GCSE
MATHEMATICS
8300/1H

Higher Tier Paper 1 Non-Calculator

Mark scheme

November 2022

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22BG8300/1H/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.

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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	Comment
1	$\frac{28}{9}$	B1	

Q	Answer	Mark	Comment
2	36	B1	

Q	Answer	Mark	Comment
3	$\frac{3}{1000}$	B1	

Q	Answer	Mark	Comment
4	$3x \equiv x + 2x$	B1	

Q	Answer	Mark	Comments
5	3 + 7 or 10	M1	implied by 10 symbols or 6.2
	62 ÷ their 10 × 3 or 6.2 × 3 or 18.6 or 62 ÷ their 10 × 7 or 6.2 × 7 or 43.4	M1dep	oe full method to work out either number
	18.6 or $\frac{93}{5}$ or $18\frac{3}{5}$ and 43.4 or $\frac{217}{5}$ or $43\frac{2}{5}$	A1	oe decimals, fractions or mixed numbers either order
	Additional Guidance		
	18.6 and 43.4 in working, but truncated or rounded to 18 or 19 and 43 on the answer line	M1M1A1	
	$62 = 10x$	M1	
	$\frac{x}{62} = \frac{3}{10}$ or $\frac{y}{62} = \frac{7}{10}$	M1	

Q	Answer	Mark	Comments
6	Definitely true Cannot be true Might be true	B3	B1 for each any clear indication
	Additional Guidance		
	Only a 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
7(a)	$\begin{pmatrix}4\\-1\end{pmatrix}$	B2	B1 $\begin{pmatrix}4\\....\end{pmatrix}$ or $\begin{pmatrix}....\\-1\end{pmatrix}$ or $(4, -1)$ SC1 $\begin{pmatrix}-4\\1\end{pmatrix}$ or $\begin{pmatrix}-1\\4\end{pmatrix}$
	Additional Guidance		
	Ignore fraction lines		

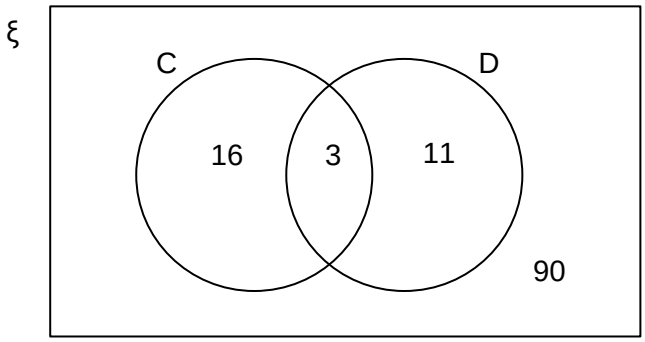
Q	Answer	Mark	Comments
7(b)	$\begin{pmatrix}12\\8\end{pmatrix}$	B1	
	Additional Guidance		
	$4\begin{pmatrix}3\\2\end{pmatrix}$ or $\begin{pmatrix}12\\8\end{pmatrix}$ in working with answer $\begin{pmatrix}3\\2\end{pmatrix}$		B0
	Ignore fraction lines		

Q	Answer	Mark	Comments
7(c)	$\begin{pmatrix}0\\-2\end{pmatrix}$	B1	

Q	Answer	Mark	Comments
8	Valid common denominator for subtraction with at least one numerator correct	M1	eg $\frac{21}{30} - \frac{8}{30}$ or $\frac{13}{30}$ or $\frac{105}{150} - \frac{40}{150}$ or $\frac{65}{150}$ condone decimals in numerator(s)
	their $\frac{13}{30} \times \frac{3}{2}$ or $\frac{\text{their } 13 \div 2}{\text{their } 30 \div 3}$	M1	oe product their $\frac{13}{30}$ can be any single fraction, mixed number or decimal other than their $\frac{13}{30}$ inverted or $\frac{7}{10}$ or $\frac{4}{15}$ condone decimals in numerator(s) correct answer not in correct fraction form eg $\frac{6.5}{10}$ scores M1M1
	$\frac{13}{20}$ or $\frac{39}{60}$	A1	oe fraction SC2 $\frac{29}{20}$ oe fraction or mixed number
	Additional Guidance		
	If 10 or 15 is used as the common denominator, both numerators must be correct for the first mark		
	Correct fraction in working with incorrectly simplified fraction on answer line		M2A1
	Correct fraction in working with conversion to decimal on answer line		M2A0
	$\frac{65}{150} \div \frac{2}{3} = \frac{32}{50}$		M1M0A0
	$\frac{65}{150} \div \frac{2}{3} = \frac{32.5}{50}$ with no further working		M1M1A0

Q	Answer	Mark	Comments
9	$\frac{12}{4} \leqslant x$ or $3 \leqslant x$ or $x < \frac{25}{4}$ or $x < 6.25$ or $x \leqslant 6$ or $x < 7$	M1	oe fully correct inequality is $\frac{12}{4} \leqslant x < \frac{25}{4}$ or $3 \leqslant x < 6.25$
	3 4 5 6 with no extras	A1	any order SC1 3 4 5 6 with one extra or any three of 3 4 5 6 with no extras or 12 16 20 24
	Additional Guidance		
	Ignore incorrect evaluations of 25 ÷ 4 if correct answer is given eg $3 \leqslant x < 6.5$ and answer 3 4 5 6		M1A1
	3 × 4 and 4 × 4 and 5 × 4 and 6 × 4 identified as only correct multiplications with no answer given implies M1		M1A0

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="8">10</td><td>120 ÷ 4 × 3 or 90</td><td>M1</td><td>oe
implied by 90 in the box and outside the circles</td></tr>
<tr><td>14 + 19 + their 90 – 120
or 14 + 19 – 120 ÷ 4 or 3
or
19 – their 3 in C only
and 14 – their 3 in D only</td><td>M1</td><td>oe their 90 must be > 87

0 < their 3 < 14</td></tr>
<tr><td>16, 3, 11 and 90 in correct positions</td><td>A1</td><td>SC1 their 4 Venn diagram values total 120, allow a blank intersection to imply 0</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">Allow up to M1M1 for working outside Venn diagram but Venn diagram takes precedence over working</td><td></td></tr>
<tr><td colspan="2">3 in the intersection with 90 in the box and outside the circles</td><td>M1M1</td></tr>
<tr><td colspan="2">3 in the intersection with a different number to 90 in the box and outside the circles</td><td>M0M1</td></tr>
<tr><td colspan="2">
</td><td>M1M1A1</td></tr>
</table>

Q	Answer	Mark	Comments
11	3^{11} (: 3^7) or $3^6 : 3^2$ or $3^5 : 3^{(1)}$ or $\frac{a}{3^7}$ or 177 147 : 2187	M1	oe eg 729 : 9 or 243 : 3 3^n may be implied by a multiplication string of n 3s a can be any value other than 3^7
	$\frac{3^{11}}{3^7}$ (: 1) or $\frac{3^6}{3^2}$ (: 1) or $3^6 \times 3^{-2}$ (: 1) or $\frac{3^5}{3^{(1)}}$ (: 1) or $3^{-1} \times 3^5$ (: 1) or 3^4 (: 1) or $\frac{177\,147}{2187}$ (: 1)	M1dep	oe left-hand side with one or two components eg $\frac{729}{9}$: 1 or $243 \times \frac{1}{3}$: 1 allow (: 1) to be (: 3^0) 3^n may be implied by a multiplication string of n 3s
	81 : 1	A1	
	Additional Guidance		
	$\frac{3^6 \times 3^5}{3^7}$ (: 1) with no further work		M1M0A0
	81 : 1 or 3^4 (: 1) could be seen from incorrect working eg $\frac{9^{11}}{3^7} = 3^4$ Answer 81 : 1		M1M0A0

Q	Answer	Mark	Comments
12	11 : 10	B1	

Q	Answer	Mark	Comment
13	$0.789\dot{7}$	B1	

Q	Answer	Mark	Comment
14	Explanation that the ratio and graph do not match	B1	eg This is the graph of $y = 2x$, not $y = \frac{1}{2}x$ This is the graph of $x : y = 1 : 2$ It should go through (3, 1.5)
	Explanation that the domain of the graph is incorrect	B1	eg The graph goes from $x = 0$, not $x = -3$
	Additional Guidance		
	3 : 6 is 1 : 2	B1	
	(3, 6) doesn't work	B1	
	The gradient is 2, not $\frac{1}{2}$	B1	
	He got x and y mixed up	B1	
	His graph is not going up in the ratio 2 : 1	B0	
	The gradient is 2	B0	
	He didn't follow the ratio	B0	
	The graph doesn't have negative numbers	B1	
	There are no minuses	B1	
	It doesn't go from –3 to 3	B1	
	The axes should be the same length	B0	

Q	Answer	Mark	Comment
15	$6x^2 + 8x - 15x - 20$ or $6x^2 - 7x - 20$	M1	allow 4 terms with 3 correct or $6x^2 - 7x + k$, where k is a non-zero number
	$-11x^2 + 22x$ or $5x^2 - 15x - 5$	M1	
	$6x^2 + 8x - 15x - 20$ or $6x^2 - 7x - 20$ and $-11x^2 + 22x$ and $5x^2 - 15x - 5$	A1	
	$6x^2 + 8x - 15x - 20$ or $6x^2 - 7x - 20$ and $-11x^2 + 22x$ and $5x^2 - 15x - 5$ and -25	A1	
	Additional Guidance		
	Allow terms seen in a grid		
	Sign errors cannot be recovered		
	Ignore equating the expression to zero		

Q	Answer	Mark	Comment
16	$4 = 0^2 + p \times 0 + r$ or $r = 4$	M1	oe equation may be implied
	$1^2 + p$ (× 1) + their 4 = 3 or $p = -2$	M1	oe equation allow their 4 to be r
	8^2 + (their –2) × 8 + their 4 or 64 – 16 + 4	M1dep	oe dep on M1M1 do not allow their 4 to be r
	52	A1	

Q	Answer	Mark	Comment
17(a)	51, 58 and 60	B1	

Q	Answer	Mark	Comment
17(b)	$160 < h \leqslant 170$	B1	

Q	Answer	Mark	Comment
17(c)	Points plotted with upper class boundaries and cf values condone (150, 0) omitted or incorrectly plotted for this mark only	B1ft	$\pm \frac{1}{2}$ square ft their cumulative frequencies, which must be increasing ignore bars drawn if points clearly plotted
	Smooth curve or polygon	B1ft	ft their 5 or 6 points (point with cf 0 may be omitted) must be increasing and not a single straight line
	Additional Guidance		
	For the second mark, the points must be evenly spaced accept an omission of the point with cf 0, but do not accept an incorrect starting point for the pattern of their points accept a horizontal line drawn from their final point, but do not accept a continuation of the curve or polygon		
	Points plotted at lower class boundaries or midpoints, but with correct smooth curve or polygon for their points		B0B1
	Bars drawn with correct curve		B1B1
	Bars drawn without curve but with correct points clearly plotted		B1B0
	Bars drawn without correct curve or correct points plotted		B0B0

Q	Answer	Mark	Comment
17(d)	**Alternative method 1**		
	Vertical line drawn from 176 to curve or polygon	M1	implied by correct reading for their increasing curve or polygon or mark at correct place on their increasing curve or polygon or on the vertical axis $\pm \frac{1}{2}$ square
	Correct value for 60 – their reading or correct value for their 60 – their reading	A1ft	ft their increasing curve or polygon answer must be an integer their 60 must be from an increasing curve or polygon
	Alternative method 2		
	$2 + 7 + \frac{4}{10} \times 35$ or $2 + 7 + 14$ or $4 + 12 + \frac{6}{10} \times 35$ or $4 + 12 + 21$ or 37	M1	
	23	A1	
	Additional Guidance		
	In alternative method 1 condone the curve or polygon drawn only for the required section (170 – 180) as long as the cumulative frequencies are increasing throughout		
	Answer 23 not from alternative method 2 must match their graph		

Q	Answer	Mark	Comment
18	**Alternative method 1 – combining the ratios**		
	21 : 35 and 35 : 20 or (3 : 5 and) 5 : $\frac{20}{7}$ or $\frac{21}{5}$: 7 (and 7 : 4)	M1	oe making the E term common allow as fractions with a common denominator eg $\frac{21}{35}$ and $\frac{20}{35}$
	21 : 35 : 20 or 3 : 5 : $\frac{20}{7}$ or $\frac{21}{5}$: 7 : 4 or $\frac{21/5}{76/5}$ or $\frac{3}{76/7}$	M1dep	oe allow as integers 21 and 35 and 20 or as fractions with a common denominator eg $\frac{21}{35}$ and $\frac{35}{35}$ and $\frac{20}{35}$
	$\frac{21}{76}$	A1	
	Alternative method 2 – based on D		
	$\frac{5(D)}{3}$ and $\frac{20(D)}{21}$	M1	oe
	$\frac{21(D)}{21} + \frac{35(D)}{21} + \frac{20(D)}{21}$ or $\frac{76(D)}{21}$	M1dep	oe with common denominator
	$\frac{21}{76}$	A1	

The mark scheme for Question 18 continues on the next page

18 (cont)	**Alternative method 3 – based on E**		
	$\frac{3(E)}{5}$ and $\frac{4(E)}{7}$	M1	oe
	$\frac{21(E)}{35} + \frac{35(E)}{35} + \frac{20(E)}{35}$ or $\frac{76(E)}{35}$	M1dep	oe with common denominator
	$\frac{21}{76}$	A1	
	Alternative method 4 – based on F		
	$\frac{21(F)}{20}$ and $\frac{7(F)}{4}$	M1	oe
	$\frac{21(F)}{20} + \frac{35(F)}{20} + \frac{20(F)}{20}$ or $\frac{76(F)}{20}$	M1dep	oe with common denominator
	$\frac{21}{76}$	A1	
	Additional Guidance		
	Allow unrounded decimal values throughout		

Q	Answer	Mark	Comment
19(a)	$\left(\frac{4}{5}\right)^2$ or $\frac{4^2}{5^2}$ or $\left(\frac{25}{16}\right)^{-1}$ or $\frac{1}{\left(5/4\right)^2}$ or $\frac{1}{5^2/4^2}$ or $\left(\frac{1}{5/4}\right)^2$ or $\frac{1}{25/16}$ or $\frac{1/25}{1/16}$	M1	missing brackets must be recovered accept a correct decimal or mixed number for any fraction eg $\frac{1}{1.25^2}$
	$\frac{16}{25}$	A1	oe fraction or decimal
	Additional Guidance		
	Ignore any attempt to convert a correct fraction into a decimal		M1A1

Q	Answer	Mark	Comment
19(b)	$\left(\sqrt{\frac{9}{100}}\right)^3$ or $\frac{3^3}{10^3}$ or $\left(\frac{3}{10}\right)^3$ or $\sqrt{\frac{9^3}{100^3}}$ or $\sqrt{\left(\frac{9}{100}\right)^3}$ or $\frac{\left(\sqrt{9}\right)^3}{\left(\sqrt{100}\right)^3}$ or or $\sqrt{\frac{729}{1000\,000}}$ or $\frac{\sqrt{729}}{\sqrt{1000\,000}}$	M1	oe with 0.09 for $\frac{9}{100}$ or 0.3 for $\frac{3}{10}$ or 3^2 for 9 or 10^2 for 100 missing brackets must be recovered
	$\frac{27}{1000}$ or 0.027	A1	
	Additional Guidance		
	Ignore any attempt to convert a correct fraction into a decimal		M1A1
	For M1 do not allow power $\frac{1}{2}$ with no square root		

Q	Answer	Mark	Comment
20	**Alternative method 1**		
	$(x + 15)^2$	M1	
	$x^2 + 15x + 15x + 225$ or $x^2 + 30x + 225$ or $b = 30$ or $c = 225$	M1dep	
	$b = 30$ and $c = 225$	A1	
	Alternative method 2: simultaneous equations using $x = -15$ and $b^2 - 4ac = 0$		
	$(-15)^2 - 15b + c = 0$ or $b^2 - 4 (\times 1) \times c = 0$	M1	oe do not allow missing brackets unless recovered
	$b^2 - 4 (\times 1) \times (15b - 225) = 0$ or $b^2 - 60b + 900 = 0$ or $(b - 30)^2 = 0$ or $b = 30$ or $c = 225$	M1dep	oe method to eliminate one unknown eg $\left(\frac{225 + c}{15}\right)^2 - 4c = 0$
	$b = 30$ and $c = 225$	A1	
	Alternative method 3: using $b^2 - 4ac = 0$ in the quadratic formula		
	$-15 = \frac{-b}{2(\times 1)}$	M1	oe
	$b = 30$	M1dep	
	$b = 30$ and $c = 225$	A1	
	Additional Guidance		
	30 and 225 may come from incorrect working eg do not allow $c = 225$ from $(x - 15)^2$		

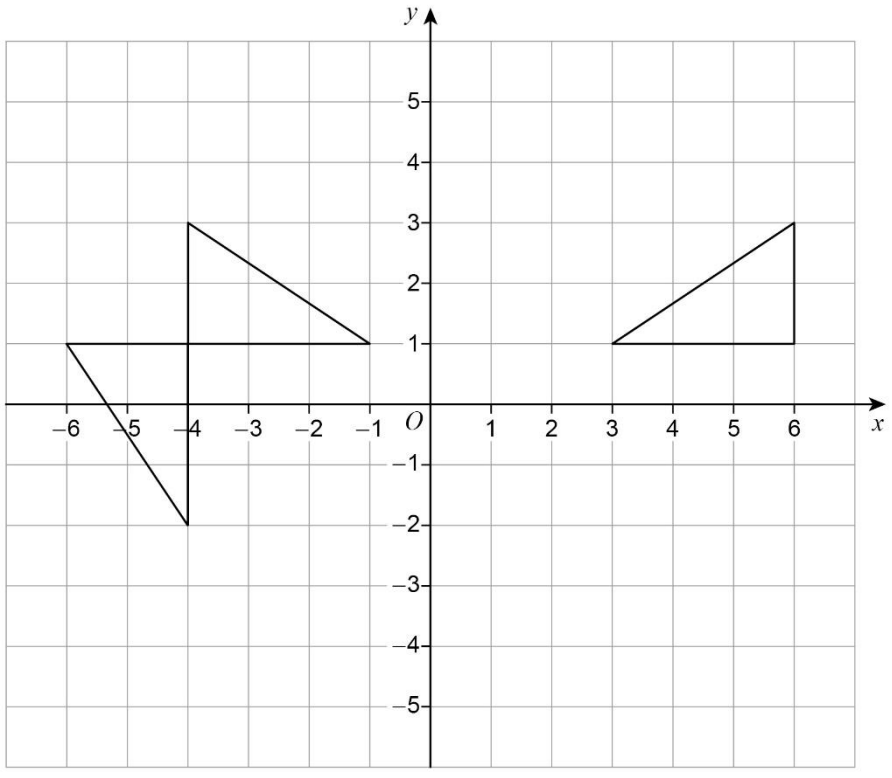
Q	Answer	Mark	Comment
21	**Alternative method 1**		
	$10x = 6.11\ldots$ and $x = 0.61\ldots$ or $100x = 61.11\ldots$ and $10x = 6.11\ldots$	M1	oe two powers of 10
	$10x - x = 6.11\ldots - 0.61\ldots$ or $9x = 5.5$	M1dep	oe subtraction of powers of 10 eg $100x - 10x = 61.1\ldots - 6.1\ldots$
	$\frac{11}{18}$ or $\frac{55}{90}$ or $\frac{605}{990}$	A1	oe fraction
	Alternative method 2		
	$(0.6\dot{1} =)\ 0.6 + 0.0\dot{1}$ and $10x = 0.11\ldots$ and $x = 0.01\ldots$ or $100x = 1.11\ldots$ and $10x = 0.11\ldots$	M1	oe two powers of 10
	$10x - x = 0.11\ldots - 0.01\ldots$ or $9x = 0.1$ and $\frac{6}{10}$ + their $\frac{1}{90}$	M1dep	oe subtraction of powers of 10, with x evaluated as a fraction and added to $\frac{6}{10}$ eg $1000x - 10x = 11.11\ldots - 0.11\ldots$ or $990x = 11$ and $\frac{3}{5} + \frac{11}{990}$ sum of correct fractions implies M1M1
	$\frac{11}{18}$ or $\frac{55}{90}$ or $\frac{605}{990}$	A1	oe fraction
	Additional Guidance		
	Ignore incorrect simplification of a correct fraction eg $\frac{605}{990}$ and $\frac{121}{190}$		M1M1A1
	Otherwise correct fraction with fraction(s) or decimal(s) as the numerator and/or denominator, eg $\frac{5.5}{9}$		M1M1A0

Q	Answer	Mark	Comment
22	**Alternative method 1**		
	$\frac{8-0}{4-0}$ or 2	M1	oe gradient from origin to point
	$-\frac{1}{2}$ or $y = -\frac{1}{2}x \ldots$	M1	oe gradient of tangent negative inverse of their gradient
	8 = their $-\frac{1}{2} \times 4 + c$ or $c = 10$	M1dep	oe equation in c (any letter) dep on previous mark
	0 = their $-\frac{1}{2}x$ + their 10	M1	oe equation in x ft their equation of the form $y = mx + c$ where m and c are numbers $\neq 0$
	20	A1	condone (20, 0)
	Alternative method 2		
	$\frac{8-0}{4-0}$ or 2	M1	oe gradient from origin to point
	$-\frac{1}{2}$ or $y = -\frac{1}{2}x \ldots$	M1	oe gradient of tangent negative inverse of their gradient
	$\frac{8-0}{4-x}$ = their $-\frac{1}{2}$	M1dep	oe equation in x dep on previous mark
	their 2 × (8 – 0) = their –1 × (4 – x) or 16 = –4 + x	M1dep	oe linear equation in x
	20	A1	condone (20, 0)

The mark scheme for Question 22 continues on the next page

22 (cont)	**Alternative method 3**		
	$\frac{8-0}{4-0}$ or 2	M1	oe gradient from origin to point
	$-\frac{1}{2}$ or $y = -\frac{1}{2}x \ldots$	M1	oe gradient of tangent negative inverse of their gradient
	$y - 8 =$ their $-\frac{1}{2} \times (x - 4)$	M1dep	oe equation eg $x + 2y = 20$ dep on previous mark
	$0 - 8 =$ their $-\frac{1}{2} \times (x - 4)$	M1	oe linear equation in x ft their equation in y and x
	20	A1	condone (20, 0)
	Alternative method 4		
	$4^2 + 8^2$ and $(x - 4)^2 + 8^2$	M1	
	$x^2 = 4^2 + 8^2 + (x - 4)^2 + 8^2$	M1dep	oe equation in x
	$x^2 = 16 + 64 + x^2 - 8x + 16 + 64$	M1dep	oe equation in x with brackets expanded and squares evaluated
	$8x = 16 + 64 + 16 + 64$ or $8x = 160$	M1dep	oe linear equation in x
	20	A1	condone (20, 0)

Q	Answer	Mark	Comment
23	**Alternative method 1**		
	(sin 30 =) $\frac{1}{2}$ or (tan 30 =) $\frac{1}{\sqrt{3}}$ or $\frac{\sqrt{3}}{3}$ or (cos 30 =) $\frac{\sqrt{3}}{2}$	M1	oe may be implied by (4 × sin 30 =) 2 may be implied by correct position in a multiplication string
	$4 \times \frac{1}{2} \times \frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{2}$	M1dep	oe with all trig values correct condone any order unless error seen
	1 with all three values seen	A1	implied by 90 with all three values seen
	90 with M1M1A1 scored	A1	accept any angle of the form 90 + 360n, where n is an integer
	Alternative method 2		
	$4 \times \sin 30° \times \frac{\sin 30°}{\cos 30°} \times \cos 30°$	M1	
	$4 \times \frac{1}{2} \times \frac{1/2}{\sqrt{3}/2} \times \frac{\sqrt{3}}{2}$	M1dep	oe eg $4 \times \left(\frac{1}{2}\right)^2$
	1 with $\frac{\sin 30°}{\cos 30°}$ and $\frac{1}{2}$ and $\frac{\sqrt{3}}{2}$ seen	A1	if cos 30° is cancelled out only $\frac{1}{2}$ need be seen
	90 with M1M1A1 scored	A1	accept any angle of the form 90 + 360n, where n is an integer
	Additional Guidance		
	Condone a square root sign on 1 up to M1M1		

Q	Answer	Mark	Comment
24	Line $x = 1$ drawn	M1	any indication implied by a correct reflection
	Correct shape drawn, with vertices at (3, 1), (6, 1) and (6, 3)	M1dep	
	Correct shape drawn, with vertices at (–6, 1), (–4, 1) and (–4, –2),	M1	ft their *A*'*B*'*C*'
	B or (–4, 1) and both correct shapes drawn	A1	accept *B* circled with both correct shapes drawn
	Additional Guidance		
	Ignore incorrect labelling		
	Accept lines not ruled		
	Ignore extra lines drawn, but do not accept extra triangles unless the correct triangle(s) are clearly indicated		
			

Q	Answer	Mark	Comment
25(a)	$(x + 1)(x - 6)$ or $\frac{5 \pm \sqrt{(-5)^2 - 4 (\times 1) \times (-6)}}{2 (\times 1)}$ or $2.5 \pm \sqrt{12.25}$ or -1 and 6 identified	M1	oe do not accept missing bracket on $(-5)^2$ unless recovered
	$-1 < x < 6$	A1	condone $-1 < x$ and $x < 6$

Q	Answer	Mark	Comment
25(b)	Open circles at -1 and 6 joined by line	B1ft	ft their double-sided inequality in (a) if the bounds are within the number line condone ft an inequality given in two parts if the bounds are within the number line condone ft a single-sided inequality if the bound is within the number line

Q	Answer	Mark	Comment
26	**Alternative method 1**		
	$RPQ = y$	M1	may be seen on diagram
	$RPQ = y$ and $RQP = 180 - 2y$	M1dep	may be seen on diagram
	$RQP = 2x$ and $2x = 180 - 2y$ and correct rearrangement to $y = 90 - x$ with M1M1 awarded	A1	$RQP = 2x$ may be implied by 'alternate segment theorem'
	Correct reasons given with M1M1 scored and a correct initial equation for the A mark	B1	(base angles of an) isosceles triangle (are equal) sum of the angles in a triangle is 180° alternate segment (theorem)
	Alternative method 2		
	$RPQ = y$	M1	may be seen on diagram
	$RQP = 2x$	M1	may be seen on diagram
	$2x + 2y = 180$ and correct rearrangement to $y = 90 - x$ with M1M1 awarded	A1	
	Correct reasons given with M1M1 scored and a correct initial equation for the A mark	B1	(base angles of an) isosceles triangle (are equal) alternate segment (theorem) sum of the angles in a triangle is 180°

The mark scheme for Question 26 continues on the next page

26 (cont)	**Alternative method 3**		
	$RQP = 2x$	M1	may be seen on diagram
	$RQP = 2x$ and $RPQ = 180 - 2x - y$	M1dep	may be seen on diagram
	$y = 180 - 2x - y$ and correct rearrangement to $y = 90 - x$ with M1M1 awarded	A1	
	Correct reasons given with M1M1 scored and a correct initial equation for the A mark	B1	alternate segment theorem sum of the angles in a triangle is 180° (base angles of an) isosceles triangle (are equal)
	Alternative method 4		
	$RPQ = y$	M1	may be seen on diagram
	SP extended to T and $QPT = y$	M1	may be seen on diagram any or no letter for T
	$2x + 2y = 180$ and correct rearrangement to $y = 90 - x$ with M1M1 awarded	A1	
	Correct reasons given with M1M1 scored and a correct initial equation for the A mark	B1	(base angles of an) isosceles triangle (are equal) alternate segment theorem angles on a straight line sum to 180°
	Additional Guidance		
	Method marks can be scored using angle notation eg $RPQ = QRP$ is equivalent to $RPQ = y$		

Q	Answer	Mark	Comment
27	**Alternative method 1**		
	$\left(\sqrt{2\frac{13}{16}} =\right) \sqrt{\frac{45}{16}}$ or $\frac{\sqrt{45}}{4}$ or $\frac{3\sqrt{5}}{4}$	M1	oe conversion from a mixed number
	$\frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$ or $\frac{2\sqrt{5}}{5}$	M1	oe rationalisation
	$\frac{15\sqrt{5}}{20} - \frac{8\sqrt{5}}{20}$ or $(0.75\sqrt{5} - 0.4\sqrt{5} =) 0.35\sqrt{5}$	M1dep	oe with common surd in numerator and common non-surd denominator do not allow fraction(s) in numerator(s) or denominator dep on M1M1
	$\frac{7\sqrt{5}}{20}$	A1	oe in the form $\frac{a\sqrt{5}}{b}$ eg $\frac{28\sqrt{5}}{80}$
	Alternative method 2		
	$\left(\sqrt{2\frac{13}{16}} =\right) \sqrt{\frac{45}{16}}$ or $\frac{\sqrt{45}}{4}$ or $\frac{3\sqrt{5}}{4}$	M1	oe conversion from a mixed number
	$\frac{\sqrt{45}\sqrt{5}}{4\sqrt{5}} - \frac{8}{4\sqrt{5}}$ or $\frac{15}{4\sqrt{5}} - \frac{8}{4\sqrt{5}}$ or $\frac{7}{4\sqrt{5}}$	M1dep	oe with common denominator do not allow fraction(s) in numerator(s) or denominator
	$\frac{15}{4\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} - \frac{8}{4\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$ or $\frac{7}{4\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$	M1dep	oe with all denominators rationalised
	$\frac{7\sqrt{5}}{20}$	A1	oe in the form $\frac{a\sqrt{5}}{b}$ eg $\frac{28\sqrt{5}}{80}$