GCSE
MATHEMATICS
8300/1H

Higher Tier Paper 1 Non-Calculator

Mark scheme

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2 1 6 G 8 3 0 0 / 1 H / M S

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 $a \leq$ 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.

Question	Answer	Mark	Comments
1	a^{15}	B1	

Question	Answer	Mark	Comments
2	$\frac{26}{70}$	B1	

Question	Answer	Mark	Comments
3	hexagon-based pyramid	B1	

Question	Answer	Mark	Comments
4	$y = \frac{k}{x}$	B1	

Question	Answer	Mark	Comments
5	200 written as a product of factors where at least one factor is prime	M1	eg 2 and 100 or 2×10^2 or $200 \div 5 = 40$ may be on a factor tree or repeated division allow one strand to be incorrect if a previous value completes the product eg 10×20 followed by $5 \times 2 \times 5 \times 6$ implies $5 \times 2 \times 20$ for M1
	2 and 2 and 2 and 5 and 5	A1	may be on a factor tree or repeated division
	$2^3 \times 5^2$ or $5^2 \times 2^3$	A1	
	Additional Guidance		
	Allow any number of 1s included as factors up to M1A1 only		
	M1 may be awarded for correct work with no or incorrect answer, even if this is seen among multiple attempts		
	$1 \times 2^3 \times 5^2$		M1A1A0
	$2^3.5^2$ or $2^3 \cdot 5^2$ or $2^3 5^2$ or $2^3,5^2$		M1A1A1
	$2 + 2 + 2 + 5 + 5$		M1A1A0
	$2^3 + 5^2$		M1A1A0
	$2 \times 2 \times 2 \times 5 \times 5$ and $2^3 \times 5^2$ on answer line but $2 \times 2 \times 2 \times 5 \times 5 = 2^3 \times 5^2$ on answer line		M1A1A0 M1M1A1
	$2^3 \times 5^2 = 10^5$		M1A1A0
	$2^3 \times 5^2 = 200$		M1A1A1
	8×25 with no prime factorisation		M0A0A0

Question	Answer	Mark	Comments
6	$\frac{7}{5}$ or $1\frac{2}{5}$	B2	B1 28 and 20 or $2\frac{1}{3}$ and $1\frac{2}{3}$ oe mixed numbers or fractions with common denominator or correct unsimplified fraction or mixed number eg $\frac{14}{10}$ or $1\frac{8}{20}$ or correct simplification of a fraction where at least one of the values is 28 or 20 and the other is not 12 SC1 $\frac{5}{7}$

Additional Guidance	
Allow a fractional numerator and/or denominator in a correct fraction eg $\frac{2\frac{1}{3}}{1\frac{8}{12}}$ or $\frac{\frac{28}{12}}{\frac{5}{3}}$	B1
$\frac{2.4}{1.8}$ simplified to $\frac{4}{3}$	B0
Ignore an attempt to convert $\frac{7}{5}$ to an improper fraction eg $\frac{7}{5} = 1\frac{2}{7}$ on the answer line	B2
7 : 5 with no working worthy of B1	B0

Question	Answer	Mark	Comments
7	$(\sqrt{97} =) \sqrt{100}$ or 10 or $(2.014^3 =) 2^3$ or 8 or $(0.49 =) 0.5$ or $\frac{1}{2}$	M1	
	$(\sqrt{97} =) \sqrt{100}$ or 10 and $(2.014^3 =) 2^3$ or 8 and $(0.49 =) 0.5$ or $\frac{1}{2}$	M1	$\frac{10+8}{0.5}$ or $\frac{18}{0.5}$ scores M2
	36	A1	

Question	Answer	Mark	Comments
8(a)	$5x - 3x$ or $2x$ or $3x - 5x$ or $-2x$ or $15 - 6$ or 9 or $6 - 15$ or -9	M1	may be seen as an annotation to the given inequality eg -6 written under $+15$
	$2x > 9$ or $-9 > -2x$ or 4.5 or $\frac{9}{2}$ or $4\frac{1}{2}$	A1	implied by correct answer
	$x > 4.5$ or $x > \frac{9}{2}$ or $x > 4\frac{1}{2}$	A1ft	ft solution of inequality of the form $2x > k$ where k is a number or $m > -2x$ where m is a number or $ax > 9$ where a is an integer not equal to 1 or $-9 > bx$ where b is an integer not equal to 1

Additional Guidance	
In all cases accept the inequality written correctly in reverse order For example, for $2x > 9$ accept $9 < 2x$	
$4.5 < x$	M1A1A1
$2x > 21$, $x > 10.5$	M1A0A1ft
$8x > 9$, $x > 1.125$	M1A0A1ft
Do not allow a correct answer in working followed by an incorrect answer on the answer line eg $x > \frac{9}{2}$ in working with 4.5 on the answer line	M1A1A0
Do not allow the correct answer with another answer eg $x > 4.5$ and $x = 4.5$ on the answer line	M1A1A0

Question	Answer	Mark	Comments
8(b)	$2 \leqslant x < 5$ or $5 > x \geqslant 2$	B2	any letter B1 $2 \leqslant x$ or $x \geqslant 2$ or $x < 5$ or $5 > x$ SC1 $2 < x \leqslant 5$ or $5 \geqslant x > 2$
	Additional Guidance		
	$2 \leqslant x$ and $x < 5$		B1
	$2 \leqslant x$ and $x > 5$		B1
	$2 \leqslant x > 5$		B1
	$2 \leqslant x \leqslant 5$		B1
	$2 \leqslant x \leqslant 4$		B1
	$2 < x < 5$		B1
	$2 \geqslant x > 5$		B0
	$2 \leqslant 5$		B0

Question	Answer	Mark	Comments
9	(4, 16)	B2	may be on diagram B1 one correct coordinate SC1 (16, 4)
	Additional Guidance		
	B1 may be scored from 4 at the vertex vertically below *Q* or from 16 at the vertex vertically above *P* if not contradicted by the answer		

Question	Answer	Mark	Comments
10(a)	2×10^3 or 7×10^4 or 140 000 000	M1	oe correct value not in standard form eg 14×10^7
	1.4×10^8	A1	SC1 Correctly converts an ordinary number with at least four digits to standard form
	Additional Guidance		
	Condone extra zeros on 1.4 eg $1.40\,000\,000 \times 10^8$		M1A1
	1.4×10^8 from 1 400 000 000		M0A0
	2×10^3 is implied by $(2 \times 7) \times (10^3 \times 10^a)$ 7×10^4 is implied by $(2 \times 7) \times (10^b \times 10^4)$		M1
	1 400 000 000 converted to 1.4×10^9		SC1

Question	Answer	Mark	Comments
10(b)	180 or 0.3 or $(1.8 \div 3 =)$ 0.6 or $(10^2 \div 10^{-1} =) 10^3$ or calculation which would have the outcome 600 or correct value not given as an ordinary number	M1	eg 1800 ÷ 3 eg 6×10^2
	600	A1	
	Additional Guidance		
	1800 ÷ 0.3 = 600 scores M1 only, as 600 comes from incorrect working		M1A0
	1800 ÷ 30 = 600 scores zero, as 600 comes from incorrect working		M0A0

Question	Answer	Mark	Comments
11	$62 \div 2$ or 62×0.5 or 31	M1	oe eg $62 \div 60 \times 30$
	their $31 - 25$ or 6	M1	their 31 must be > 25
	their 6×3 or 18 or their 6×4 or 24	M1dep	dep on 2nd M1
	49	A1	
	Additional Guidance		
	49 from correct working, but a different answer given		M3A0

Question	Answer	Mark	Comments
12	**Alternative method 1**		
	$\sin 30 = \frac{x}{10}$ or $(x =)$ 10 sin 30	M1	oe eg $\frac{x}{\sin 30} = \frac{10}{\sin 90}$
	$\sin 30 = 0.5$	M1	oe may be seen in a table $0.5 = \frac{x}{10}$ oe scores M1M1
	5	A1	
	Alternative method 2		
	Correct trigonometric method to show that the length of the missing side is $5\sqrt{3}$	M1	oe
	$\sqrt{(5\sqrt{3})^2 + x^2} = 10$	M1dep	oe
	5	A1	
	Additional Guidance		
	Accept use of cos 60 instead of sin 30		

Question	Answer	Mark	Comments
13	5 ÷ 6 attempted with at least 0.8 shown and a carry of any integer from 1 to 7 or $0.1\dot{6} \times 5$ or $1.\dot{6} \div 2$ or $1 - 0.1\dot{6}$	M1	oe calculation involving a correct recurring decimal which would give an outcome of $0.8\dot{3}$
	$0.8\dot{3}$	A1	condone any number of 3s immediately before the recurring 3
	Additional Guidance		
	Condone other recurring symbols or repeated dots eg 0.83^{r} or 0.83…	M1A1	

Question	Answer	Mark	Comments
14	$\frac{7}{x}$	B1	

Question	Answer	Mark	Comments
15	$x^2 + 3ax + ax + 3a^2$ ($\equiv x^2 + bx + 75$) or $x^2 + 4ax + 3a^2$ ($\equiv x^2 + bx + 75$) or $3ax + ax + 3a^2 \equiv bx + 75$ or $4ax + 3a^2 \equiv bx + 75$ or $3a^2 = 75$	M1	
	$a = 5$ and/or $a = -5$	A1	implied by $(x + 5)(x + 15)$ or $(x - 5)(x - 15)$ implied by answer 20 and/or -20
	20 and -20	A1	oe ± 20

Question	Answer	Mark	Comments
16(a)	Vertical line from 21 to [15, 17] or 16	M1	implied by correct point marked on curve or vertical axis
	24	A1	SC1 23 or 25

Question	Answer	Mark	Comments
16(b)	(Median =) 22	B1	in working or in box plot
	(LQ =) 18 and (UQ =) 24	B1	in working or in box plot
	Rectangular box with median line and whiskers to 3 and 28	B1	
	Additional Guidance		
	Median and quartiles may be seen on cumulative frequency diagram		
	If the values for the median and/or the LQ and UQ are correct in working but incorrect in the box plot award up to B1B1B0		

Question	Answer	Mark	Comments
17	$\begin{pmatrix} 5 \\ -8 \end{pmatrix}$	B1	

Question	Answer	Mark	Comments
18(a)	Correct explanation	B1	eg 35 is more than 17 + 13
	Additional Guidance		
	It is more than 30		B1
	AB cannot be more than *AC* + *BC*		B1
	AC + *BC* only add up to 30		B1
	The triangle inequality		B1
	17 + 13 is only 30		B1
	17 + 13 is 30		B0
	It would be too long		B0

Question	Answer	Mark	Comments
18(b)	Correct explanation	B1	eg (it should be) $\frac{31}{\sin x}$
	Additional Guidance		
	x and 31 should be swapped		B1
	She has used 31 as an angle		B1
	She has used x as a length		B1
	It should be $\frac{\sin x}{31}$ $\left(=\frac{\sin 72}{54}\right)$		B1

Question	Answer	Mark	Comments
19(a)	0.1 on Fail for First check	B1	oe fraction, decimal or percentage
	0.01 on Fail and 0.99 on Pass for Second check	B1	oe fraction, decimal or percentage
	Additional Guidance		
	Ignore any extra branches drawn		

Question	Answer	Mark	Comments
19(b)	**Alternative method 1**		
	0.9 × their 0.01 or 0.009	M1	oe eg $\frac{9}{10} \times \frac{1}{100} = \frac{9}{1000}$
	their 0.009 + their 0.1	M1dep	oe their 0.1 must be > 0 and < 1
	0.109	A1ft	oe fraction, decimal or percentage ft their tree diagram if all probabilities are > 0 and < 1
	Alternative method 2		
	0.9 × their 0.99 or 0.891	M1	oe eg $\frac{9}{10} \times \frac{99}{100} = \frac{891}{1000}$
	1 – their 0.891	M1dep	oe
	0.109	A1ft	oe fraction, decimal or percentage ft their tree diagram if all probabilities are > 0 and < 1
	Additional Guidance		
	Answer 0.109%		M2A0

Question	Answer	Mark	Comments
20	g/cm^3	B1	

Question	Answer	Mark	Comments
21	**Alternative method 1: using the left hand values**		
	$(a =)$ 6 ÷ 2 or $(a =)$ 3	M1	implied by $3n^2$…
	3 × their 3 + b = 7 or $b = -2$	M1dep	oe $3n^2 - 2n$ … implies M1M1
	3 + their –2 + c = 10 or $c = 9$	M1dep	oe
	$3n^2 - 2n + 9$	A1	SC1 30 and 49 as the next two terms
	Alternative method 2: subtracting $3n^2$ to get a linear sequence		
	$(a =)$ 6 ÷ 2 or $(a =)$ 3	M1	implied by $3n^2$…
	10 – their 3 × 1^2 or 7 and 17 – their 3 × 2^2 or 5 or $b = -2$	M1dep	oe using any two terms $3n^2 - 2n$ … implies M1M1
	(their 5 – their 7) (× 1) + c = 7 or –2 (× 1) + c = 7 or $c = 9$	M1dep	oe equation using any term
	$3n^2 - 2n + 9$	A1	SC1 30 and 49 as the next two terms

Mark scheme and Additional Guidance continues on the next page

21 cont	**Alternative method 3: simultaneous equations**		
	Simultaneous equations leading to a fully correct method to work out a or b or $a = 3$ or $b = -2$	M1	eg $a + b + c = 10$ and $4a + 2b + c = 17$ and $9a + 3b + c = 30$ and $3a + b = 7$ and $5a + b = 13$ and $2a = 6$ and $(a =)\ 3$ implied by $3n^2\ldots$ or $\ldots -2n \ldots$
	Substitutes for a or b in one or two of the simultaneous equations with fully correct method to work out the other value	M1dep	eg $3 \times$ their $3 + b = 7$ or $b = -2$ $3n^2 - 2n \ldots$ implies M1M1
	Substitutes for a & b to work out c or $c = 9$	M1dep	any term eg $3 - 2 + c = 10$
	$3n^2 - 2n + 9$	A1	SC1 30 and 49 as the next two terms
	Alternative method 4: Using the '0th' term to get c		
	$(a =)\ 6 \div 2$ or $(a =)\ 3$	M1	implied by $3n^2\ldots$
	$0n^2 + 0n + c = 9$ or $c = 9$	M1	
	their $3 + b +$ their $9 = 10$ or $b = -2$	M1dep	oe dep on M2
	$3n^2 - 2n + 9$	A1	SC1 30 and 49 as the next two terms
	Additional Guidance		
	In all cases a, b and c refer to the general expression for the nth term of a quadratic sequence $an^2 + bn + c$		
	Condone $n = 3n^2 - 2n + 9$ and accept any letter for n		
	Note that $b = -2$ does not imply a specific number of marks		

Question	Answer	Mark	Comments
22	$1\frac{24}{25}$	B3	oe mixed number B2 $\frac{49}{25}$ B1 $\left(\frac{7}{5}\right)^2$ or $\frac{1}{\left(\frac{5}{7}\right)^2}$ or $\left(\frac{1}{5/7}\right)^2$ or $\frac{1}{25/49}$ or $\left(\frac{25}{49}\right)^{-1}$ or $\frac{1}{5^2} \div \frac{1}{7^2}$
	Additional Guidance		
	For B2 or B1 allow equivalent fractions or decimals eg 1.96 for $\frac{49}{25}$		B2

Question	Answer	Mark	Comments
23	$y\sqrt{x+1} = 1$ or $\sqrt{x+1} = \frac{1}{y}$ or $y^2 = \frac{1}{x+1}$	M1	
	$y^2(x+1) = 1$ or $y^2x + y^2 = 1$ or $y^2x = 1 - y^2$ or $x + 1 = \frac{1}{y^2}$ or $\frac{1}{y^2} - 1$ or $\frac{1-y^2}{y^2}$	M1dep	
	$x = \frac{1}{y^2} - 1$ or $x = \frac{1-y^2}{y^2}$	A1	oe in the form $x =$
	Additional Guidance		
	Correct answer in working repeated on answer line without $x =$ eg $x = \frac{1}{y^2} - 1$ seen in working with answer $\frac{1}{y^2} - 1$		M1M1A1
	Allow $\left(\frac{1}{y}\right)^2$ for $\frac{1}{y^2}$ throughout		
	Allow 1^2 for 1 throughout		

Question	Answer	Mark	Comments
24(a)	**Alternative method 1: eliminates d**		
	$4c + d = 7$ and $10c + d = 22$	M1	oe equations
	$(10 - 4)c = 22 - 7$ or $6c = 15$ or $c = 2.5$	M1dep	oe correct equation in c eg $10c + 7 - 4c = 22$
	$c = 2.5$ and $d = -3$	A1	oe fraction or mixed number for c
	Alternative method 2: eliminates c		
	$4c + d = 7$ and $10c + d = 22$	M1	
	$(10 - 4)d = 70 - 88$ or $6d = -18$ or $d = -3$	M1dep	oe correct equation in d eg $4\left(\frac{22 - d}{10}\right) + d = 7$
	$c = 2.5$ and $d = -3$	A1	oe fraction or mixed number for c
	Alternative method 3: works out the difference or the equation of the function through the points		
	(difference =) $\frac{22 - 7}{10 - 4}$ or 2.5	M1	(gradient =) $\frac{22 - 7}{10 - 4}$ or (m =) 2.5
	$c = 2.5$	M1dep	oe fraction or mixed number
	$c = 2.5$ and $d = -3$	A1	oe fraction or mixed number for c

Question	Answer	Mark	Comments
24(b)	$\frac{2x - 1}{2}$	B1	

Question	Answer	Mark	Comments
25	**Alternative method 1**		
	$(\sqrt{150} =) \sqrt{25}\sqrt{6}$ or $5\sqrt{6}$ or $(\sqrt{2} \times \sqrt{3} =) \sqrt{6}$	M1	numerator allow $\sqrt{2}\sqrt{3}$ for $\sqrt{6}$ denominator
	$\frac{\sqrt{25}\sqrt{6}-\sqrt{6}}{\sqrt{6}}$ or $\frac{5\sqrt{6}-\sqrt{6}}{\sqrt{6}}$ or $\frac{4\sqrt{6}}{\sqrt{6}}$	M1dep	allow consistent use of $\sqrt{2}\sqrt{3}$ for $\sqrt{6}$
	4 with M1M1 awarded	A1	
	Alternative method 2		
	$\sqrt{6}(\sqrt{25}-1)$ or $\sqrt{6}(5-1)$ or $4\sqrt{6}$ or $(\sqrt{2} \times \sqrt{3} =) \sqrt{6}$	M1	numerator allow $\sqrt{2}\sqrt{3}$ for $\sqrt{6}$ denominator
	$\frac{\sqrt{6}(\sqrt{25}-1)}{\sqrt{6}}$ or $\frac{\sqrt{6}(5-1)}{\sqrt{6}}$	M1dep	allow consistent use of $\sqrt{2}\sqrt{3}$ for $\sqrt{6}$
	4 with M1M1 awarded	A1	
	Alternative method 3		
	$\frac{\sqrt{150}-\sqrt{6}}{\sqrt{2}\times\sqrt{3}} \times \frac{\sqrt{6}}{\sqrt{6}}$	M1	allow $\frac{\sqrt{2}\sqrt{3}}{\sqrt{2}\sqrt{3}}$ for $\frac{\sqrt{6}}{\sqrt{6}}$
	$\frac{\sqrt{900}-6}{6}$	M1dep	oe rationalised
	4 with M1M1 awarded	A1	
	Additional Guidance		
	Condone answer 4 and –6 from use of $\sqrt{25} = \pm 5$		M1M1A1

Question	Answer	Mark	Comments
26	**Alternative method 1: substitutes $2f$ for d**		
	$\frac{e-f}{2f-e}=\frac{1}{4}$ or $2f-e=4(e-f)$	M1	oe equation in e and f
	$6f=5e$ or $\frac{e}{f}=\frac{6}{5}$	M1dep	oe with variables collected eg $1.5f=1.25e$ oe with single fractions eg $\frac{f}{5}=\frac{e}{6}$
	6 : 5	A1	oe ratio
	Alternative method 2: substitutes $\frac{d}{2}$ for f		
	$d-e=4(e-\frac{d}{2})$ or $3d=5e$	M1	oe equation in d and e
	$6f=5e$ or $\frac{e}{f}=\frac{6}{5}$	M1dep	oe with variables collected eg $1.5f=1.25e$ oe with single fractions eg $\frac{f}{5}=\frac{e}{6}$
	6 : 5	A1	oe ratio
	Alternative method 3: substitutes $2f$ for d and forms simultaneous equations		
	$e-f=1$ and $2f-e=4$	M1	oe with rhs in the ratio 1 : 4 eg $e-f=2$ and $2f-e=8$
	$f=5$ or $e=6$	M1dep	correct solution for one unknown from their correct simultaneous equations eg $f=10$ or $e=12$ from above equations
	6 : 5	A1	oe ratio
	Additional Guidance		
	5 : 6 with no method marks awarded		M0M0A0

Question	Answer	Mark	Comments
27	$5^2 \times \pi$ (÷ 6) or 25π (÷ 6)	M1	oe allow 3.14 or better for π throughout
	$\frac{1}{2} \times 5 \times 5 \times \sin 60$ or $\frac{1}{2} \times 5 \times 2.5 \tan 60$ or $\frac{25}{2} \times \frac{\sqrt{3}}{2}$	M1	oe correct method to work out the area of the triangle or the area of the hexagon implied by 75 sin 60 or 37.5 tan 60 or $\frac{75\sqrt{3}}{2}$ oe
	$\frac{25\pi}{6} - \frac{25\sqrt{3}}{4}$	A1	oe eg $\frac{1}{6}\left(25\pi - \frac{75\sqrt{3}}{2}\right)$ implied by correct answer
	$\frac{50\pi - 75\sqrt{3}}{12}$	A1	oe in correct form eg $\frac{50\pi - 15\sqrt{75}}{12}$
	Additional Guidance		
	Using Pythagoras to work out the perpendicular height of the triangle may lead to an area of $\frac{5\sqrt{18.75}}{2}$ for the triangle or $15\sqrt{18.75}$ for the area of the hexagon		2nd M1

Question	Answer	Mark	Comments
28(a)	Correct graph (translated 90° to the right)	B1	mark intention
	Additional Guidance		
	Condone the graph starting at (90, 1)		
	Ignore the curve outside the domain $0 \leqslant x \leqslant 360$		

Question	Answer	Mark	Comments
28(b)	Correct graph (translated 1 up)	B1	mark intention
	Additional Guidance		
	Ignore the curve outside the domain $0 \leqslant x \leqslant 360$		

Question	Answer	Mark	Comments
28(c)	Correct statement	B1	eg this is $y = -\cos x$ cos 0 = 1 it's upside down it should be the same as cos x
	Additional Guidance		
	It has been reflected in the x-axis instead of the y-axis	B1	
	It should have been reflected in the y-axis	B1	
	It starts at -1 (instead of 1)	B1	
	180 is above the x-axis	B1	
	Correct curve drawn	B1	
	cos $(-180) = -1$	B1	
	She has done $-y$ instead of $-x$	B1	
	It can't start as a negative	B1	
	It should go down not up	B0	
	She shouldn't have flipped it	B0	
	Ignore non-contradictory statements alongside a correct statement	B1	

Question	Answer	Mark	Comments
29	**Alternative method 1**		
	Rotation, 180°, (about) (–1, 1)	B3	B2 rotation, 180° or rotation (about) (–1, 1) or turn, 180° (about) (–1, 1) B1 rotation or turn, 180° or turn (about) (–1, 1)
	Alternative method 2		
	Enlargement, scale factor –1 (with centre) (–1, 1)	B3	B2 enlargement, scale factor –1 B1 enlargement (with centre) (–1, 1)
	Alternative method 3		
	Reflection in (–1, 1)	B3	there are no part marks in this method
	Additional Guidance		
	Allow *B* instead of (–1, 1) throughout		
	Compound transformation		B0