GCSE
MATHEMATICS
8300/3F

Foundation Tier

Paper 3 Calculator

Shadow paper based on November 2022 paper

Mark scheme

November 2022

Version: 1.0

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	270°	B1	

Q	Answer	Mark	Comments
2	$d = c - 6$	B1	

Q	Answer	Mark	Comments
3	4.75	B1	

Q	Answer	Mark	Comments
4	*CDE*	B1	

Q	Answer	Mark	Comments
5(a)	23 and 29 with no other values	B2	either order B1 23 with at most one incorrect value or 29 with at most one incorrect value
	Additional Guidance		
	Ignore any values out of range for B1		
	1, 23, 39		B1
	1, 17, 19		B1

Q	Answer	Mark	Comments
5(b)	64 or 125	B1	only one value needed
	Additional Guidance		
	Ignore any values out of range		
	64 and 125 given		B1
	Condone 4 and 64 on answer line		B1
	Condone 4^3 and 64 on answer line		B1
	Condone 4 or 4^3 on answer line with 64 seen in working		B1
	Condone 5 and 125 on answer line		B1
	Condone 5^3 and 125 on answer line		B1
	Condone 5 or 5^3 on answer line with 125 seen in working		B1
	4 or 4^3 on answer line with no correct evaluation seen		B0
	5 or 5^3 on answer line with no correct evaluation seen		B0
	More than one answer including an incorrect answer in range		B0

Q	Answer	Mark	Comments
6(a)	39	B1	

Q	Answer	Mark	Comments
6(b)	122	B1	

Q	Answer	Mark	Comments
6(c)	66	B1	

Q	Answer	Mark	Comments
7(a)	13	B1	
	Additional Guidance		
	Answer 15 – 13 = 2		B0

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th colspan="2">Comments</th></tr>
<tr><td rowspan="4">7(b)</td><td>0</td><td>B1</td><td colspan="2"></td></tr>
<tr><td colspan="4">Additional Guidance</td></tr>
<tr><td colspan="3">$\frac{0}{-6}$</td><td>B0</td></tr>
<tr><td colspan="3">Answer $-6 \times 0 = 0$</td><td>B0</td></tr>
</table>

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th colspan="2">Comments</th></tr>
<tr><td rowspan="9">8</td><td>$\frac{3}{10}$, 0.305, 32%
with no incorrect conversions</td><td>B2</td><td colspan="2">accept in any format
eg 0.3, 0.305, 0.32
B1 correctly converts at least one to a different form which shows at least two in comparable form
eg 0.32 or 30.5(%) or 0.3 or 30(%)
or $\frac{32}{100}$ and $\frac{30}{100}$</td></tr>
<tr><td colspan="4">Additional Guidance</td></tr>
<tr><td colspan="3">Condone missing percentage signs</td><td></td></tr>
<tr><td colspan="3">Examples of probabilities in the same comparable form
30(%), 30.5(%), (32%)
0.3(00), (0.305), 0.32(0)
$\frac{3}{10}$, $\frac{3.05}{10}$, $\frac{3.2}{10}$ or $\frac{30}{100}$, $\frac{30.5}{100}$, $\frac{32}{100}$ or $\frac{300}{1000}$, $\frac{305}{1000}$, $\frac{320}{1000}$</td><td></td></tr>
<tr><td colspan="3">$\frac{3}{10}$, 0.305, 32(%) with no working</td><td>B2</td></tr>
<tr><td colspan="3">Award B2 with no incorrect conversions
eg1 Answer $\frac{3}{10}$, 0.305, 32(%) with $\frac{12}{40}$ and $\frac{70.5}{100}$
eg2 Answer $\frac{3}{10}$, $\frac{305}{1000}$, $\frac{32}{100}$ with no incorrect conversions</td><td>B2</td></tr>
<tr><td colspan="3">Do not award B2 with an incorrect conversion
eg $\frac{3}{10}$, 0.305, 32(%) with 30(%) and 30.05(%)</td><td>B1</td></tr>
<tr><td colspan="3">$\frac{32}{100}$ and $\frac{305}{1000}$ and $\frac{3}{10}$ in working (not comparable conversions)</td><td>B0</td></tr>
<tr><td colspan="3">$\frac{61}{200}$ alone without $\frac{60}{200}$ or $\frac{62}{200}$</td><td>B0</td></tr>
</table>

Q	Answer	Mark	Comments
9(a)	(x =) 10 and (y =) –1	B2	B1 (x =) 10 or (y =) –1
	Additional Guidance		
	<table><tr><td>x</td><td>0</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td></tr><tr><td>y</td><td>11</td><td>7</td><td>3</td><td>–1</td><td>–5</td><td>–9</td></tr></table>		B2

Q	Answer	Mark	Comments
9(b)	Straight line from (0, 11) to (4, 3)	B2	B1 at least two of (0, 11), (2, 7) and (4, 3) plotted or straight line from (0, 11) to (2, 7) or straight line from (2, 7) to (4, 3) $\pm \frac{1}{2}$ square
	Additional Guidance		
	B2 or B1 may be awarded for a straight line without points plotted		
	Mark intention		
	Ignore line drawn after (4, 3)		
	Two points plotted with the same x-coordinate is choice unless the line is drawn through one of the points		

Q	Answer	Mark	Comments
9(c)	9	B1ft	correct or ft their line in (b) $\pm \frac{1}{2}$ square

Q	Answer	Mark	Comments
10(a)	One example that would give a positive answer	B1	eg 12 + (–6) (= 6) or 7 + (–6) (= 1)
	Additional Guidance		
	Evaluation is not required but if given must be correct		
	Allow two or more correct examples eg 12 + (–6) = 6 and 7 + (–6) = 1		B1
	Do not ignore an incorrect example alongside a correct example eg1 12 + (–6) = 6 and –6 + 4 = –2 (–6 + 4 is an incorrect example) eg2 7 + –2 and –6 + 4 eg3 –6 + 6 = 0 and 7 +(–6) = 1 (–6 + 6 is an incorrect example) eg4 7 + (–6) = 3 and –6 + 4 = 2 (2 is an incorrect evaluation)		 B0 B0 B0 B0
	Allow an example in words eg twelve added to negative six (is six)		B1
	The number could be 12		B1
	Allow brackets around negative numbers eg 12 + (– 6)		B1
	12 – 6 (= 6)		B1
	–6 + 6 = 0		B0

Q	Answer	Mark	Comments
10(b)	One example that would give a positive answer	B1	eg –4 – (–6) (= 2) or –1 – (–6) (= 5)

Additional Guidance	
Evaluation not required but if given must be correct	
Allow two or more correct examples eg –4 – (–6) (= 2) and –1 – (–6) (= 5)	B1
Do not ignore an incorrect example alongside a correct example eg1 –4 – (–6) (= 2) and –7 – (–6) = –1 (–1 is an incorrect example) eg2 –4 – (–6) and –7 – (–6) eg3 –6 – (–6) = 0 and –1 – (–6) = 5 (–6 – (–6) is an incorrect eg) eg4 –4 – (–6) (= 2) and –1 – (–6) = 7 (7 is an incorrect evaluation)	 B0 B0 B0 B0
Allow an example in words eg negative six subtracted from negative four (is two)	B1
The number could be –4	B1
Allow brackets around negative numbers eg (–4) – (–6)	B1
–4 + 6 (= 2)	B1
–6 – (–6) = 0	B0

Q	Answer	Mark	Comments
10(c)	One example that shows the statement is not correct	B1	eg $-4 \times \frac{1}{2}$ $(= -2)$ or $\frac{1}{2} \times -4$ $(= -2)$
	Additional Guidance		
	Evaluation not required but if given must be correct		
	Allow two or more correct examples eg $-4 \times \frac{1}{2}$ $(= -2)$ and $-10 \times \frac{1}{2}$ $(= -5)$		B1
	Do not ignore an incorrect example alongside a correct example eg1 $-4 \times \frac{1}{2}$ $(= -2)$ and $8 \times \frac{1}{2} = 4$ ($8 \times \frac{1}{2} = 4$ is an incorrect eg) eg2 $-4 \times \frac{1}{2}$ and $4 \times \frac{1}{2}$ eg3 $-4 \times \frac{1}{2}$ and $-8 \times \frac{1}{2} = 4$ (4 is an incorrect evaluation)		B0 B0 B0
	Allow an example in words eg 0 halved (is 0)		B1
	The number could be –6		B1
	$0 \times \frac{1}{2}$		B1
	$-\frac{1}{2}^{2} = 2$		B0
	$-\frac{1}{2}^{2}$		B0

Q	Answer	Mark	Comments
11	84 in Eat burgers Yes	B1	
	36 in Eat burgers No	B1ft	ft 120 – their 84 if giving a value > 0
	63 in At least once a month Yes	B1ft	ft their 84 ÷ 4 × 3 truncated to the nearest integer or rounded up to the nearest integer
	21 in At least once a month No	B1ft	ft their 84 – their 63 if giving a value > 0 or their 84 ÷ 4 truncated to the nearest integer or rounded up to the nearest integer

Additional Guidance

Mark the four given diagram ovals only	
60 60 45 15	B0B1ft B1ftB1ft
Follow through values may be rounded up or down to whole numbers provided the total is correct eg 90 30 68 22 (68 is $\frac{3}{4}$ of 90 rounded up)	B0B1ft B1ftB1ft
Follow through decimal values, withhold first B1, if applicable, at first use of decimal eg1 92.4 27.6 69.3 23.1 (92.4 is incorrect and first use of decimal) eg2 84 36 58.8 25.2 (58.8 is incorrect and first use of decimal)	B0B1ft B1ftB1ft B1B1 B0B1ft
Correct or ft relative frequencies shown out of 120 seen in appropriate places, withhold first B1 that would have been awarded eg1 $\frac{84}{120}$ $\frac{36}{120}$ $\frac{63}{120}$ $\frac{21}{120}$ eg2 $\frac{80}{120}$ $\frac{40}{120}$ $\frac{60}{120}$ $\frac{20}{120}$	B0B1ft B1ftB1ft B0B0ft B1ftB1ft

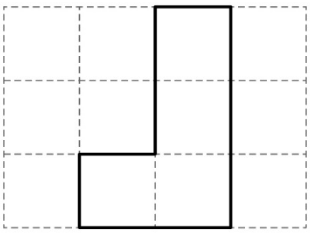
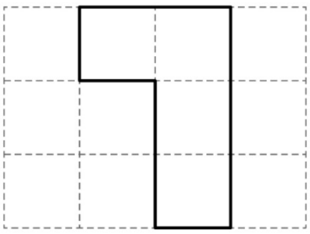
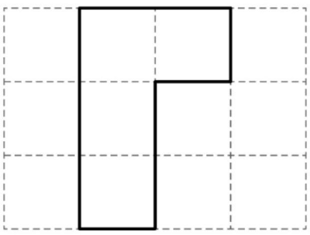
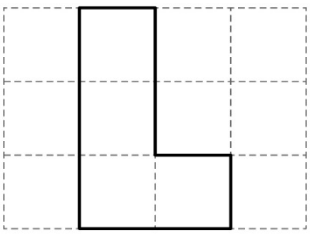
<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="9">12</td><td>2027 2032 2037
or
2025 2028 2031 2034 2037
or
5×3 or 15 (years)</td><td>M1</td><td>15 is implied by an answer 2022 + 15n or 2022 + 15n where n is a positive integer</td></tr>
<tr><td>2037</td><td>A1</td><td>accept 37</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">Allow the years to be written with two digits for M1
eg 27 32 37</td><td></td></tr>
<tr><td colspan="2">27 32 37
Answer 37</td><td>M1A1</td></tr>
<tr><td colspan="2">27 32 37
Answer 7</td><td>M1A0</td></tr>
<tr><td colspan="2">Answer 2052 or 2067 or 2007 or 1992</td><td>M1A0</td></tr>
<tr><td colspan="2">Ignore any errors in a list after 2037
eg 2022 2027 2032 2037 2041</td><td>M1</td></tr>
<tr><td colspan="2">Ignore any errors in a list after 2037
eg 2022 2025 2028 2031 2037 2041</td><td>M1</td></tr>
</table>

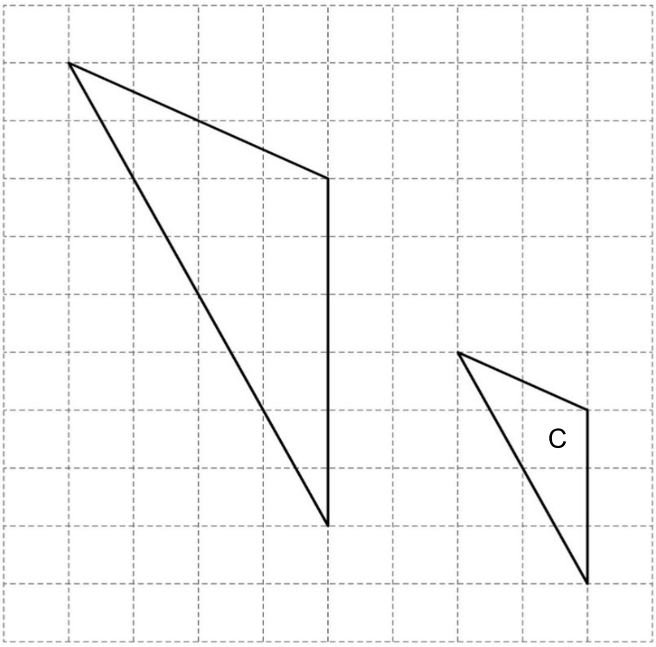
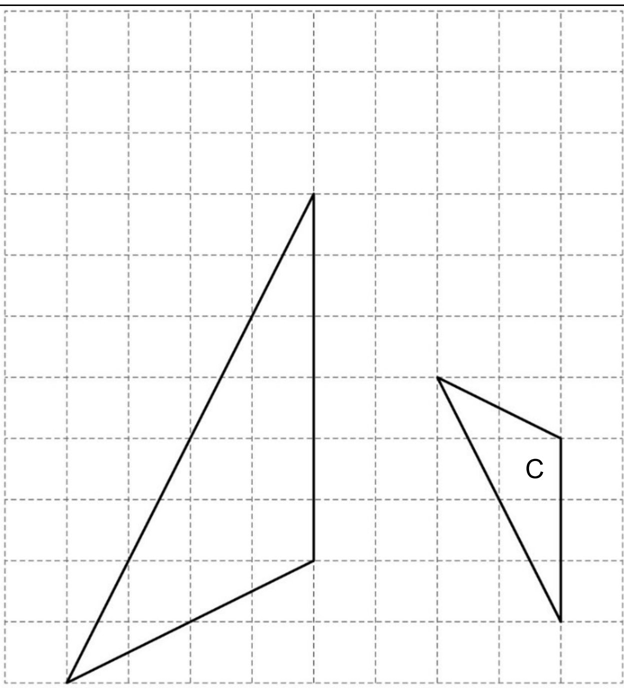
Q	Answer	Mark	Comments
13	Valid explanation	B1	eg it should be × 7 then – 2 or she has done $(x - 2) \times 7$

Additional Guidance

Ignore irrelevant statements alongside correct statements, unless contradictory eg it should be × 7 then – 2 and she should change her equation	B1
Do not ignore incorrect statements alongside a correct statement eg it should be × 7 then – 2 and x and y should be swapped	B0
The operations are in the wrong order	B1
Misplacing the 2 and 7 with their operations	B0
The order is wrong	B0
– 2 and × 7 are in the wrong order	B1
2 and 7 are the wrong way round	B0
× 7 needs to go before the – 2	B1
She has subtracted the 2 first when he should have multiplied by 7	B1
× 7 needs to go first	B1
× 7 needs to go in the first box	B1
She has put the – 2 in the wrong place (condone)	B1
She has put the numbers in the wrong squares	B0
She has subtracted 2 from x and not multiplied by 7	B1
She should have multiplied by 7 first (before subtracting 2)	B1
She should have multiplied before subtracting	B0
She has made $x - 2 \times 7 = y$	B0
She has made $-2x \times 7 = y$	B0
Swap the input and the output boxes	B0

Q	Answer	Mark	Comments
14	cuboid	B1	

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th colspan="2">Comments</th></tr>
<tr><td rowspan="9">15(a)</td><td>Congruent shape drawn using given side</td><td>B1</td><td colspan="2">any orientation</td></tr>
<tr><td colspan="4">Additional Guidance</td></tr>
<tr><td colspan="3">Allow internal lines</td><td></td></tr>
<tr><td colspan="3">Mark intention</td><td></td></tr>
<tr><td colspan="3">Ignore any labels</td><td></td></tr>
<tr><td colspan="3"></td><td>B1</td></tr>
<tr><td colspan="3"></td><td>B1</td></tr>
<tr><td colspan="3"></td><td>B1</td></tr>
<tr><td colspan="3"></td><td>B1</td></tr>
</table>

Q	Answer	Mark	Comments
15(b)	Enlargement drawn with scale factor 2 using given side	B1	any orientation
	Additional Guidance		
	Mark intention		
	Ignore any labels		
	 		B1
	 		B1

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th colspan="2">Comments</th></tr>
<tr><td rowspan="6">16(a)</td><td>2</td><td>B1</td><td colspan="2"></td></tr>
<tr><td colspan="4">Additional Guidance</td></tr>
<tr><td colspan="3">2 with 23 or 22.5 indicated as the middle
eg 2 contains 23rd data point or value</td><td>B1</td></tr>
<tr><td colspan="3">2 (23)</td><td>B0</td></tr>
<tr><td colspan="3">2 out of 23 is the median</td><td>B0</td></tr>
<tr><td colspan="3">2 and 8</td><td>B0</td></tr>
</table>

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="10">16(b)</td><td>$(0 \times 8$ and) 1×10 and 2×8 and 3×7 and 4×6 and 5×4 and 6×2
or
(0 and) 10 and 16 and 21 and 24 and 20 and 12
or 103</td><td>M1</td><td>allow one error or omission</td></tr>
<tr><td>$\frac{(0+)10+16+21+24+20+12}{45}$
or $103 \div 45$
or their $103 \div 45$</td><td>M1dep</td><td>oe eg $\frac{103}{45}$ or $2\frac{13}{45}$</td></tr>
<tr><td>2.29</td><td>A1</td><td>accept 2.28 or 2.3 with $103 \div 45$ seen</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">$103 \div 7$ or $103 \div 12$</td><td>M1M0</td></tr>
<tr><td colspan="2">$0 \times 7 + 1 \times 10 + 2 \times 8 + 3 \times 7 + 4 \times 6 + 5 \times 4 + 6 \times 3$ (6×3 is one error)
$109 \div 45 = 2.42\ldots$</td><td>M1M1A0</td></tr>
<tr><td colspan="2">$7 + 10 + 16 + 21 + 24 + 20 + 12$ (7 is one error)
$110 \div 45 = 2.44\ldots$</td><td>M1M1A0</td></tr>
<tr><td colspan="2">$10 + 21 + 24 + 20 + 12$ (16 missing is one omission)
$87 \div 45 = 1.93\ldots$</td><td>M1M1A0</td></tr>
<tr><td colspan="2">$(0 +)\ 10 + 16 + 21 + 24 + 20 + 12 \div 45$ with missing brackets not recovered</td><td>M1M0</td></tr>
<tr><td colspan="2">Correct products or values seen but a different method used is a choice of methods
eg (0) 10 16 21 24 20 12 followed by $45 \div 7$ or $45 \div 12$</td><td>M0</td></tr>
</table>

Q	Answer	Mark	Comments
16(c)	$8 + 10$ or $45 - 27$ or 18 or $\frac{27}{45}$	M1	oe
	$\frac{18}{45}$ or 0.4 or 40%	A1	oe
	Additional Guidance		
	M1 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts		
	Ignore conversion attempt after correct answer seen		
	18 out of 45		M1A0
	18 : 45		M1A0

Q	Answer	Mark	Comments
17	**Alternative method 1**		
	6 × 2.25 or 13.5	M1	oe
	their 13.5 ÷ 2.6 or [5.19, 5.19231] or [5.19, 5.19231] × 100 or [519, 519.231]	M1	oe their 13.5 must come from a division or multiplication using 6 and 2.25 only
	5.19	A1	SC2 5.2 SC1 35.1(0) or 1.02 or 1.03
	Alternative method 2		
	6 ÷ 2.6 or [2.3, 2.31]	M1	oe
	their [2.3, 2.31] × 2.25 or [5.175, 5.1975] or [5.175, 5.1975] × 100 or [517.5, 519.75]	M1	oe their [2.3, 2.31] must come from a division or multiplication using 6 and 2.6 only
	5.18 or 5.19 or 5.20	A1	SC2 5.2 SC1 35.1(0) or 1.02 or 1.03
	Alternative method 3		
	2.25 ÷ 2.6 or [0.865, 0.87]	M1	oe
	6 × their [0.865, 0.87] or [5.19, 5.22] or [5.19, 5.22] × 100 or [519, 522]	M1dep	oe
	5.19 or 5.20 or 5.21 or 5.22	A1	SC2 5.2 SC1 35.1(0) or 1.02 or 1.03

Additional Guidance continue on the next page

	Additional Guidance	
17 cont	Up to M2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts	
	In Alt 1 and Alt 2 the 2nd mark is not dependent In Alt 3 the 2nd mark is dependent	
	Answer 518 cm, 519 cm, 520 cm, 521 cm or 522 cm with metres crossed out	M1M1A0
	Begins by multiplying or dividing by a power of 10 eg1 $600 \times 2.25 \div 2.6$ oe with answer 5.19 (recovered) eg2 $6 \times 225 \div 2.6$ oe with answer 519 eg3 600×2.25 oe with answer 1350 eg4 0.6×225 oe	 M1M1A1 M1M1A0 M1M0 M1
	5.19 in working but a different answer on the answer line, eg 1 5.19 in working but 5 on answer line eg 2 5.19 in working but 519 on answer line	 M1M1A0 M1M1A0
	$6 \times 2.25 \div 2.6$ oe	M1M1
	$6 \div (3.8 \div 2.25)$	M1M1
	$6 \times 2.25 \times 2.6$ oe (which gives 35.1)	M1M0
	$6 \div 2.25 \div 2.6$ oe (which gives 1.02 or 1.03)	M0M1
	$6 \div 2.25 \times 2.6$ oe (which gives 6.93333…)	M0M0
	2.25×2.6 with no other relevant working	M0

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="5">18</td><td colspan="3">Alternative method 1 – capacity of 7 tins of white paint and 5 tins of blue paint compared with the 3000 ml bucket capacity</td></tr>
<tr><td>4615 ÷ 13 or 355
or
7 × 165 or 1155</td><td>M1</td><td>oe</td></tr>
<tr><td>their 355 × 5 or 1775
or
3000 – their 1155 or 1845
or
3000 – their 355 × 5 or 1225</td><td>M1dep</td><td>oe
4615 × $\frac{5}{13}$ is M2
their 355 and their 1155 must be from correct methods</td></tr>
<tr><td>their 1155 + their 1775 or 2930
or
3000 – their 1775 and their 1155
or
their 1225 and their 1155
or
3000 – their 1155 and their 1775
or
their 1845 and their 1775</td><td>M1dep</td><td>oe
eg 3000 – 1775 or 1225
and
1225 – 165 – 165 – 165 – 165 – 165 – 165 – 165 or 70
their 1225, their 1845, their 1155 and their 1775 must be from correct methods</td></tr>
<tr><td>2930 and Yes
or
1225 and 1155 and Yes
or
1845 and 1775 and Yes
or
70 and Yes</td><td>A1</td><td>oe
eg1 Yes, there is space for 70 more
eg2 Yes, all the white paint will fit into the bucket</td></tr>
</table>

Mark scheme and Additional Guidance continue on the next page

18 cont	**Alternative method 2 –** The number of tins of white or blue paint that can be added to 5 tins of blue or 7 tins of white paint to fill the 3000 ml bucket		
	$4615 \div 13$ or 355 or 7×165 or 1155	M1	oe
	their 355×5 or 1775 or $3000 -$ their 1155 or 1845 or $3000 -$ their 355×5 or 1225	M1dep	oe $4615 \times \frac{5}{13}$ is M2 their 355 and their 1155 must be from correct methods
	$\frac{3000 - \text{their } 1775}{165}$ or $\frac{\text{their } 1225}{165}$ or [7.4, 7.42] or $\frac{3000 - \text{their } 1775}{7}$ or $\frac{\text{their } 1225}{7}$ or 175 or $\frac{3000 - \text{their } 1155}{355}$ or $\frac{\text{their } 1845}{\text{their } 355}$ or [5.19, 5.2] or $\frac{3000 - \text{their } 1155}{5}$ or $\frac{\text{their } 1845}{5}$ or 369	M1dep	oe their 355, their 1225, their 1845, their 1155 and their 1775 must be from correct methods
	[7.4, 7.42] and Yes or [5.19, 5.2] and Yes or 175 and Yes or 369 and Yes	A1	oe

Mark scheme and Additional Guidance continue on the next page

18 cont	**Alternative method 3** – 5 tins of blue paint as a proportion of 3000 ml added to 7 tins of white as a proportion of 3000 ml		
	$4615 \div 13$ or 355 or 7×165 or 1155	M1	oe
	$\frac{\text{their } 355 \times 5}{3000}$ or [0.59, 0.592] or $\frac{\text{their } 1155}{3000}$ or 0.385 or 0.39	M1dep	oe their 355 and their 1155 must be from correct methods
	$\frac{\text{their } 355 \times 5}{3000}$ or [0.59, 0.592] **and** $\frac{\text{their } 1155}{3000}$ or 0.385 or 0.39	M1dep	oe
	[0.59, 0.592] + 0.385 = [0.975, 0.977] and Yes	A1	oe eg1 0.59 + 0.4 = 0.99 and Yes eg2 59(%) + 39(%) < 100(%) and Yes
	Alternative method 4 – 5 tins of blue paint as proportion of 3000 ml compared with the volume of the bucket remaining after 7 tins of white added as a proportion of 3000 ml		
	$4615 \div 13$ or 355 or 7×165 or 1155	M1	oe
	$\frac{\text{their } 355 \times 5}{3000}$ or [0.59, 0.592] or $\frac{3000 - \text{their } 1155}{3000}$ or 0.615	M1dep	oe their 355 and their 1155 must be from correct methods
	$\frac{\text{their } 355 \times 5}{3000}$ or [0.59, 0.592] **and** $\frac{3000 - \text{their } 1155}{3000}$ or 0.615	M1dep	oe their 355 and their 1155 must be from correct methods
	[0.59, 0.592] < 0.615 and Yes	A1	oe eg1 0.59 < 0.6 and Yes eg2 59(%) < 62(%) and Yes

Additional Guidance continue on the next page

18 cont	**Additional Guidance**	
	Up to M3 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts	
	Allow working in other units eg litres but units must be consistent for the 3rd mark	
	Yes may be implied eg1 2930 and there is 70 (ml) space in bucket eg2 7.4 tins so 7 tins is not too much	
	2930 and Yes	M1M1M1A1
	1225 and 1155 and Yes	M1M1M1A1
	1845 and 1775 and Yes	M1M1M1A1
	70 and Yes	M1M1M1A1
	Condone $1225 - 1155 = 70$ and Yes	M1M1M1A1
	Condone an incorrect statement after the correct answer seen eg 1225 and 1155 and 70 and Yes, there is 70 ml space in the bucket	M1M1M1A1

Q	Answer	Mark	Comments
19	$n \geqslant 18$	B1	

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th colspan="2">Comments</th></tr>
<tr><td rowspan="10">20(a)</td><td>37.95 ÷ 1.1 or 34.5</td><td>M1</td><td colspan="2">oe eg 37.95 × 0.9(0909…)</td></tr>
<tr><td>34.50</td><td>A1</td><td colspan="2"></td></tr>
<tr><td colspan="4">Additional Guidance</td></tr>
<tr><td colspan="3">M1 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts</td><td></td></tr>
<tr><td colspan="3">Condone (£)34.50p</td><td></td></tr>
<tr><td colspan="3">34.50 in working with answer 34.5</td><td>M1A1</td></tr>
<tr><td colspan="3">34.5(0) in working with answer 34 or 35</td><td>M1A0</td></tr>
<tr><td colspan="3">Answer of 34 or 35 with no working</td><td>M0A0</td></tr>
<tr><td colspan="3">34.5(0) × 1.1 = 37.95</td><td>M1A0</td></tr>
<tr><td colspan="3">Build up must be a fully correct method</td><td></td></tr>
</table>

Q	Answer	Mark	Comments
20(b)	12.5	B3	B2 180 ÷ 8 × 5 ÷ 9 oe or 180 ÷ 8 × 5 oe or 112.5 or 180 × 5 ÷ 9 oe or 100 or 180 ÷ 8 ÷ 9 oe or 2.5 or 9 ÷ 5 × 8 oe or 14.4 B1 180 ÷ 8 or 22.5 or 180 × 5 or 900 or 180 ÷ 9 or 20 or 9 ÷ 5 or 1.8 or 9 × 8 or 72 or 8 ÷ 5 or 1.6 or 5 ÷ 8 or 0.625

Additional Guidance

Up to B2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts	
12.5 in working with answer 12 or 13	B3
20 × 5	B2
900 ÷ 9	B2
22.5 ÷ 9	B2
1.8 × 8	B2

Q	Answer	Mark	Comments
21(a)	Valid description	B1	eg as height increases so does mass or as mass decreases so does height

Additional Guidance

Ignore incorrect or irrelevant statements alongside correct statements, unless contradictory	
As one increases so does the other	B1
It is usually heavier the taller it is	B1
As height increases the weight increases	B1
They are directly proportional (condone)	B1
It is positive correlation because the taller the monkeys the heavier the monkeys	B1
The taller they are the more they weigh	B1
Taller monkeys are heavier	B1
The tallest monkeys have more mass than the shorter monkeys	B1
The shortest monkeys have a lower mass	B1
Mass and height both increase at the same time (condone)	B1
The height and mass of the monkeys increase at the same rate (condone)	B1
A tall monkey is heavy	B0
The bigger they are the more they weigh (height is not implied from bigger)	B0
It is heavier as it grows (height is not implied from growth)	B0
It is positive correlation	B0

Q	Answer	Mark	Comments
21(b)	Straight line passing through (36, [9,13]) and (62, [30, 34])	B1	accept intention to draw a straight line ignore anything outside (36, [9,13]) and (62, [30, 34])
	Correct reading $\pm\frac{1}{2}$ square for their straight line	B1ft	ft their line with positive gradient ignore any working lines on their graph
	Additional Guidance		
	No line of best fit		B0B0
	Short straight line not passing through (36, [9,13]) and (62, [30, 34]) with positive gradient and correct reading $\pm\frac{1}{2}$ square for their line		B0B1ft
	Two lines of best fit, mark the line that leads to their answer		
	Two lines of best fit, no answer, apply the usual rules of choice		

Q	Answer	Mark	Comments
22	$\frac{1}{2} \times (17 + 25) \times 13$ or 273	M1	oe any correct method to find the area of the trapezium
	$\frac{1}{2} \times 12 \times 9$ or 54	M1	oe eg $\frac{1}{2} \times 12 \times 9 \times \sin 90$
	327	A1	
	Additional Guidance		
	Up to M2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts		
	Ignore Pythagoras' theorem, trigonometry or perimeter calculations		
	$17 \times 13 + \frac{1}{2} \times 8 \times 13$		M1
	Missing brackets must be recovered eg1 $\frac{1}{2} \times 25 + 17 \times 13$ and 327 eg2 $\frac{1}{2} \times 25 + 17 \times 13$		 M1 M0
	$25 \times 13 = 325$		M0M0A0

Q	Answer	Mark	Comments
23	**Alternative method 1**		
	$96 \div 8 \times 3$ or 36	M1	oe $96 \div 8 \times 11$ or 132 implies M1
	96×2.5 or 240	M1	oe eg $96 \times 5 \div 2$ 23×12 implies M2
	36 and 240 and 372 or $350 - 36 - 240 = 74$	A1	oe eg1 276 and 372 eg2 36 and 240 and 22 eg3 276 and $(350 - 96 =)$ 254
	Alternative method 2		
	8×2.5 or 20	M1	oe eg1 $8 \times 5 \div 2$ eg2 8 : 3 : 20
	$96 \div 8 \times (8 + 3 +$ their 20) or $96 \div 8 \times 3$ and $96 \div 8 \times$ their 20	M1dep	oe eg 12×31 23×12 implies M2
	20 and 372 or 36 and 240 and 372 or $350 - 36 - 240 = 74$	A1	oe eg1 276 and 372 eg2 36 and 240 and 22 eg3 276 and $(350 - 96 =)$ 254
	Additional Guidance		
	Up to M2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts		
	In Alt 1 the 2nd mark is not dependent In Alt 2 the 2nd mark is dependent		
	372 alone or 372 with no correct method		M0
	$96 \div 8 \times 11 = 132$ and $132 + 240 = 372$		M1M1A1
	$2\frac{1}{2} \times 96 = 240$ and $96 + 240 = 336$ and $96 + 36 + 240 = 372$		M1M1A1
	$2\frac{1}{2} \times 96 = 240$		M1
	$2\frac{1}{2}$ of $96 = 240$		M0
	$96 \div 11$		M0

Q	Answer	Mark	Comments
24	**Alternative method 1**		
	1.44×1000 or 1440	M1	
	$\frac{\text{their } 1440}{75}$ or 19.2 or $\frac{\text{their } 1440}{19.2}$ or 75	M1dep	oe
	19.2 and Yes or 75 and Yes	A1	
	Alternative method 2		
	1.44×1000 or 1440	M1	
	19.2×75 or 1440	M1	oe
	1440 and Yes	A1	
	Alternative method 3		
	$\frac{1.44}{75}$ or 0.0192 or $\frac{1.44}{19.2}$ or 0.075	M1	oe eg 1.92×10^{-3}
	their 0.0192×1000 or 19.2 or 0.075×1000 or 75	M1dep	oe
	19.2 and Yes or 75 and Yes	A1	

Mark scheme and Additional Guidance continue on the next page

Q	Answer	Mark	Comments
24 cont	**Alternative method 4**		
	$19.2 \div 1000$ or 0.0192 or 19.2×75 or 1440	M1	
	their 0.0192×75 or their $1440 \div 1000$ or 1.44 or $\frac{1.44}{\text{their } 0.0192}$ or 75	M1dep	oe
	1.44 and Yes or 75 and Yes	A1	
	Alternative method 5		
	$\frac{1.44}{75}$ or 0.0192	M1	oe eg 1.92×10^{-3}
	$19.2 \div 1000$ or 0.0192	M1	oe
	0.0192 and 0.00144 and Yes	A1	
	Additional Guidance		
	Up to M2 may be awarded for correct work, with Yes or incorrect answer, even if this is seen amongst multiple attempts		
	In Alt 2 and Alt 5 the 2nd mark is Yes dependent In Alt 1, Alt 3 and Alt 4 the 2nd mark is dependent		
	$19.2 \times 75 = 14400$		M1
	19.2×75^3 or $1.44 \div 75^3$ unless recovered		M0

Q	Answer	Mark	Comments
25(a)	**Alternative method 1**		
	29	B3	B2 55 or 26 + 29 or 84 – 29 or $\frac{84-26}{2}$ or $\frac{58}{2}$ B1 84 – 26 or 58
	Alternative method 2		
	26 + x or 84 – x	M1	oe
	$x + 26 + x = 84$ or $2x + 26 = 84$ or $\frac{84-26}{2}$ or $\frac{58}{2}$	M1dep	oe eg $26 + x = 84 - x$
	29	A1	
	Additional Guidance		
	$26 + x = 84$		M1

Q	Answer	Mark	Comments
25(b)	No and gives valid reason	B1	eg No and the first term is –1 or No and the second term is zero or No and $1^2 - 2 = -1$ or $2^2 - 4 = 0$ or No and all the terms are positive except the first two

Additional Guidance

Ignore incorrect or irrelevant statements alongside correct statements	
Ignore all other statements and evaluations if $1^2 - 2 = -1$ or $2^2 - 4 = 0$ seen	
Ticks Yes	B0
No and –1, 0, 3, 8, …	B1
No and $1^2 - 2 = -1$ with $2^2 - 2 = 2$	B1
No and $4 = 2^2$	B1
No and $2^2 - 4 = 0$ (0 is positive) (condone)	B1
No and n^2 can be equal to $2n$ and $2^2 = 4$	B1
No and n^2 can be equal to $2n$	B0
No and if you put $n = 1$ it's negative	B1
No and $n^2 = 1$ and $2n = 2$	B1
No, all the terms are positive except when $n = 1$ or 2	B1
No and if $n = 2$ it creates 0	B1
No, not when $n = 1$	B0
No, it doesn't work for the first term	B0
No and $0.5^2 - (2 \times 0.5) = -0.75$	B0
No and when $n = 0$ it won't be positive	B0

Q	Answer	Mark	Comments
26	$-\frac{8}{5}$ or $-1\frac{3}{5}$ or -1.6	B2	B1 $\frac{8}{5}$ or $1\frac{3}{5}$ or 1.6 or $x - 5$ and $y + 8$ or possible coordinates for *P* and *Q* stated or shown on a diagram eg *P*(5, 0) and *Q*(0, 8) or right-angled triangle shown with 5 as horizontal length and 8 as vertical length

Additional Guidance

B1 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts	
Ignore attempts at rounding after correct answer seen	
Accept $\frac{8}{-5}$	B2
Condone $\frac{-8}{5}$	B2
$(x - 5)$ $(y + 8)$	B1
$x - 5$ and $y + 8$ may be seen embedded in a fraction eg $\frac{y-(y+8)}{x-(x-5)}$ or $\frac{y-(y+8)}{x+(x-5)}$	B1
$-\frac{5}{8}$	B0
$\frac{5}{8}$	B0

Q	Answer	Mark	Comments
27	$\times \frac{2}{3}$	B1	

Q	Answer	Mark	Comments
28	**Alternative method 1**		
	$0.55 \times (200 + 20)$ or 0.55×220 or 121	M1	oe
	their 121 – 104 or 17	M1dep	
	17 : 3	A1	SC2 answer 3 : 17
	Alternative method 2		
	$(1 - 0.55) \times (200 + 20)$ or 0.45×220 or 99	M1	oe
	their 99 – 96 or 3	M1dep	
	17 : 3	A1	SC2 answer 3 : 17
	Additional Guidance		
	Up to M2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts		
	121 : 99 or 99 : 121		M1M0A0
	0.45 : 0.55		M0M0A0
	Beware of 121 and 99 from incorrect working		M0

Q	Answer	Mark	Comments
29	$c = -2d$	B1	

Q	Answer	Mark	Comments
30	$0.5 \times \pi \times 65$ or $0.5 \times [204, 204.204]$ or $[102, 102.102]$ or $0.5 \times \pi \times 65 + 85$ or $[187, 187.102]$	M1	oe eg 32.5π
	$(0.5 \times \pi \times 65 + 85) \div 24$ or their $[187, 187.102] \div 24$	M1	oe their [187, 187.1] can be any value
	[7.79, 7.80]	A1	may be implied by 7.8
	7.8	B1ft	ft any answer seen with greater than 2 sf SC2 4.3
	Additional Guidance		
	Up to M2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts, B1ft may also be awarded		
	$\frac{150}{24} = 6.25$ answer 6.3	M0M1A0B1ft	
	$\frac{150}{24} = 6.25$	M0M1A0B0ft	
	$0.5 \times \pi \times 65$ and $102.1 \div 24 = 4.25$ answer 4.3	M1M1A0B1ft	
	SC2 for an answer of 4.3 without working is when 85 is not used		

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="11">31</td><td>56×68 or 3808
or
32×85 or 2720
or
$\frac{3808}{2720}$ or $\frac{476}{340}$ or $\frac{7}{5}$</td><td>M1</td><td></td></tr>
<tr><td>1.4</td><td>A1</td><td></td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">M1 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts</td><td></td></tr>
<tr><td colspan="2">Ignore attempts at rounding after correct answer seen</td><td></td></tr>
<tr><td colspan="2">Condone use of units in answer
eg 1.4 kg</td><td>M1A1</td></tr>
<tr><td colspan="2">$\frac{7}{5} = 1.4$ on answer line</td><td>M1A1</td></tr>
<tr><td colspan="2">$\frac{7}{5}$ and 1.4 on answer line</td><td>M1A0</td></tr>
<tr><td colspan="2">$\frac{47.6}{34}$</td><td>M1A0</td></tr>
<tr><td colspan="2">$\frac{68}{85} = 0.8$</td><td>M0A0</td></tr>
</table>