oe
	[2506, 2547] and 2600 and Yes	A1	oe
	Alternative method 2 Works out volume of water as proportion of volume of hemisphere		
	$\frac{4}{3} \times \pi \times 12^3$ or 2304π or [7216, 7239.2] or $\frac{2}{3} \times \pi \times 12^3$ or 1152π or [3581, 3638]	M1	oe eg $\frac{4}{3}\pi \times 1728$ allow without any multiplication signs eg $\frac{4}{3}\pi 12^3$
	325×8 or 2600	M1	oe
	their 2600 ÷ their 1152π or [0.71, 0.73]	M1dep	oe eg their 2600 ÷ their [3581, 3638] or 72% dep on M2 must be using volume of hemisphere
	[71, 73](%) and Yes	A1	oe eg 0.72 and 0.7 and Yes

Question 21 continues on the next page

21 cont	**Alternative method 3** Works out time to fill 70% of volume of hemisphere		
	$\frac{4}{3} \times \pi \times 12^3$ or 2304π or [7216, 7239.2] or $\frac{2}{3} \times \pi \times 12^3$ or 1152π or [3581, 3638]	M1	oe eg $\frac{4}{3}\pi \times 1728$ allow without any multiplication signs eg $\frac{4}{3}\pi 12^3$
	0.7 × their 1152π or 806.4π or [2506, 2547] or their $1152\pi \div 325$ or [11, 11.2]	M1dep	oe 0.7 × their [3581, 3638] or $\frac{4032}{5}\pi$ or their [3581, 3638] ÷ 325 must be using volume of hemisphere
	0.7 × their $1152\pi \div 325$ or 0.7 × their [3581, 3638] ÷ 325 or [7.7, 7.84]	M1dep	oe their [2506, 2547] ÷ 325 or 0.7 × their [11, 11.2]
	[7.7, 7.84] and Yes	A1	oe

Question 21 continues on the next page

21 cont	**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	
	Allow 1.33(…) for $\frac{4}{3}$	
	Allow 0.66(…) or 0.67 for $\frac{2}{3}$	
	π may be seen as [3.14, 3.142] eg Alt 1 $\frac{2}{3} \times 3.14 \times 12^3$	M1
	If a number (or calculation) in terms of π is seen but π is subsequently omitted, treat as a miscopy for M marks eg Alt 1 1152π $0.7 \times 1152 = 806.4$ $325 \times 8 = 2600$ Yes	M1 M1dep M1A0
	Yes cannot be implied by inequalities	
	Alts 1 and 2 $325\,\text{cm}^3 \times 8$ seen is M1 even if evaluated incorrectly $325^3 \times 8$ seen is M0 unless recovered to 2600	
	Do not allow misreads of the given formula unless recovered eg1 using 12^2 instead of 12^3 eg2 using $\frac{3}{4}$ instead of $\frac{4}{3}$	
	For $0.7 \times$ their 1152π, do not accept $70\% \times$ their 1152π unless recovered	

Q	Answer	Mark	Comments
22	$8 \div 5$ or $19.2 \div 12$ or $\frac{8}{5}$ or $\frac{19.2}{12}$ or 1.6 or $12 \div 5$ or $19.2 \div 8$ or $\frac{12}{5}$ or $\frac{19.2}{8}$ or 2.4	M1	oe use of a valid pair of sides to make an appropriate calculation or value eg $5 \div 8$ or 0.625 or $5 \div 12$ or [0.416, 0.417]
	$8 \div 5 = 19.2 \div 12$ or $\frac{8}{5} = \frac{19.2}{12}$ or $12 \div 5 = 19.2 \div 8$ or $\frac{12}{5} = \frac{19.2}{8}$	A1	oe showing sides are in proportion eg $5 \div 8 = 12 \div 19.2$ or $\frac{5}{12} = \frac{8}{19.2}$
	Additional Guidance		
	For A1 equating may be implied by two calculations or two fractions with correct evaluation eg $8 \div 5 = 19.2 \div 12$ is implied by $8 = 5 \times 1.6$ and $19.2 = 12 \times 1.6$		M1A1
	For A1 equating may be implied by calculations eg1 $8 \div 5 = 19.2 \div 12$ is implied by $8 \div 5 = 1.6$ and $12 \times 1.6 = 19.2$ eg2 $8 \div 5 = 19.2 \div 12$ is implied by $\frac{8}{5} \times 12 = 19.2$		M1A1 M1A1
	$5 \times 19.2 = 8 \times 12$		M1A1
	$5 \times 19.2 = 96$ and $8 \times 12 = 96$		M1A1
	Non-contradictory working can be ignored eg correct response along with area calculations		M1A1
	Ignore words eg references to scale factors, enlargement, angles		
	Working on diagrams may be seen eg1 Arrows or lines from 5 to 8 and 12 to 19.2 with × 1.6 on them eg2 Arrows or lines from 5 to 8 and 12 to 19.2 with 1.6 on them Arrows or lines must unambiguously link relevant numbers		M1A1 M1A0
	For $8 \div 5$ or $\frac{8}{5}$ allow 8 : 5 etc		

Q	Answer	Mark	Comments
23	$80 \times x$ or $80x$ or $x \times 80$ or $x80$ or $x \div 60$ or $\frac{x}{60}$ or $\frac{1}{60}x$ or $x\frac{1}{60}$ or $80 \div 60$ or $\frac{80}{60}$	M1	teabags per hour boxes per minute
	$\frac{80x}{60}\left(=\frac{4x}{3}\right)$ or $80 \div 60 \times x\left(=\frac{4x}{3}\right)$	A1	oe showing 80 and 60 and x eg $\frac{80 \times x}{60}\left(=\frac{4x}{3}\right)$ or $x\frac{80}{60}\left(=\frac{4x}{3}\right)$ or $\frac{80}{60} \times x\left(=\frac{4x}{3}\right)$ or $80x \div 60\left(=\frac{4x}{3}\right)$

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 allow M1 if only seen embedded in an incorrect expression or calculation eg $80x \times 4 = 320x$	M0
$60 \times \frac{4x}{3} = 80x$ (M1 allowed as $80x$ is not embedded in an incorrect expression or calculation, A0 because using the given answer)	M1A0
Condone $x = 80 \div 60$	M1A0
$\frac{80x}{60}\left(=\frac{4x}{3}\right)$	M1A1
$\frac{80}{60} = \frac{4}{3}$ and $\frac{4}{3} \times x\left(=\frac{4x}{3}\right)$	M1A1
$\frac{80}{60} = \frac{4}{3}$ and $\frac{4x}{3}$	M1A0
No equivalents allowed for M1	
Ignore units	
Condone 1.33(…) for $\frac{4}{3}$	
Ignore non-contradictory working after M1A1 seen	