GCSE
MATHEMATICS
8300/3F

Foundation Tier Paper 3 Calculator

Mark scheme

November 2022

Version: 1.0 Final

22BG8300/3F/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	90°	B1	

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

Q	Answer	Mark	Comments
3	2.75	B1	

Q	Answer	Mark	Comments
4	*ADC*	B1	

Q	Answer	Mark	Comments
5(a)	29 and 31 with no other values	B2	either order B1 29 with at most one incorrect value or 31 with at most one incorrect value
	Additional Guidance		
	Ignore any values out of range for B1		
	1, 29, 31		B1
	1, 23, 29		B1

Q	Answer	Mark	Comments
5(b)	125 or 216	B1	only one value needed
	Additional Guidance		
	Ignore any values out of range		
	125 and 216 given		B1
	Condone 5 and 125 on answer line		B1
	Condone 6^3 and 216 on answer line		B1
	Condone 5 or 5^3 on answer line with 125 seen in working		B1
	6 or 6^3 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)	43	B1	

Q	Answer	Mark	Comments
6(b)	118	B1	

Q	Answer	Mark	Comments
6(c)	55	B1	

Q	Answer	Mark	Comments
7(a)	12	B1	
	Additional Guidance		
	Answer $12 - 12 = 0$		B0

Q	Answer	Mark	Comments
7(b)	0	B1	
	Additional Guidance		
	$\frac{0}{7}$		B0
	Answer $7 \times 0 = 0$		B0

Q	Answer	Mark	Comments
8	$\frac{7}{10}$, 0.705, 72% with no incorrect conversions	B2	accept in any format eg 0.7, 0.705, 0.72 B1 correctly converts at least one to a different form which shows at least two in comparable form eg 0.72 or 70.5(%) or 0.7 or 70(%) or $\frac{72}{100}$ and $\frac{70}{100}$
	Additional Guidance		
	Condone missing percentage signs		
	Examples of probabilities in the same comparable form 70(%), 70.5(%), (72%) 0.7(00), (0.705), 0.72(0) $\left(\frac{7}{10}\right)$, $\frac{7.05}{10}$, $\frac{7.2}{10}$ or $\frac{70}{100}$, $\frac{70.5}{100}$, $\frac{72}{100}$ or $\frac{700}{1000}$, $\frac{705}{1000}$, $\frac{720}{1000}$		
	$\frac{7}{10}$, 0.705, 72(%) with no working		B2
	Award B2 with no incorrect conversions eg1 Answer $\frac{7}{10}$, 0.705, 72(%) with $\frac{28}{40}$ and $\frac{70.5}{100}$ eg2 Answer $\frac{7}{10}$, $\frac{705}{1000}$, $\frac{72}{100}$ with no incorrect conversions		B2
	Do not award B2 with an incorrect conversion eg $\frac{7}{10}$, 0.705, 72(%) with 70(%) and 70.05(%)		B1
	$\frac{72}{100}$ and $\frac{705}{1000}$ and $\frac{7}{10}$ in working (not comparable conversions)		B0
	$\frac{141}{200}$ alone without $\frac{140}{200}$ or $\frac{144}{200}$		B0

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="3">9(a)</td><td>(x =) 10 and (y =) 15</td><td>B2</td><td>B1 (x =) 10 or (y =) 15</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2"><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>3</td><td>7</td><td>11</td><td>15</td><td>19</td><td>23</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">9(b)</td><td>Straight line from (0, 3) to (4, 11)</td><td>B2</td><td>B1 at least two of (0, 3), (2, 7) and (4, 11) plotted
or straight line from (0, 3) to (2, 7)
or straight line from (2, 7) to (4, 11)
$\pm \frac{1}{2}$ square</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">B2 or B1 may be awarded for a straight line without points plotted</td><td></td></tr>
<tr><td colspan="2">Mark intention</td><td></td></tr>
<tr><td colspan="2">Ignore line drawn after (4, 11)</td><td></td></tr>
<tr><td colspan="2">Two points plotted with the same x-coordinate is choice unless the line is drawn through one of the points</td><td></td></tr>
</table>

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 $-2 + 5 (= 3)$ or $5 + -2 (= 3)$
	Additional Guidance		
	Evaluation is not required but if given must be correct		
	Allow two or more correct examples eg $-1 + 5 = 4$ and $-4 + 5 = 1$		B1
	Do not ignore an incorrect example alongside a correct example eg1 $-1 + 5 = 4$ and $-7 + 5 = -2$ ($-7 + 5$ is an incorrect example) eg2 $-1 + 5$ and $-7 + 5$ eg3 $-5 + 5 = 0$ and $-2 + 5 = 3$ ($-5 + 5$ is an incorrect example) eg4 $-2 + 5 = 3$ and $-4 + 5 = -9$ (-9 is an incorrect evaluation)		B0 B0 B0 B0
	Allow an example in words eg five added to negative four (is one)		B1
	The number could be -2		B1
	Allow brackets around negative numbers eg $5 + (-2)$		B1
	$5 - 2 (= 3)$		B1
	$-5 + 5 = 0$		B0

Q	Answer	Mark	Comments
10(b)	One example that would give a negative answer	B1	eg $-6 + 5 (= -1)$ or $5 + -6 (= -1)$
	Additional Guidance		
	Evaluation not required but if given must be correct		
	Allow two or more correct examples eg $-7 + 5 = -2$ and $-6 + 5 = -1$		B1
	Do not ignore an incorrect example alongside a correct example eg1 $-7 + 5 = -2$ and $-1 + 5 = 4$ ($-1 + 5$ is an incorrect example) eg2 $-7 + 5$ and $-1 + 5$ eg3 $-5 + 5 = 0$ and $-6 + 5 = -1$ ($-5 + 5$ is an incorrect example) eg4 $-9 + 5 = -4$ and $-8 + 5 = -13$ (-13 is an incorrect evaluation)		B0 B0 B0 B0
	Allow an example in words eg five added to negative ten (is negative five)		B1
	The number could be -6		B1
	Allow brackets around negative numbers eg $5 + (-8)$		B1
	$5 - 6 (= -1)$		B1
	$-5 + 5 = 0$		B0

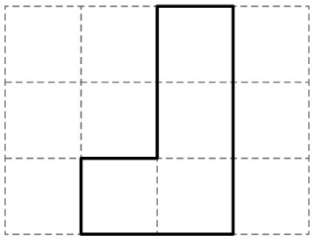
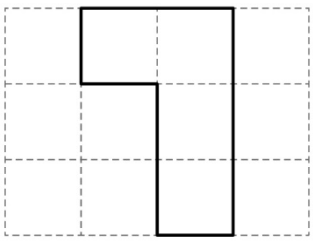
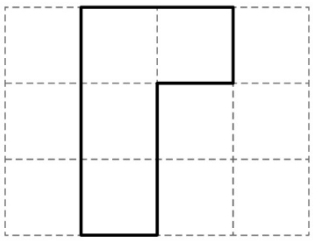
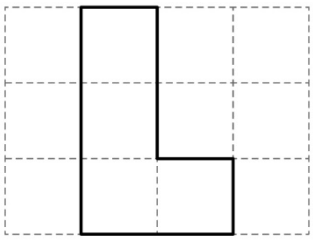
Q	Answer	Mark	Comments
10(c)	One example that shows the statement is not correct	B1	eg $-3 \times 2 (= -6)$ or $2 \times -3 (= -6)$
	Additional Guidance		
	Evaluation not required but if given must be correct		
	Allow two or more correct examples eg $-7 \times 2 = -14$ and $-6 \times 2 = -12$		B1
	Do not ignore an incorrect example alongside a correct example eg1 $-5 \times 2 = -10$ and $4 \times 2 = 8$ (4×2 is an incorrect example) eg2 -4×2 and 4×2 eg3 $-5 \times 2 = -10$ and $-8 \times 2 = -10$ (-10 is an incorrect evaluation)		B0 B0 B0
	Allow an example in words eg 0 doubled (is 0)		B1
	The number could be -6		B1
	0×2		B1
	$0 + 0$		B1
	$-1 + -1 (= -2)$ or $-1 - 1 (= -2)$		B1
	$-1^2 = -2$		B0
	-1^2		B0

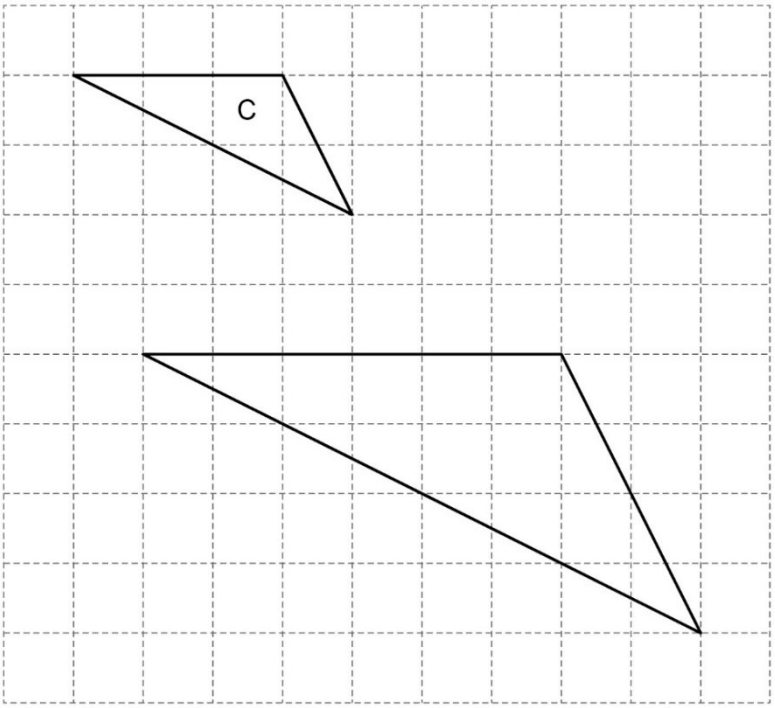
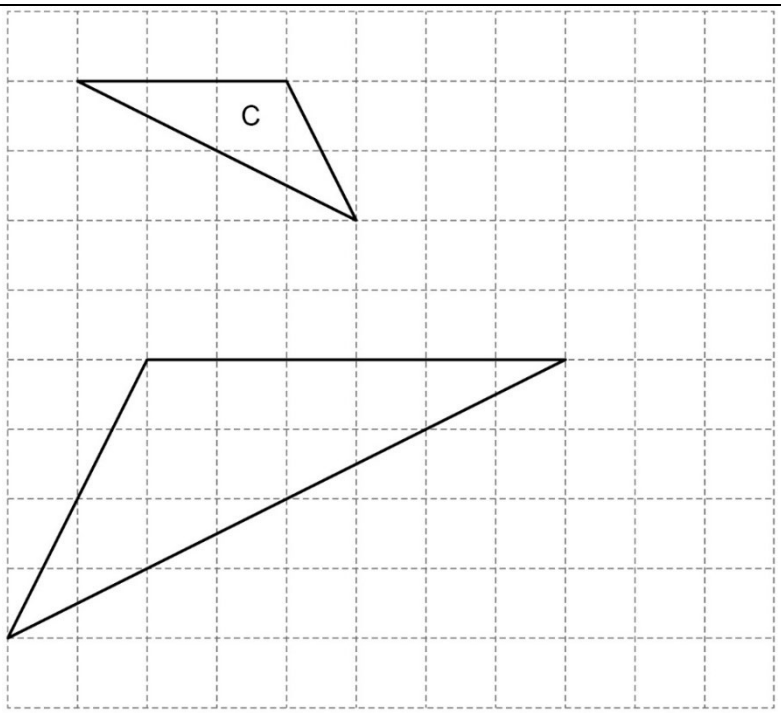
Q	Answer	Mark	Comments
11	96 in Eat sushi Yes	B1	
	384 in Eat sushi No	B1ft	ft 480 – their 96 if giving a value > 0
	64 in At least once a month Yes	B1ft	ft their 96 ÷ 3 × 2 truncated to the nearest integer or rounded up to the nearest integer
	32 in At least once a month No	B1ft	ft their 96 – their 64 if giving a value > 0 or their 96 ÷ 3 truncated to the nearest integer or rounded up to the nearest integer
	Additional Guidance		
	Mark the four given diagram ovals only		
	240 240 160 80		B0B1ft B1ftB1ft
	Follow through values may be rounded up or down to whole numbers provided the total is correct eg 80 400 53 27 (53 is $\frac{2}{3}$ of 80 rounded down)		B0B1ft B1ftB1ft
	Follow through decimal values, withhold first B1, if applicable, at first use of decimal eg1 105.6 374.4 70.4 35.2 (105.6 is incorrect and first use of decimal) eg2 80 400 53.3 26.7 (53.3 is correct ft and first use of decimal) eg3 96 384 63.36 32.64 (63.36 is incorrect and first use of decimal)		B0B1ft B1ftB1ft B0B1ft B0ftB1ft B1B1 B0B1ft
	Correct or ft relative frequencies shown out of 480 seen in appropriate places, withhold first B1 that would have been awarded eg1 $\frac{96}{480}$ $\frac{384}{480}$ $\frac{64}{480}$ $\frac{32}{480}$ eg2 $\frac{45}{480}$ $\frac{435}{480}$ $\frac{30}{480}$ $\frac{15}{480}$ eg3 $\frac{90}{480}$ $\frac{390}{480}$ $\frac{30}{480}$ $\frac{60}{480}$		B0B1 B1B1 B0B0ft B1ftB1ft B0B0ft B0ftB1ft

Q	Answer	Mark	Comments
12	2015 2011 2007 or 2016 2013 2010 (2007) or 4 × 3 or 12 (years)	M1	12 is implied by an answer $2019 - 12n$ or $2019 + 12n$ where n is a positive integer
	2007	A1	accept 07
	Additional Guidance		
	Allow the years to be written with two digits for M1 eg 15 11 (0)7		
	15 11 (0)7 Answer 07	M1A1	
	15 11 (0)7 Answer 7	M1A0	
	Answer 7 without M1 awarded	M0A0	
	Answer 1995 or 1983 or 2031 or 2043	M1A0	
	Ignore any errors in a list after 2007 eg 2015 2011 2007 2004	M1	
	Ignore any errors in a list after 2010 eg 2016 2013 2010 2006	M1	

Q	Answer	Mark	Comments
13	Valid explanation	B1	eg it should be × 5 then + 3 or he has done $(x + 3) \times 5$
	Additional Guidance		
	Ignore irrelevant statements alongside correct statements, unless contradictory eg it should be × 5 then + 3 and he should change his equation	B1	
	Do not ignore incorrect statements alongside a correct statement eg it should be × 5 then + 3 and x and y should be swapped	B0	
	The operations are in the wrong order	B1	
	Misplacing the 3 and 5 with their operations	B0	
	The order is wrong	B0	
	+ 3 and × 5 are in the wrong order	B1	
	3 and 5 are the wrong way round	B0	
	× 5 needs to go before the + 3	B1	
	He has added the 3 first when he should have multiplied by 5	B1	
	× 5 needs to go first	B1	
	× 5 needs to go in the first box	B1	
	He has put the + 3 in the wrong place (condone)	B1	
	He has put the numbers in the wrong squares	B0	
	He has added 3 to x and not multiplied by 5	B1	
	He should have multiplied by 5 first (before adding 3)	B1	
	He should have multiplied before adding	B0	
	He has made $x + 3 \times 5 = y$	B0	
	He has made $3x \times 5 = y$	B0	
	Swap the input and the output boxes	B0	

Q	Answer	Mark	Comments
14	triangular-based pyramid	B1	

Q	Answer	Mark	Comments
15(a)	Congruent shape drawn using given side	B1	any orientation
	Additional Guidance		
	Allow internal lines		
	Mark intention		
	Ignore any labels		
		B1	
		B1	
		B1	
		B1	

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	

Q	Answer	Mark	Comments
16(a)	1	B1	
	Additional Guidance		
	1 with 10 indicated as the greatest frequency eg 1 scores 10	B1	
	1 (10)	B0	
	1, 10 is the most	B0	
	1 and 10	B0	

Q	Answer	Mark	Comments
16(b)	(0 × 7 and) 1 × 10 and 2 × 8 and 3 × 7 and 4 × 5 and 5 × 3 or (0 and) 10 and 16 and 21 and 20 and 15 or 82	M1	allow one error or omission
	$\frac{(0+)\ 10+16+21+20+15}{40}$ or 82 ÷ 40 or their 82 ÷ 40	M1dep	oe eg $\frac{82}{40}$ or $\frac{41}{20}$ or $2\frac{1}{20}$
	2.05	A1	accept 2.1 or 2 with 82 ÷ 40 seen
	Additional Guidance		
	82 ÷ 6 or 82 ÷ 15		M1M0
	0 × 7 + 1 × 10 + 2 × 8 + 3 × 7 + 4 × 5 + 5 × 2 (5 × 2 is one error) 77 ÷ 40 = 1.925		M1M1A0
	7 + 10 + 16 + 21 + 20 + 15 (7 is one error) 89 ÷ 40 = 2.225		M1M1A0
	10 + 21 + 20 + 15 (16 missing is one omission) 66 ÷ 40 = 1.65		M1M1A0
	(0 +) 10 + 16 + 21 + 20 + 15 ÷ 40 with missing brackets not recovered		M1M0
	Correct products or values seen but a different method used is a choice of methods eg (0) 10 16 21 20 15 followed by 40 ÷ 6 or 40 ÷ 15		M0

Q	Answer	Mark	Comments
16(c)	$10 + 8 + 7 + 5 + 3$ or 33 or $40 - 7$ or 33 or $\frac{7}{40}$	M1	oe
	$\frac{33}{40}$ or 0.825 or 82.5%	A1	oe accept 0.83 or 83%
	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		
	33 out of 40		M1A0
	33 : 40		M1A0

Q	Answer	Mark	Comments
17	**Alternative method 1**		
	8 × 1.65 or 13.2	M1	oe
	their 13.2 ÷ 3.8 or [3.47, 3.474] or [3.47, 3.474] × 100 or [347, 347.4]	M1	oe their 13.2 must come from a division or multiplication using 8 and 1.65 only
	3.47	A1	SC2 3.4(0) or 3.5(0) SC1 50.16 or 1.27 or 1.28
	Alternative method 2		
	8 ÷ 3.8 or [2.1, 2.11]	M1	oe
	their [2.1, 2.11] × 1.65 or [3.465, 3.4815] or [3.465, 3.4815] × 100 or [346.5, 348.15]	M1	oe their [2.1, 2.11] must come from a division or multiplication using 8 and 3.8 only
	3.47	A1	SC2 3.4(0) or 3.5(0) SC1 50.16 or 1.27 or 1.28
	Alternative method 3		
	1.65 ÷ 3.8 or [0.43, 0.434211]	M1	oe
	8 × their [0.43, 0.434211] or [3.44, 3.474] or [3.44, 3.474] × 100 or [344, 347.4]	M1dep	oe
	3.47	A1	SC2 3.4(0) or 3.5(0) SC1 50.16 or 1.27 or 1.28

Additional guidance continues 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 347 cm or 348 cm with metres crossed out	M1M1A0
	Begins by multiplying or dividing by a power of 10 eg1 800 × 1.65 ÷ 3.8 oe with answer 3.47 (recovered) eg2 8 × 165 ÷ 3.8 oe with answer 347 eg3 800 × 1.65 oe with answer 1320 eg4 0.8 × 165 oe	 M1M1A1 M1M1A0 M1M0 M1
	3.47 in working but a different answer on the answer line, eg 1 3.47 in working but 3 on answer line eg 2 3.47 in working but 347 on answer line	 M1M1A0 M1M1A0
	8 × 1.65 ÷ 3.8 oe	M1M1
	8 ÷ (3.8 ÷ 1.65)	M1M1
	8 × 1.65 × 3.8 oe (which gives 50.16)	M1M0
	8 ÷ 1.65 ÷ 3.8 oe (which gives 1.27 or 1.28)	M0M1
	8 ÷ 1.65 × 3.8 oe (which gives 18.4242…)	M0M0
	1.65 × 3.8 with no other relevant working	M0

Q	Answer	Mark	Comments
18	**Alternative method 1** – capacity of 9 tins of white paint and 4 tins of red paint compared with the 2500 ml bucket capacity		
	3630 ÷ 11 or 330 or 9 × 140 or 1260	M1	oe
	their 330 × 4 or 1320 or 2500 – their 1260 or 1240 or 2500 – their 330 × 4 or 1180	M1dep	oe 3630 × $\frac{4}{11}$ is M2 their 330 and their 1260 must be from correct methods
	their 1260 + their 1320 or 2580 **or** 2500 – their 1320 and their 1260 **or** their 1180 and their 1260 **or** 2500 – their 1260 and their 1320 **or** their 1240 and their 1320	M1dep	oe eg 2500 – 1320 or 1180 **and** 1180 – 140 – 140 – 140 – 140 – 140 – 140 – 140 – 140 – 140 or –80 their 1180, their 1240, their 1260 and their 1320 must be from correct methods
	2580 and No **or** 1180 and 1260 and No **or** 1240 and 1320 and No or (–)80 and No	A1	oe eg1 No, there is 80 too much eg2 No, only 60 ml of the last tin will fit into the bucket

Mark scheme and Additional Guidance continue on the next page

18 cont	**Alternative method 2** – The number of tins of white or red paint that can be added to 4 tins of red or 9 tins of white paint to fill the 2500 ml bucket		
	3630 ÷ 11 or 330 or 9 × 140 or 1260	M1	oe
	their 330 × 4 or 1320 or 2500 – their 1260 or 1240 or 2500 – their 330 × 4 or 1180	M1dep	oe 3630 × $\frac{4}{11}$ is M2 their 330 and their 1260 must be from correct methods
	$\frac{2500 - \text{their } 1320}{140}$ or $\frac{\text{their } 1180}{140}$ or [8.4, 8.43] or $\frac{2500 - \text{their } 1320}{9}$ or $\frac{\text{their } 1180}{9}$ or 131(.1…) or $\frac{2500 - \text{their } 1260}{\text{their } 330}$ or $\frac{\text{their } 1240}{\text{their } 330}$ or [3.75, 3.8] or $\frac{2500 - \text{their } 1260}{4}$ or $\frac{\text{their } 1240}{4}$ or 310	M1dep	oe their 330, their 1180, their 1240, their 1260 and their 1320 must be from correct methods
	[8.4, 8.43] and No or [3.75, 3.8] and No or 131(.1…) and No or 310 and No	A1	oe

Mark scheme and Additional Guidance continue on the next page

18 cont	**Alternative method 3** – 4 tins of red paint as a proportion of 2500 ml added to 9 tins of white as a proportion of 2500 ml		
	$3630 \div 11$ or 330 or 9×140 or 1260	M1	oe
	$\frac{\text{their } 330 \times 4}{2500}$ or 0.52(8) or 0.53 or $\frac{\text{their } 1260}{2500}$ or 0.504 or 0.5(0)	M1dep	oe their 330 and their 1260 must be from correct methods
	$\frac{\text{their } 330 \times 4}{2500}$ or 0.52(8) or 0.53 **and** $\frac{\text{their } 1260}{2500}$ or 0.504 or 0.5(0)	M1dep	oe
	$0.528 + 0.504 = 1.032$ and No	A1	oe eg1 $0.53 + 0.5 = 1.03$ and No eg2 52(%) + 50(%) > 100(%) and No
	Alternative method 4 – 4 tins of red paint as proportion of 2500 ml compared with the volume of the bucket remaining after 9 tins of white added as a proportion of 2500 ml		
	$3630 \div 11$ or 330 or 9×140 or 1260	M1	oe
	$\frac{\text{their } 330 \times 4}{2500}$ or 0.52(8) or 0.53 or $\frac{2500 - \text{their } 1260}{2500}$ or 0.49(6) or 0.5(0)	M1dep	oe their 330 and their 1260 must be from correct methods
	$\frac{\text{their } 330 \times 4}{2500}$ or 0.52(8) or 0.53 **and** $\frac{2500 - \text{their } 1260}{2500}$ or 0.49(6) or 0.5(0)	M1dep	oe their 330 and their 1260 must be from correct methods
	$0.528 > 0.496$ and No	A1	oe eg1 $0.53 > 0.5$ and No eg2 52(%) > 50(%) and No

Additional Guidance continues on the next page

	Additional Guidance	
18 cont	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	
	No may be implied eg1 2580 and there is 80 (ml) too much paint eg2 8.4 tins so 9 tins is too much	
	2580 and No	M1M1M1A1
	1180 and 1260 and No	M1M1M1A1
	1240 and 1320 and No	M1M1M1A1
	80 and No	M1M1M1A1
	Condone 1180 – 1260 = 80 and No	M1M1M1A1
	Condone an incorrect statement after the correct answer seen eg 1180 and 1260 and –80 and No, there is 60ml left in the 9th tin	M1M1M1A1

Q	Answer	Mark	Comments
19	$n \leqslant 2$	B1	

Q	Answer	Mark	Comments
20(a)	27 ÷ 1.2 or 22.5	M1	oe eg 27 × 0.83(3…)
	22.50	A1	
	Additional Guidance		
	M1 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts		
	Condone (£)22.50p		
	22.50 in working with answer 22.5		M1A1
	22.5(0) in working with answer 22 or 23		M1A0
	Answer of 22 or 23 with no working		M0A0
	22.5(0) × 1.2 = 27		M1A0
	Build up must be a fully correct method		

Q	Answer	Mark	Comments
20(b)	7.5	B3	B2 168 ÷ 8 × 5 ÷ 14 oe or 168 ÷ 8 × 5 oe or 105 or 168 × 5 ÷ 14 oe or 60 or 168 ÷ 8 ÷ 14 oe or 1.5 or 14 ÷ 5 × 8 oe or 22.4 B1 168 ÷ 8 or 21 or 168 × 5 or 840 or 168 ÷ 14 or 12 or 14 ÷ 5 or 2.8 or 14 × 8 or 112 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	
7.5 in working with answer 7 or 8	B3
21 × 5	B2
840 ÷ 14	B2
21 ÷ 14	B2
2.8 × 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 dogs the heavier the dogs	B1	
	The taller they are the more they weigh	B1	
	Taller dogs are heavier	B1	
	The tallest dogs have more mass than the shorter dogs	B1	
	The shortest dogs have a lower mass	B1	
	Mass and height both increase at the same time (condone)	B1	
	The height and mass of the dogs increase at the same rate (condone)	B1	
	A tall dog 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	$\frac{1}{2} \times (14 + 20) \times 11$ or 187	M1	oe any correct method to find the area of the trapezium
	$\frac{1}{2} \times 10 \times 7$ or 35	M1	oe eg $\frac{1}{2} \times 10 \times 7 \times \sin 90$
	222	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		
	$14 \times 11 + \frac{1}{2} \times 6 \times 11$		M1
	Missing brackets must be recovered eg1 $\frac{1}{2}\times 20+14\times 11$ and 187 eg2 $\frac{1}{2}\times 20+14\times 11$		M1 M0
	$20 \times 11 = 220$		M0M0A0

Q	Answer	Mark	Comments
23	**Alternative method 1**		
	72 ÷ 6 × 5 or 60	M1	oe 72 ÷ 6 × 11 or 132 implies M1
	72 × 1.5 or 108	M1	oe eg 72 × 3 ÷ 2 14 × 12 implies M2
	60 and 108 and 240 or 250 – 60 – 108 = 82	A1	oe eg1 168 and 240 eg2 60 and 108 and 10 eg3 168 and (250 – 72 =) 178
	Alternative method 2		
	6 × 1.5 or 9	M1	oe eg1 6 × 3 ÷ 2 eg2 6 : 5 : 9
	72 ÷ 6 × (6 + 5 + their 9) or 72 ÷ 6 × 5 and 72 ÷ 6 × their 9	M1dep	oe eg 12 × 20 14 × 12 implies M2
	9 and 240 or 60 and 108 and 240 or 250 – 60 – 108 = 82	A1	oe eg1 168 and 240 eg2 60 and 108 and 10 eg3 168 and (250 – 72 =) 178
	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		
	240 alone or 240 with no correct method		M0
	72 ÷ 6 × 11 = 132 and 132 + 108 = 240		M1M1A1
	$1\frac{1}{2} \times 72 = 36$ and 72 + 36 = 108 and 72 + 60 + 108 = 240		M1M1A1
	$1\frac{1}{2} \times 72 = 36$		M1
	$1\frac{1}{2}$ of 72 = 36		M0
	72 ÷ 11		M0

Q	Answer	Mark	Comments
24	**Alternative method 1**		
	3.6 × 1000 or 3600	M1	
	$\frac{\text{their } 3600}{512}$ or 7(.0…) or $\frac{\text{their } 3600}{7.87}$ or 457(.4…)	M1dep	oe
	7(.0…) and No or 457(.4…) and No	A1	
	Alternative method 2		
	3.6 × 1000 or 3600	M1	
	7.87 × 512 or 4029(.4…)	M1	oe
	4029(.4…) and 3600 and No	A1	
	Alternative method 3		
	$\frac{3.6}{512}$ or 0.007(0…) or $\frac{3.6}{7.87}$ or 0.457(4…)	M1	oe eg $7(.0\ldots) \times 10^{-3}$
	their 0.007(0…) × 1000 or 7(.0…) or 0.457(4…) × 1000 or 457(.4…)	M1dep	oe
	7(.0…) and No or 457(.4…) and No	A1	

Mark scheme and Additional Guidance continue on the next page

Q	Answer	Mark	Comments
24 cont	**Alternative method 4**		
	7.87 ÷ 1000 or 0.00787 or 7.87 × 512 or 4029(.4…)	M1	
	their 0.00787 × 512 or their 4029(.4…) ÷ 1000 or 4(.0…) or $\frac{3.6}{\text{their } 0.00787}$ or 457(.4…)	M1dep	oe
	4(.0…) and No or 457(.4…) and No	A1	
	Alternative method 5		
	$\frac{3.6}{512}$ or 0.007(0…)	M1	oe eg $7(.0\ldots) \times 10^{-3}$
	7.87 ÷ 1000 or 0.00787	M1	oe
	0.007(0…) and 0.00787 and No	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		
	In Alt 2 and Alt 5 the 2nd mark is not dependent In Alt 1, Alt 3 and Alt 4 the 2nd mark is dependent		
	7.87 × 512 = 1 056 293 519		M1
	7.87×512^3 or $3.6 \div 512^3$ unless recovered		M0

Q	Answer	Mark	Comments
25(a)	**Alternative method 1**		
	20	B3	B2 53 or $33 + 20$ or $73 - 20$ or $\frac{73-33}{2}$ or $\frac{40}{2}$ B1 $73 - 33$ or 40
	Alternative method 2		
	$33 + x$ or $73 - x$	M1	oe
	$x + 33 + x = 73$ or $2x + 33 = 73$ or $\frac{73-33}{2}$ or $\frac{40}{2}$	M1dep	oe eg $33 + x = 73 - x$
	20	A1	
	Additional Guidance		
	$33 + x = 73$		M1

Q	Answer	Mark	Comments
25(b)	No and gives valid reason	B1	eg No and the first term is zero or No and $1 - 1^2 = 0$ or No and all the terms are negative except the first
	Additional Guidance		
	Ignore incorrect or irrelevant statements alongside correct statements		
	Ignore all other statements and evaluations if $1 - 1^2 = 0$ seen		
	Ticks Yes		B0
	No and 0, –2, –6, …		B1
	No and $1 - 1^2 = 0$ with $2 - 1^2 = 1$		B1
	No and $1 = 1^2$		B1
	No and $1 - 1 = 0$ (0 is positive) (condone)		B1
	No and n^2 can be equal to n and $1^2 = 1$		B1
	No and n^2 can be equal to n		B0
	No and n could equal 1 which cannot become bigger when squared		B1
	No and if you put $n = 1$ it's not negative		B1
	No and $n = 1$ and $n^2 = 1$		B1
	No, all the terms are negative except when $n = 1$		B1
	No and if $n = 1$ it creates 0		B1
	No, not when $n = 1$		B0
	No, it doesn't work for the first term		B0
	No and $0.5 - 0.5^2 = 0.25$		B0
	No and when $n = 0$ it won't be negative		B0

Q	Answer	Mark	Comments
26	$-\frac{5}{4}$ or $-1\frac{1}{4}$ or -1.25	B2	B1 $\frac{5}{4}$ or $1\frac{1}{4}$ or 1.25 or $x+4$ and $y-5$ or possible coordinates for *P* and *Q* stated or shown on a diagram eg *P*(0, 5) and *Q*(4, 0) or right-angled triangle shown with 4 as horizontal length and 5 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 $\frac{-5}{4}$	B2
Condone $\frac{5}{-4}$	B2
$(x+4)$ $(y-5)$	B1
$x+4$ and $y-5$ may be seen embedded in a fraction eg $\frac{y-(y-5)}{x-(x+4)}$ or $\frac{y-(y-5)}{x+(x+4)}$	B1
$-\frac{4}{5}$	B0
$\frac{4}{5}$	B0

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

Q	Answer	Mark	Comments
28	**Alternative method 1**		
	$0.49 \times (250 + 50)$ or 0.49×300 or 147	M1	oe
	their $147 - 128$ or 19	M1dep	
	19 : 31	A1	SC2 answer 31 : 19
	Alternative method 2		
	$(1 - 0.49) \times (250 + 50)$ or 0.51×300 or 153	M1	oe
	their $153 - 122$ or 31	M1dep	
	19 : 31	A1	SC2 answer 31 : 19
	Additional Guidance		
	Up to M2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts		
	147 : 153 or 153 : 147		M1M0A0
	0.49 : 0.51		M0M0A0
	Beware of 147 and 153 from incorrect working $122 + 25 = 147$ $128 + 25 = 153$		 M0 M0

Q	Answer	Mark	Comments
29	$c = \frac{2}{d}$	B1	

Q	Answer	Mark	Comments
30	$0.5 \times \pi \times 45$ or $0.5 \times$ [141, 141.4] or [70.5, 70.7] or $0.5 \times \pi \times 45 + 75$ or [145.5, 145.7]	M1	oe eg 22.5π
	$(0.5 \times \pi \times 45 + 75) \div 18$ or their [145.5, 145.7] $\div$ 18	M1	oe their [145.5, 145.7] can be any value
	8.08(…) or 8.09(…)	A1	may be implied by 8.1
	8.1	B1ft	ft any answer seen with greater than 2 sf SC2 3.9
	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		
	$\frac{120}{18} = 6.67$ answer 6.7		M0M1A0B1ft
	$\frac{120}{18} = 6.7$		M0M1A0B0ft
	$0.5 \times \pi \times 45$ and $70.7 \div 18 = 3.93$ answer 3.9		M1M1A0B1ft
	SC2 for an answer of 3.9 without working is when 75 is not used		

Q	Answer	Mark	Comments
31	24×1.8 or 43.2 or 20×1.92 or 38.4 or $\frac{432}{384}$ or $\frac{9}{8}$ or $1\frac{1}{8}$	M1	oe eg1 24×180 or 4320 eg2 20×192 or 3840
	1.125 or 1.13	A1	accept 1.1 with M1 awarded
	Additional Guidance		
	M1 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		
	Condone use of units in answer eg 1.125 m		M1A1
	$\frac{9}{8} = 1.125$ on answer line		M1A1
	$\frac{9}{8}$ and 1.125 on answer line		M1A0
	$\frac{43.2}{38.4}$		M1A0
	$\frac{1.92}{1.8} = 1.1$		M0A0