GCSE
MATHEMATICS
8300/2F

Foundation Tier

Paper 2 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	45	B1	

Q	Answer	Mark	Comments
2	$\frac{3}{10}$	B1	

Q	Answer	Mark	Comments
3	–0.4°C	B1	

Q	Answer	Mark	Comments
4	Q	B1	

Q	Answer	Mark	Comments
5(a)	c^3	B1	
	Additional Guidance		
	Allow C^3		B1
	$ccc = c^3$		B1
	ccc		B0
	$1c^3$		B0
	$c3$		B0

Q	Answer	Mark	Comments
5(b)	2 or $2n^0$	B1	
	Additional Guidance		
	$\frac{4n}{2n} = 2$ or $\frac{4n}{2n} = 2n^0$	B1	
	$\frac{4n}{2n}$	B0	
	$\frac{4}{2}$ or $4 \div 2$	B0	

Q	Answer	Mark	Comments
5(c)	$3t$	B1	
	Additional Guidance		
	Allow 3T	B1	
	$3 \times t = 3t$	B1	
	$3 \times t$	B0	
	3^t	B0	
	$\frac{3t}{1}$ or $\frac{3}{1}t$	B0	

Q	Answer	Mark	Comments
6(a)	100 or 10^2	B1	
	Additional Guidance		
	Allow commas but not decimal points eg 1,00 eg 1.00 or 10.0	 B1 B0	

Q	Answer	Mark	Comments
6(b)	7.9 or $\frac{79}{10}$ or $7\frac{9}{10}$	B1	
	Additional Guidance		
	Allow extra zeros eg 7.90		B1

Q	Answer	Mark	Comments
6(c)	$\frac{3}{8}$	B1	oe fraction eg $\frac{6}{16}$
	Additional Guidance		
	0.375		B0

Q	Answer	Mark	Comments
6(d)	24 24 or –24 –24	B1	accept $\sqrt{576}$ $\sqrt{576}$
	Additional Guidance		
	Condone 24 only in one box if other box is blank		B1
	Condone –24 only in one box if other box is blank		B1
	Condone $\sqrt{576}$ only in one box if other box is blank		B1

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="11">7(a)</td><td>(One test) Six symbols</td><td>B1</td><td>allow any orientation for the half circle</td></tr>
<tr><td>(Two tests) Two and a half symbols</td><td>B1</td><td></td></tr>
<tr><td>(Three tests) Three and a half symbols</td><td>B1</td><td>SC1 totals seen for either pictogram
ie 12, 16, 6 for group A
or 24, 10, 14 or 6, 2.5, 3.5 for group B</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">Mark intention eg accept any attempt at circle and half circle symbol (unless obviously intended to be quarter or three-quarter circle) and allow different sizes and symbols such as plain circles</td><td></td></tr>
<tr><td colspan="2">Two half circle symbols are not acceptable for a whole circle (unless joined to make a circle)</td><td></td></tr>
<tr><td colspan="2">Alignment of symbols is not being tested</td><td></td></tr>
<tr><td colspan="2">Apart from the Special Case, ignore numbers given</td><td></td></tr>
<tr><td colspan="2">SC1 may be implied by 24, 10 and 14 symbols</td><td></td></tr>
<tr><td colspan="2"><table><tr><td>One test</td><td>  </td></tr><tr><td>Two tests</td><td>  </td></tr><tr><td>Three tests</td><td>  </td></tr></table></td><td>B1B1B1</td></tr>
</table>

Q	Answer	Mark	Comments
7(b)	$\frac{3}{5}$ or $\frac{21}{35}$ or 0.6 or 60% or $35 - 21$ or 14 seen	M1	oe may be seen in a calculation eg $1 - \frac{21}{35}$
	$\frac{2}{5}$ or $\frac{14}{35}$ or 0.4 or 40%	A1	oe
	Additional Guidance		
	Ignore simplification or conversion if correct answer seen		
	$\frac{14}{35}$ in working or on answer line with 14 on answer line		M1A0
	Ignore words if correct answer seen eg $\frac{14}{35}$ unlikely		M1A1
	Answer 14 : 35 or 14 : 21 or 21 : 14 (even if correct answer also seen)		M1A0
	14 out of 35 without correct answer seen		M1A0
	Answer 21 : 35 only		M0A0
	eg $\frac{14}{21}$ or $\frac{1}{14}$ or 14% implies 14		M1

Q	Answer	Mark	Comments
8	$4 \times 11 + 3 \times -4$ or $(4r =)\ 44$ or $(3t =) -12$	M1	oe
	32	A1	
	Additional Guidance		
	$44 + 12$		M1A0
	44 or -12 may be implied by a calculation eg $4 \times 13 + 3 \times 4 = 56$		M1A0
	56 only does not imply 44		M0A0
	Values are not implied by incorrect expressions eg only $44r$		M0
	Incorrect further work		A0

Q	Answer	Mark	Comments
9	**Alternative method 1** Using number of coins left		
	195 ÷ 6 or 32.5	M1	oe implied by (195 ÷ 50) ÷ 6 or 3.9 ÷ 6 or 0.65
	their 32 × 6 or 192 or their 32.5 – their 32 or 0.5	M1dep	oe their 32 must be an integer
	195 – their 192 or their 0.5 × 3 (coins left)	M1dep	oe implied by 0.5 × 100 × 3 or 0.5 × 300 or 50 × 3
	1.50	A1	
	Alternative method 2 Using total value of coins given		
	195 ÷ 6 or 32.5	M1	oe implied by (195 ÷ 50) ÷ 8 or 3.9 ÷ 6 or 0.65
	their 32 × 50 × 6 or their 32 × 300 or 9600	M1dep	oe their 32 must be an integer
	195 × 50 or 9750	M1	oe
	1.50	A1	
	Alternative method 3 Using value of coins given to each child		
	195 ÷ 6 or 32.5	M1	oe implied by (195 ÷ 50) ÷ 8 or 3.9 ÷ 6 or 0.65
	their 32 × 50 or 1600	M1dep	oe their 32 must be an integer
	195 ÷ 6 × 50 or 9750 ÷ 6 or 1625	M1dep	oe dep on 1st M1 only
	1.50	A1	

Additional Guidance is on the next page

9 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	
	Use the scheme that awards most marks	
	Methods are shown in pence but equivalent working may be in pounds	
	NB 3 coins per child or (£)3 does not imply M3 in Alt 1. The 3 must be coins left	
	Alt 3 1600 or 16.(00) with no method does not imply 1625 or 16.25	
	In Alt 2 the 3rd mark is **not** dependent	
	Note that the third mark in Alt 3 implies the first mark ie 1625	M1M0M1

Q	Answer	Mark	Comments
10	$104 - 94$ or 10 or $104 - 94$ or 10 or $\frac{104-94}{2}$ or 5 or $\frac{94-104}{2}$ or -5 or $\frac{104+94}{2}$ or $\frac{198}{2}$ or 99 or $12 + 23 + 27 + 37 = 99$ or $2 + 25 + 32 + 40 = 99$	M1	oe eg $2 + 25 + 27 + 40 - 12 - 23 - 32 - 37$ or $12 + 23 + 32 + 37 - 2 - 25 - 27 - 40$ or $-10 + 2 + -5 + 3$ or $10 - 2 + 5 - 3$
	27 and 32	A1	either order
	Additional Guidance		
	Up to M1 may be awarded for correct work with no answer, or incorrect answer, even if this is seen amongst multiple attempts		
	Answer 27 and 32 even if working unclear (eg many attempts)		M1A1
	99 only seen from an incorrect addition		M0

Q	Answer	Mark	Comments
11	$p = m - 7$	B1	

Q	Answer	Mark	Comments
12(a)	15 or $\frac{1}{4}$ or 45 or $\frac{3}{4}$	M1	oe allow no units or incorrect units may be on graph
	45 minutes or $\frac{3}{4}$ hour	A1	oe
	Additional Guidance		
	Allow abbreviated units eg 45 min(s) eg condone 45 m eg $\frac{3}{4}$ h		M1A1 M1A1 M1A1
	45 minutes in working with answer 45		M1A1
	$\frac{3}{4}$ hour in working with answer $\frac{3}{4}$		M1A1
	0.15 + 0.15 + 0.15 is M0 unless recovered to 45		

Q	Answer	Mark	Comments
12(b)	25 or $5 + 5 + 15$	M1	oe may be embedded 25 may be on graph eg on y-axis
	50	A1	
	Additional Guidance		
	25×2 with no or incorrect evaluation		M1A0
	Allow the first mark embedded in a calculation eg $25 + 5$ or $25 + 5 + 5 + 15$ or $25 + 25 + 15 + 15$ or $25 - 20 - 15$		M1A0

Q	Answer	Mark	Comments
13	Definitely true Cannot be true Definitely true	B3	B1 for each any clear indication
	Additional Guidance		
	Only one cross in a row – mark the cross		
	A tick and cross(es) in a row – mark the tick		
	More than one tick in a row scores B0 for that row		

Q	Answer	Mark	Comments
14(a)	$\frac{270 + 531}{9}$ or $\frac{801}{9}$	M1	oe
	89	A1	SC1 329.3
	Additional Guidance		
	Only $270 + 531 \div 9$ with brackets missing		M0A0
	89.00		M1A1
	89.0		M1A0

Q	Answer	Mark	Comments
14(b)	**Alternative method 1**		
	$55 = \frac{270 + x}{12}$ or 55×12 or 660 seen	M1	oe eg 660 = 270 + cost of rent of house any letter or symbol or word(s)
	$55 \times 12 - 270$	M1dep	oe
	390	A1	
	Alternative method 2		
	$270 \div 12$ or 22.5	M1	oe
	(55 – their 22.5) × 12 or 32.5×12	M1dep	oe
	390	A1	
	Additional Guidance		
	Up to M2 may be awarded for correct work with no answer, or incorrect answer, even if this is seen amongst multiple attempts		
	(270 + any value) ÷ 12 does not imply M1 unless set up as an equation for the first mark of Alt 1		
	Allow 9 as a misread for 12		

Q	Answer	Mark	Comments
15	P (4, 0) Q (6, 6)	B2	B1 P (4, 0) or Q (6, 6) or both x-coordinates correct or both y-coordinates correct SC1 P (6, 6) Q (4, 0)
	Additional Guidance		
	Accept eg $P(\overset{x}{4}, \overset{y}{0})$		
	Do not accept eg $P(4x, 0y)$		

Q	Answer	Mark	Comments
16(a)	$360 - 144 - 40 - 90$ or 86 or $x + x + 144 + 40 + 90 = 360$	M1	oe eg $360 - 274$ or $2x + 274 = 360$
	43	A1	
	Additional Guidance		
	$86 \div 2$	M1	
	86 may be embedded for M1 eg $86 + 144 + 40 + 90 = 360$ eg $144 + 40 + 90 + 40 + 46 = 360$ (because 40 and 46 total 86) eg $144 + 40 + 90 + 43 + 43 = 360$ (43 needs to be selected to score A1)	 M1 M1 M1	
	43 seen followed by answer 86	M1A0	

Q	Answer	Mark	Comments
16(b)	$\frac{195}{90}$ or 2.166… or $\frac{90}{195}$ or 0.46(15…) or 0.46 or any correct method that would lead to answer 312 eg $\frac{144}{90} \times 195$ or $195 \div \frac{90}{144}$ or $\frac{144}{360} \times 195 \times 4$ or 0.4×780 or $195 \times 4 \div \frac{360}{144}$ or $144 + 144 + (144 \div 6)$ or $288 + 24$	M2	oe M1 linking a correct angle with number of people eg $90 \rightarrow 195$ or $\frac{1}{4} \rightarrow 195$ or $180 \rightarrow 390$ or $72 \rightarrow 156$ or $195 \times 360 \div 90$ or 195×4 or 780 or $\frac{144}{90}$ or 1.6 or $\frac{90}{144}$ or 0.625 or 0.62 or 0.63 or $\frac{144}{360}$ or 0.4 or 40% or $\frac{360}{144}$ or 2.5
	312	A1	

Additional Guidance	
Up to M2 may be awarded for correct work with no answer, or incorrect answer, even if this is seen amongst multiple attempts	
M1 may be seen as eg $90 = 195$	
If shown on pie chart, just writing 195 in Computer sector is insufficient for M1 unless 90 or $\frac{1}{4}$ also shown	
Allow embedded fraction, even in an incorrect calculation for at least M1 eg $\frac{90}{144} \times 195$ eg $\frac{90}{195} \times 144$	M1 M2
Build-up must be correct or full method must be shown	
312 from an incorrect method eg $195 + 86 + 31$	M0A0

Q	Answer	Mark	Comments
17	100	B1	oe eg 10^2 or hundred
	Additional Guidance		
	Do not allow 100 000 even if word thousand is crossed out		
	1 hundred or one hundred or a hundred	B1	
	100 000 100 thousand	B1	

Q	Answer	Mark	Comments
18(a)	48.5(0) × 30 000	M1	oe implied by digits 1455
	1 455 000	A1	oe eg 1.455×10^6 or 1.455 million or 1.455 m SC1 2 910 000 or 727 500
	Additional Guidance		
	Allow any commas or spaces eg 1,455,000	M1A1	
	Using decimal points is A0, even if 1 455 000 seen in working eg 145 500.00	M1A0	
	1 455 000 seen in working but loses or gains one zero on answer line is acceptable as a transcription error eg 1 455 000 seen and answer 1 4055 000 or answer 1 455 00	M1A1	
	Do not allow the A1 for further work (but may gain M1 eg for digits 1455 seen or SC1)		

Q	Answer	Mark	Comments
18(b)	It is not possible to tell	B1	

Q	Answer	Mark	Comments
18(c)	**Alternative method 1** Working out the increase using 65%		
	$50\,000 - 30\,000$ or $20\,000$	M1	oe
	$0.65 \times 30\,000$ or $19\,500$	M1	oe
	$20\,000$ and $19\,500$ and Yes	A1	oe
	Alternative method 2 Working out the tickets for the second or first match using 65%		
	$0.65 \times 30\,000$ or $19\,500$	M1	oe
	$30\,000 + 0.65 \times 30\,000$ or $49\,500$ or $50\,000 - 0.65 \times 30\,000$ or 500	M1dep	oe $1.65 \times 30\,000$ scores M2
	$49\,500$ and Yes or $30\,500$ and Yes	A1	oe
	Alternative method 3 Working out the percentage increase		
	$50\,000 - 30\,000$ or $20\,000$ or $\frac{50\,000}{30\,000}$ or 1.666…	M1	oe
	$\frac{50\,000 - 30\,000}{30\,000}$ or $\frac{20\,000}{30\,000}$ or $\frac{50\,000}{30\,000} - 1$ or $1.666\ldots - 1$ or 0.666… or 66.6… or 1.666… **and** 1.65	M1dep	oe eg $\frac{50-30}{30}$
	66.6… and Yes or 0.666… and 0.65 and Yes or 1.666… and 1.65 and Yes	A1	oe

Additional Guidance is on the next page

	Additional Guidance	
18(c) cont	Up to M2 may be awarded for correct work with no answer, or incorrect answer, even if this is seen amongst multiple attempts	
	May use sales of tickets but must use 1 455 000 **Alt 1** $50\,000 \times 48.5 - 30\,000 \times 48.5$ or $2\,425\,000 - 1\,455\,000$ or $970\,000$ $0.65 \times 1\,455\,000$ or $945\,750$ $970\,000$ and $945\,750$ and Yes **Alt 2** $0.65 \times 1\,455\,000$ or $945\,750$ $1\,455\,000 + 945\,750$ or $2\,400\,750$ or $2\,425\,000 - 945\,750$ or $1\,479\,250$ $2\,400\,7500$ and $2\,425\,000$ and Yes or $1\,479\,250$ and $1\,455\,000$ and Yes **Alt 3** $50\,000 \times 48.5 - 30\,000 \times 48.5$ or $2\,425\,000 - 1\,455\,000$ or $970\,000$ or $\frac{2\,425\,000}{1\,455\,000}$ $\frac{2\,425\,000 - 1\,455\,000}{1\,455\,000}$ 66.6… and Yes	 M1 M1 A1 M1 M1dep A1 M1 M1dep A1
	Only $30\,000 - 50\,000$ (may be recovered)	M0
	In Alt 1 the 2nd mark is **not** dependent	
	Build-up to 65% must be correct or full method must be shown	
	Accept $65\% \times 30\,000$ for 2nd mark of Alt 1 or 1st mark of Alt 2	M1

Q	Answer	Mark	Comments	
19	**Alternative method 1**			
	Pair of integers in the ratio 4 : 5 between 16 : 20 and 60 : 75 or list of multiples of 9 with at least 3 correct including 72 or $72 \div 9 = 8$ or $72 \div 8 = 9$ or $9 \times 8 = 72$	M1	16 and 20 or 20 and 25 or 24 and 30 or 28 and 35 or 32 and 40 or 36 and 45 or 40 and 50 or 44 and 55 or 48 and 60 or 52 and 65 or 56 and 72 or 60 and 75 or 64 and 80 or 68 and 85	
	72	A1		
	Alternative method 2			
	An integer [70, 80] divided in the ratio 4 : 5 eg $75 \div 9 \times 5$ and $75 \div 9 \times 4$	M1	if no method seen, values must be rounded or truncated to at least 1 dp eg 75 and 41.7 and 33.3	
	72	A1		
	Additional Guidance			
	Up to M1 may be awarded for correct work with no answer, or incorrect answer, even if this is seen amongst multiple attempts			
	M1 pairs of responses may be seen in a ratio			
	Answer 32 : 40			M1A0
	72 seen in list of multiples eg 27, 36, 45, 54, 63, 72, … but not selected as the answer			M1A0
	72 from incorrect method with no M1 response seen			M0A0
	Alt 2 eg $75 \div 9 = 8.3$ with 41.5 and 33.2 implies multiplication by 5 and 4 (because it follows through from their answer to the correct division)			M1A0
	Alt 2 eg $75 \div 9 = 8.3$ with 41.7 and 33.3 implies multiplication by 5 and 4 (may have kept full value on calculator)			M1A0
	Alt 2 eg 75 and no working with 41.5 and 33.2 does not imply the method (because these are not rounded or truncated to at least 1 dp)			M0A0

Q	Answer	Mark	Comments
20(a)	$\frac{90-42}{100} \times 36\,000$ or $\frac{50}{100} \times 36\,000$ or 18 000 or $\frac{36}{100} \times 36\,000$ or 12 960 or $\frac{50-36}{100} \times 36\,000$ or 14 and 50 and 36 seen	M1	oe
	5040	A1	SC1 5400 or answer with digits 504
	Additional Guidance		
	Up to M1 may be awarded for correct work with no answer, or incorrect answer, even if this is seen amongst multiple attempts		
	Build-up to 50% or 36% must be correct or full method must be shown		
	eg only 50% × 36 000 with no or incorrect evaluation		M0

Q	Answer	Mark	Comments
20(b)	Ticks Cannot tell and valid reason	B1	eg ticks Cannot tell and We don't know the number sold (in 2007)
	Additional Guidance		
	Ignore calculations using percentages from the bar chart		
	Allow any unambiguous indication of Cannot tell with a valid reason		
	Ticks Cannot tell and They might have sold fewer drinks (in 2007)		B1
	Ticks Cannot tell and It (only) gives percentages		B1
	Ticks Cannot tell and It doesn't tell you how many teas were sold		B1
	Ticks Cannot tell and Don't have enough information		B1
	Ticks Cannot tell and Both bars the same height		B0
	Ticks Yes or ticks No		B0

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="11">21(a)</td><td>Correct evaluation of the square root of an integer [10, 20]
or
correct evaluation of the square of a decimal or fraction [3.5, 4.5)</td><td>M1</td><td>eg $\sqrt{10} = 3.16$ or $10 \rightarrow 3.16$

eg $3.5^2 = 12.25$ or $3.5 \rightarrow 12.25$</td></tr>
<tr><td>13</td><td>A1</td><td>SC1 answer given as $\sqrt{13}$</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">Up to M1 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 colspan="2">Condone eg $10 = 3.16$</td><td></td></tr>
<tr><td colspan="2">Answer only 13</td><td>M1A1</td></tr>
<tr><td colspan="2">Must select 13 as final answer for M1A1 ie 13 as the last in a list with a blank answer line is not enough for A1 unless 13 selected</td><td></td></tr>
<tr><td colspan="2">If $\sqrt{13}$ or 3.5^2 is evaluated then it must be correct to award the A1 for 13</td><td></td></tr>
<tr><td colspan="3">Acceptable values for square roots of integers in range
<table>
<tr><td>10</td><td>3.1(62…) or 3.2</td><td></td><td>16</td><td>4</td></tr>
<tr><td>11</td><td>3.3(16…) or 3.317 or 3.32</td><td></td><td>17</td><td>4.1(23…)</td></tr>
<tr><td>12</td><td>3.4(64…) or 3.5</td><td></td><td>18</td><td>4.2(42…) or 4.243</td></tr>
<tr><td>13</td><td>3.6(05…) or 3.606 or 3.61</td><td></td><td>19</td><td>4.3(58…) or 4.359 or 4.36 or 4.4</td></tr>
<tr><td>14</td><td>3.7(41…) or 3.742</td><td></td><td>20</td><td>4.4(72…) or 4.5</td></tr>
<tr><td>15</td><td>3.8(72…) or 3.873 or 3.9</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td colspan="3">Examples of squares of numbers in range with their acceptable values
<table>
<tr><td>3.5</td><td>12.25 or 12.3 or 12</td><td></td><td>4.0</td><td>16</td></tr>
<tr><td>3.6</td><td>12.96 or 13</td><td></td><td>4.1</td><td>16.8(1) or 17</td></tr>
<tr><td>3.7</td><td>13.69 or 13.7 or 14</td><td></td><td>4.2</td><td>17.6(4) or 18</td></tr>
<tr><td>3.8</td><td>14(.44)</td><td></td><td>4.3</td><td>18.49 or 18.5 or 18</td></tr>
<tr><td>3.9</td><td>15(.21)</td><td></td><td>4.4</td><td>19(.36)</td></tr>
</table></td></tr>
</table>

Q	Answer	Mark	Comments
21(b)	Valid response that indicates there is one (negative) answer missing	B1	eg -11 (is also an answer) or there is a negative value as well or square roots have two answers or answer is 11 and -11
	Additional Guidance		
	-11×-11 (= 121)		B1
	Another number can square to make 121 (implies exactly two)		B1
	He has forgotten the other value (implies exactly two)		B1
	There is another value it could be (implies exactly two)		B1
	It could be a different number (implies exactly two)		B1
	It could be negative (bod means 11 could be -11)		B1
	-11^2 (= 121) (condone missing brackets around -11)		B1
	$\pm \sqrt{121}$		B1
	Indication that there might be **more** than two possible values for x eg There are other possible numbers eg There could be other values eg Other numbers square to make 121 eg He hasn't included negatives		 B0 B0 B0 B0
	Repeating the question eg There is more than 1 possible value eg 11 is not the only possible value eg More than 1 number works		 B0 B0 B0
	A partially correct statement eg x could be negative or decimal eg $-11 \times -11 = -121$ eg $x^2 = -11$		 B0 B0 B0

Q	Answer	Mark	Comments
22(a)	6 5 4	B2	any order B1 answer of three positive numbers in any order with sum 15 eg 12 2 1 or $7\frac{1}{2}$ $5\frac{1}{2}$ 2 or 5 5 5 or $6\frac{2}{3}$ $4\frac{2}{3}$ $3\frac{2}{3}$ or correct equation in w, x and y eg $4w + 4x + 4y = 60$ or $w + x + y = 15$
	Additional Guidance		
	Ignore attempts to work out the volume or surface area eg 5 5 5 volume calculated as 250	B1	
	Negative numbers and/or zero used	B0	
	$wxy > 110$ or $wxy = 110$	B0	

Q	Answer	Mark	Comments
22(b)	$27a^3$	B1	

Q	Answer	Mark	Comments
23	(0, –7)	B1	

Q	Answer	Mark	Comments
24(a)	64.553 or 64.6 or 64.55	B2	B1 50.653 or 50.65 or 50.7 or 13.9 or $\frac{139}{10}$
	Additional Guidance		
	Truncated answer only eg 64 or 65 or 64.5		B0
	An incorrect answer cannot imply B1 – a value for B1 must be seen		
	Ignore subsequently incorrect rounding or any truncation once a correct B2 response seen eg 64.553 seen, answer 64 eg 64.55 seen, answer 64.5		 B2 B2

Q	Answer	Mark	Comments
24(b)	1.65×10^5	B2	B1 correct value not in standard form eg 165 000 or 16.5×10^4
	Additional Guidance		
	Ignore incorrect conversion if correct B1 value seen eg 165 000, answer 1.65×10^3 eg 165 000, answer 165^3		 B1 B1
	Ignore a decimal point in a correct B1 value if it is part of their conversion attempt		
	Condone $10^5 \times 1.65$		B2
	Only 1.65 05 or 1.65 10^5		B0
	Only $1.65 + 10^5$		B0

Q	Answer	Mark	Comments
25(a)	$1.4 \times 15 = 21$ and $50 - 21 = 29$	B1	oe eg $1.4 \times 15 = 21$ and $21 + 29 = 50$ or $50 - 29 = 21$ and $21 \div 15 = 1.4$ or $21 + 29 = 50$ and $21 \div 1.4 = 15$ may be seen as one calculation eg $50 - 1.4 \times 15 = 29$ or $29 + 1.4 \times 15 = 50$ or $50 - 29 = 1.4 \times 15$
	Additional Guidance		
	$50 - 21 = 29$ and $50 - 29 = 21$ and $21 + 29 = 50$ are equivalent		
	$1.4 \times 15 = 21$ and $21 \div 1.4 = 15$ and $21 \div 15 = 1.4$ are equivalent		
	$50 - 21 = 29$ or $29 + 21 = 50$ or $50 - 29 = 21$		B0
	(15 minutes =) 21 litres leak out $50 - 21 = 29$		B0
	$1.4 \times 15 = 21$ 29 litres left		B0
	Allow unambiguous working in ml and/or seconds		
	For eg $50 - 21 = 29$ condone $21 - 50 = 29$ or $21 - 50 = -29$		
	Condone incorrect use of equals sign eg $1.4 \times 15 = 21 + 29 = 50$ or $1.4 \times 15 = 21 - 50 = 29$		B1
	Correct response with irrelevant work		B1
	29 from two different ways with one way incorrect is choice eg $1.4 \times 15 = 21$ and $50 - 21 = 29$ and $21 \times 1.4 = 29$		B0

Q	Answer	Mark	Comments
25(b)	8	B1	
	Correct method for gradient eg $\frac{50-29}{15-\text{their } 8}$ or $\frac{21}{7}$	M1	oe eg $\frac{50-35}{15-10}$ or $\frac{15}{5}$ or $50-47$
	3	A1ft	correct or ft their 8
	Additional Guidance		
	Note that their 8 can be used to work out the rate but does not have to be		
	Values seen on graph must be used correctly eg 12 and 4 seen on the graph is M0 unless subsequently used correctly in attempt to work out the gradient		
	A1ft answers must be to 1 dp or better eg 8.5 $\frac{50-29}{15-8.5}$ 3.2 (accept 3.23…)		B0 M1 A1ft
	After B0 the method may be implied (use $\frac{50-29}{15-\text{their } 8}$ to check) eg 7 2.625 (accept 2.63)		B0 M1A1ft
	If the report is blank, 8 and 3 must be unambiguously identified in working to be acceptable		
	Allow 3 to be written as $\frac{3}{1}$		

Q	Answer	Mark	Comments
26	3.4^2 or 11.56 **and** 3^2 or 9 or 20.56	M1	implied by 20.56 or $\sqrt{20.56}$ or 4.5(3…)
	$\sqrt{3.4^2 - 3^2}$ or $\sqrt{11.56 - 9}$ or $\sqrt{2.56}$	M1dep	
	1.6	A1	
	Additional Guidance		
	Ignore incorrect rounding or truncation once correct answer seen		M1M1A1
	Answer 1.6 with no working		M1M1A1
	Answer 1.6 from trigonometry or accurate drawing		M0M0A0

Q	Answer	Mark	Comments
27	**Alternative method 1**		
	$5x + x + 4x + 5x + x + 5x + x$ or $22x$ or $5 + 1 + 4 + 5 + 1 + 5 + 1$ or 22	M1	oe eg $6x + 5x - x + 5x + x + 5x + x$ $22x$ or 22 is implied by 4.2 oe if addition not seen
	their $22x = 92.4$ or 92.4 ÷ their 22 or 4.2 or $\frac{21}{5}$	M1	oe equation must have terms collected if 1st M1 **not** awarded their $22x$ must be $20x$ or $21x$ or $23x$ if 1st M1 **not** awarded their 22 must be 20 or 21 or 23
	their 4.2 × 12	M1dep	dep on 2nd M1 oe eg 42 + 8.4
	50.4	A1ft	oe ft their 4.2 if M0M2 awarded

Mark scheme and Additional Guidance continue on the next page

27 cont	**Alternative method 2**		
	$5x + x + 5x$ or $11x$ or $5 + 1 + 5$ or 11	M1	oe eg $5x + x + 4x + x$ $11x$ or 11 is implied by 4.2 oe if addition not seen
	their $11x = 92.4 \div 2$ or $46.2 \div$ their 11 or 4.2 or $\frac{21}{5}$	M1	oe equation must have terms collected if 1st M1 **not** awarded their $11x$ must be $10x$ if 1st M1 **not** awarded their 11 must be 10
	their 4.2×12	M1dep	dep on 2nd M1 oe eg $42 + 8.4$
	50.4	A1ft	oe ft their 4.2 if M0M2 awarded
	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		
	Follow through must be to at least 1 dp and their 22 or their 11 must be seen		M0M1M1A1ft
	Both 2nd and 3rd method marks may be implied by their answer. If not using 20, 21, 22, 23, 10 or 11 you must have seen the first M1.		
	$23x = 92.4$ (1st M0, no addition seen, but $23x$ allowed) $\frac{92.4}{23} \times 14$, answer 56.2		M0M1 M1A1ft
	$6x + 4x + 5x + x + 5x + x = 20x$ (correct terms added with incorrect total) $92.4 \div 20 = 4.62$ 64.68 (multiplication by 14 implied)		M1 M1 M1A0
	$92.4 \div 20 = 4.62$ (1st M0, no addition seen, and 20 not allowed) 4.62×14, answer 64.68		M0M0 M0A0
	$5x + x + 4x + 5x + x + 5x + x = 22x^7$		M1M0M0A0

Q	Answer	Mark	Comments
28	At least two of 2^3, 3^3, 7 selected eg $2^3 \times 3^3 \times 7$ or 2 2 2 3 3 3 7 7 or $2^2 + 3^3 + 7$ or $2^3 \times 3^3$ or $2^3 + 7$ or $3^3 . 7$	M1	allow 2^3 to be $2 \times 2 \times 2$ or 8 allow 3^3 to be $3 \times 3 \times 3$ or 27 allow 7 to be 7^1 selection is implied by inclusion in intersection of overlapping circles
	1512	A1	
	Additional Guidance		
	$8 \times 27 \times 7$	M1	
	8, 27, 49	M1	
	$4 + 27 + 7$	M1	
	Intersecting circles with eg only 27 and 7 in the intersection	M1	
	Allow inclusion of 1 for up to M1 eg $1 \times 2^3 \times 3^3 \times 7$	M1	
	Answer 1512	M1A1	
	M1 seen with answer the LCM	M1A0	