GCSE
MATHEMATICS
8300/1H

Higher Tier Paper 1 Non-Calculator

Mark scheme

June 2022

Version: 1.0 Final

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	$y = x - 6$	B1	

Q	Answer	Mark	Comments
2	$\frac{7}{20}$	B1	

Q	Answer	Mark	Comments
3	240 × 1.075	B1	

Q	Answer	Mark	Comments
4	RHS	B1	

Q	Answer	Mark	Comments
5	4×10^5	B2	B1 400 000 oe correct answer not in standard form eg 40×10^4 or 8×10^7 or 2×10^2 or $8 \times 10^5 \div 2$ or $4 \times 10^7 \div 100$ or any value seen and then correctly converted to standard form eg 4 000 000 and 4×10^6 40 000 and 4×10^4
	Additional Guidance		
	Ignore incorrect position of commas or spacing in long numbers		
	Condone 400 000 and 4×10^5 on the answer line, in either order Condone 40 000 and 4×10^4 on the answer line, in either order		B2 B1
	400 000 only on the answer line		B1
	Do not award both marks for the correct answer from incorrect working but B1 can be awarded for one or both numbers incorrectly converted to standard form and the result of their division given correctly in standard form eg $(8 \times 10^8) \div (2 \times 10^3) = 4 \times 10^5$ eg $(0.8 \times 10^7) \div (2 \times 10^3) = 4 \times 10^5$		B1 B0
	Condone a decimal point and any number of zeros after 4 eg 4.00000×10^5		B2
	8×10^7 is implied by $(8 \div 2) \times (10^7 \div 10^a)$ or condone $(8 \div 2) \times (10^7 \times 10^a)$		B1
	2×10^2 is implied by $(8 \div 2) \times (10^b \div 10^2)$ or condone $(8 \div 2) \times (10^b \times 10^2)$		B1

Q	Answer	Mark	Comments
6(a)	243	B2	B1 3^{12-7} or 3^5 oe single index or $3 \times 3 \times 3 \times 3 \times 3$ oe multiplication string or 531 441 seen as 3^{12} or as a numerator or 2187 seen as 3^7 or as a denominator or 3^n correctly evaluated, where n is an integer $\geqslant 4$

Additional Guidance	
Condone 3^5 and 243 on the answer line, in either order	B2
3^5 only on the answer line	B1
Do not allow a misread	
12 – 7 is insufficient for B1 unless 3^{12-7} or 3^5 is also seen	
Do not award B1 for a correct evaluation of 3^n not ascribed to a particular value of n eg a list 3, 9, 27, 81 … does not score the mark unless 81 is identified as 3^4	

Q	Answer	Mark	Comments
6(b)	2^{13}	B2	B1 2^{3+6+4} or (8 =) $2 \times 2 \times 2$ or 2^3 or ($2^6 \times 2^4$ =) 2^{6+4} or ($2^6 \times 2^4$ =) 2^{10} or 2^9 ($\times 2^4$) or 2^7 ($\times 2^6$) or 8192

Additional Guidance	
8192 and 2^{13} on answer line, in either order	B2
8192 only on the answer line	B1
Correctly combined powers can be implied eg $8 = 2^4$ with answer 2^{14} implies $2^6 \times 2^4 = 2^{10}$	B1
Evaluations other than 8192 do not score eg 8×1024 without seeing 8×2^{10} eg $8 \times 64 \times 16$	B0 B0
Do not award B1 for 8192 if it is in a list of powers of 2 unless it is indicated or it is the highest power evaluated	
Changing terms to numbers with a base of 8 scores zero unless converted to a number with a base of 2	

Q	Answer	Mark	Comments
7	Valid criticism referring to one or both sets not being labelled	B1	eg the circles should be labelled or the labels are missing
	Valid criticism referring to the numbers not adding to 98	B1	eg the numbers add to 99 or 48 should be 47 SC1 no written criticisms, but circles labelled correctly and 48 changed to 47 on diagram
	Additional Guidance		
	Accept both statements written in one criticism		
	For more than two criticisms mark the best two unless contradicted		
	Condone written corrections as criticisms eg Add labels		B1
	Criticism 1 - There is no A label and Criticism 2 - There is no F label		B1B0
	Didn't label the diagram		B1
	There are no subjects		B1
	The diagram doesn't have labels/headings/titles		B1
	The diagram doesn't have a label/heading/title		B0
	It doesn't show how many study French		B0
	48 is wrong/one of the numbers is wrong		B1
	There's an extra student		B1
	It doesn't add up correctly/the total is wrong		B1
	It doesn't add up		B0
	The numbers are wrong		B0
	Do not accept an incorrect statement eg The number doing Art and French should be 47		B0
	If a value is used as evidence it must be correct eg the total is 100, not 98		B0

Q	Answer	Mark	Comments
8	**Alternative method 1: using different time periods**		
	450 ÷ 30 or 15 or 250 ÷ 10 or 25	M1	oe for any section of the basic rate or the overtime rate eg $\frac{450-150}{30-10}$
	15 and 25	A1	implied by any ratio equivalent to 3 : 5 do not allow as a ratio in the wrong order eg 25 : 15
	$3 : 5$ or $\frac{3}{5} : 1$ or $1 : \frac{5}{3}$	B1ft	oe fully simplified ft full simplification of their two values
	Alternative method 2: using equal time periods		
	Four correct readings from equal time periods of at least 5 hours from the two sections of the graph	M1	eg at 5 and 10 hours and at 35 and 40 hours if a reading from 30 is used, there may only be 3 readings a reading of 0 from 0 may be implied
	15 and 25 or correct totals for their equal time periods	A1	eg 10 hours = 150 and 10 hours = 250 implied by any ratio equivalent to 3 : 5 must not be seen as a ratio in the wrong order eg 250 : 150
	$3 : 5$ or $\frac{3}{5} : 1$ or $1 : \frac{5}{3}$	B1ft	oe fully simplified ft full simplification of their two values

Additional Guidance for this question is on the next page

8 cont	**Additional Guidance**	
	In alt 2, only three readings are needed if a reading from 30 hours is included in both time periods or a reading of 0 is used eg readings of 300 from 20, 450 from 30 and 700 from 40	M1
	Readings from 10, 20, 30 and 40 should be 150, 300, 450 and 700 For readings from other numbers of hours not giving a multiple of £10 allow the multiple of 10 above or below the reading or any value between, which can then be used to score all three marks eg allow [220, 230] for a reading at 15 hours eg alt 1 readings of 70 at 5 hours, 380 at 25 hours, 450 at 30 hours and 700 at 40 hours, followed by hourly rates of 15.50 and 25 and an answer of 31 : 50 eg alt 2 readings of 370 at 25 hours, 450 at 30 hours, 580 at 35 hours and 700 at 40 hours, followed by totals of 80 and 120 or hourly rates of 16 and 24 and an answer of 2 : 3	M1A1B1ft M1A1B1ft
	For $1\frac{2}{3}$ allow 1.67 or better with correct rounding	
	450 : 250 = 45 : 25 does not get the mark for 25, but gets the final mark if simplified to 9 : 5	
	Ignore units throughout eg answer £3 : £5	M1A1B1
	15 : 25	M1A1B0
	25 : 15 or 25 : 10 not simplified	M1A0B0
	25 : 15 with answer 5 : 3 or 25 : 10 with answer 5 : 2	M1A0B1ft
	Answer 5 : 3 without working implies	M1A0B1ft
	15 : 17.5	M1A0B0
	15 : 17.5 followed by 6 : 7	M1A0B1ft
	20 : 25	M1A0B0
	20 : 25 followed by 4 : 5	M1A0B1ft
	3 : 5 in working with answer 1.5 : 2.5	M1A1B0
	30 : 10 = 3 : 1	M0A0B1ft

Q	Answer	Mark	Comments
9(a)	Two fractions less than 1 with product $\frac{3}{10}$	B1	eg $\frac{3}{5}$ and $\frac{1}{2}$ or $\frac{6}{10}$ and $\frac{5}{10}$ either order
	Additional Guidance		
	Accept negatives if each processed fraction is less than 1 eg $-\frac{3}{2}$ and $-\frac{1}{5}$ eg $\frac{-1}{-2}$ and $\frac{3}{5}$ eg $\frac{-3}{-2}$ and $\frac{1}{5}$		B1 B1 B0
	Do not accept decimals within the fractions eg $\frac{0.6}{1}$ and $\frac{0.5}{1}$		B0
	$\frac{11}{10}$ and $\frac{3}{11}$		B0
	$\frac{3}{10}$ and $\frac{1}{1}$		B0
	0.6 and 0.5		B0

Q	Answer	Mark	Comments
9(b)	Two decimals less than 1 with product 0.06	B1	eg 0.3 and 0.2 or 0.60 and 0.10 or 0.5 and 0.12 or 0.75 and 0.08 either order
	Additional Guidance		
	Accept negatives eg –0.3 and –0.2		B1
	Condone negative integers eg –6 and –0.01		B1
	0.06 and 1		B0
	6 and 0.01		B0
	$\frac{3}{10}$ and $\frac{2}{10}$		B0

Q	Answer	Mark	Comments
10	**Alternative method 1**		
	Pair of arcs, equal radii (± 2 mm), centre *B*, intersecting *AB* and *BC*	M1	oe eg single arc, centre *B*, intersecting *AB* and *BC* or single arc, centre *B*, radius *BC* (± 2 mm), intersecting *AB*
	Pair of intersecting arcs, equal radii (± 2 mm), centres the intersections on *AB* and *BC* and angle bisector drawn from *B* at least to the intersection of their arcs	A1	dashed line or condone solid line
	Correct region R shown as the area between *AB* and a straight line from *B* to within 2 mm of *AD*	B1	R may be labelled or shaded arcs not required for this mark only SC1 angle bisector for a different angle correctly constructed with arcs
	Alternative method 2		
	Concentric arcs from *B*, each intersecting *AB* and *BC*	M1	intersections with *AB* and *BC* must be seen, but full arcs are not necessary
	Two lines from the *AB* intersection of one arc to the *BC* intersection of the other arc and angle bisector drawn from *B* at least to the intersection of their lines	A1	dashed line or condone solid line
	Correct region R shown as the area between *AB* and a straight line from *B* to within 2 mm of *AD*	B1	R may be labelled or shaded arcs not required for this mark only SC1 angle bisector for a different angle correctly constructed with arcs
	Additional Guidance		
	Mark any correct construction, ignoring incorrect attempts		
	Unless shaded incorrectly, ignore construction arcs or other lines in the region labelled		
	Bisector drawn with no construction arcs, but region correctly identified		M0A0B1

Q	Answer	Mark	Comments
11	20^2 ($\times \pi$) or 400 ($\times \pi$) or 15^2 ($\times \pi$) or 225 ($\times \pi$)	M1	oe
	$\frac{3}{4} \times 20^2$ ($\times \pi$) or 300 ($\times \pi$) or $\frac{1}{3} \times 15^2$ ($\times \pi$) or 75 ($\times \pi$)	M1dep	oe
	$\frac{3}{4} \times 20^2$ ($\times \pi$) or 300 ($\times \pi$) and $\frac{1}{3} \times 15^2$ ($\times \pi$) or 75 ($\times \pi$)	M1dep	
	300 ($\times \pi$) and 75 ($\times \pi$) and 4	A1	Accept P = 4Q for 4 SC2 40 ($\times \pi$) and 30 ($\times \pi$) and 30 ($\times \pi$) and 10 ($\times \pi$) and answer 3
	Additional Guidance		
	Answer 4 with no working		M0A0
	Condone inconsistent use of π eg 300π and 75 and 4		M3A1
	Condone, for example, π400 for 400π		
	Allow use of a numerical value for π for method marks and for the A mark with answer 4		
	Ignore units throughout		

Q	Answer	Mark	Comment
12(a)	Yes $\frac{3}{5}$ and No $\frac{2}{5}$ for Bag A	B1	oe fraction, decimal or percentage
	Yes $\frac{1}{10}$ and No $\frac{9}{10}$ for both pairs of branches on Bag B	B1	oe fraction, decimal or percentage

Q	Answer	Mark	Comment
12(b)	their $\frac{3}{5}$ × their $\frac{1}{10}$ or $\frac{3}{50}$	M1	oe may be on tree diagram ft their tree diagram if their $\frac{3}{5}$ and their $\frac{1}{10}$ are > 0 and < 1
	their $\frac{3}{5}$ × their $\frac{1}{10}$ × 450 or $\frac{3}{50}$ × 450	M1dep	oe their $\frac{3}{50}$ must be > 0 and < 1
	27	A1ft	ft their tree diagram if their $\frac{3}{5}$ and their $\frac{1}{10}$ are > 0 and < 1

Additional Guidance for this question is on the next page

	Additional Guidance	
	For the first mark, accept the correct probability shown on the tree diagram and ignore other probabilities	
	For the first mark, do not allow $\frac{3}{5} \times \frac{1}{10}$ seen as part of a longer multiplication string of probabilities eg $\frac{3}{5} \times \frac{1}{10} \times \frac{9}{10}$	M0
	Check tree diagram for working	
	$\frac{27}{450}$ implies	M1M1A0
	Students with incorrect probabilities on the tree diagram can score marks for follow through in part (b) or from the correct probabilities recovered eg probabilities of $\frac{3}{4}$ and $\frac{9}{10}$ on the top row of the tree diagram but an answer of 27 in part (b)	B0B0 in (a) M1M1A1 in (b)
	Allow follow through from values rather than probabilities on the branches, with denominator 5 for Bag A and 10 for Bag B eg from 2 on Bag A and 9 on Bag B allow $\frac{2}{5} \times \frac{9}{10} \times 450 = 162$	M1M1A1ft
	For A1ft allow a correct decimal answer or the answer truncated or rounded up to the nearest integer eg from $\frac{3}{4}$ and $\frac{1}{10}$ leading to $\frac{3}{40} \times 450$ accept 33 or 33.75 or 34	M1M1A1ft

Q	Answer	Mark	Comments
13	$2w = \frac{4}{5} \times 15$ or $2w = \frac{60}{5}$ or $2w = 12$ or $\frac{2w}{15} = \frac{12}{15}$ or $\frac{w}{3} = \frac{2}{1}$ or $\frac{w}{2} = \frac{3}{1}$ or $\frac{w}{15} = \frac{4}{5} \div 2$ or $\frac{w}{15} = \frac{2}{5}$ or $2w \times 5 = 4 \times 15$ or $10w = 60$ or $\frac{4}{5} \div \frac{2}{15}$	M1	oe in the form $aw = n$ where a is an integer and n is an integer, fraction or decimal oe in the form $\frac{bw}{x} = \frac{c}{x}$ where x is a common denominator oe calculation
	6	A1	
	Additional Guidance		
	Embedded answer 6 eg $\frac{2 \times 6}{15} = \frac{4}{5}$		M1A0

Q	Answer	Mark	Comment
14	15×8 or 120 or 60 (workers) for 2 (days)	M1	oe correct number of workers for any number of days except 8
	$15 \times 8 \div 6$ or 20	M1dep	oe eg $15 \times \frac{8}{6}$ or $15 \div \frac{6}{8}$
	5	A1	ignore units
	Additional Guidance		
	Award M1 for correct working within multiple attempts		

Q	Answer	Mark	Comment
15	$n + 2$	B1	

Q	Answer	Mark	Comments
16	A	B1	accept letter or graph circled

Q	Answer	Mark	Comment
17	Any two correct readings of 13 at 50 (years) 30 at 60 (years) 66 at 70 (years)	B1	may be seen on the graph implied by a difference (frequency) of 17 for 50s or 36 for 60s
	Correct difference (frequency) for any two readings eg difference (frequency) of 14 for readings of 7 at 45 (years) and 21 at 55 (years)	M1	must be from two readings correct for those ages a difference (frequency) of 17 for 50s or 36 for 60s scores B1M1
	17 and 36 and Yes	A1	Yes can be implied eg $34 < 36$
	Additional Guidance		
	Readings of 3, 13 and 30 (from 40, 50 and 60) with differences (frequencies) of 10 and 17		B1M1A0
	Award the B1 mark for any two of the three possible correct readings, even if multiple readings are taken from the graph		
	Their readings and differences (frequencies) must be integers to gain marks		
	For readings not giving an integer value allow the integer above or below the reading eg for a reading at 53 allow 17 or 18		
	Readings of 11 or 12 at 49, 27 or 28 at 59 and 64 or 65 at 69, leading to differences (frequencies) of 15, 16 or 17 and 36, 37 or 38		B0M1A0
	Differences (frequencies) other than 17 and 36 must come from readings seen on the graph or linked to ages in working		

Q	Answer	Mark	Comment
18	$2ax^3 + 2x^2 + 4x - 10$ and $bx^2 + cx$ or $2ax^3 + (2 + b)x^2 + (4 + c)x - 10$ or $2a = 12$ or $a = 6$	M1	oe correct expansions allow $2ax^3 = 12x^3$
	$2 + b = 7$ or $b = 5$ or $4 + c = 3$ or $c = -1$	M1	oe equation
	$a = 6$ and $b = 5$ and $c = -1$	A1	SC2 any two of $a = 6$ and $b = 5$ and $c = -1$
	Additional Guidance		
	One correct value without working only scores one mark eg $a = 6$ and $b = -5$ and $c = 1$ with no working eg $a = -6$ and $b = 5$ and $c = 1$ with no working		M1M0A0 M0M1A0
	Condone an incorrect -10 in the expansion if A1 is awarded		M1M1A1

Q	Answer	Mark	Comment
19(a)	x^2y^3	B1	

Q	Answer	Mark	Comment
19(b)	Could be either in top row	B1	
	Must be negative in bottom row	B1	

Q	Answer	Mark	Comment
20	**Alternative method 1**		
	$xy = 5x + 9$	M1	
	$xy - 5x = 9$ or $5x - xy = -9$	M1dep	oe collection of terms
	$x(y - 5) = 9$ or $x(5 - y) = -9$ or $\frac{9}{y-5}$ or $\frac{-9}{5-y}$	M1dep	
	$x = \frac{9}{y-5}$ or $x = \frac{-9}{5-y}$	A1	
	Alternative method 2		
	$y = 5 + \frac{9}{x}$ or $y - \frac{9}{x} = 5$	M1	allow $\frac{5x}{x}$ for 5
	$y - 5 = \frac{9}{x}$ or $5 - y = -\frac{9}{x}$	M1dep	
	$\frac{1}{y-5} = \frac{x}{9}$ or $x(y - 5) = 9$ or $x(5 - y) = -9$ or $\frac{1}{5-y} = -\frac{x}{9}$ or $\frac{9}{y-5}$ or $\frac{-9}{5-y}$	M1dep	
	$x = \frac{9}{y-5}$ or $x = \frac{-9}{5-y}$	A1	

Additional Guidance for this question is on the next page

20 cont	**Additional Guidance**	
	$\frac{9}{y-5}$ on answer line with $x = \frac{9}{y-5}$ in working	M1M1M1A1
	Allow the equation with x on the right, eg $\frac{9}{y-5} = x$	M1M1M1A1
	Allow appropriate × or ÷ signs throughout	

Q	Answer	Mark	Comment
21	$3\mathbf{a} + \mathbf{b} + \mathbf{a} + 6\mathbf{b}$ or $4\mathbf{a} + 7\mathbf{b}$	M1	$\overrightarrow{EH}$ may be seen on diagram or as part of a longer vector sum
	$2 \times$ their $(4\mathbf{a} + 7\mathbf{b})$ or $8\mathbf{a} + 14\mathbf{b}$	M1dep	$\overrightarrow{FG}$ may be seen on diagram
	Any correct path from F to E eg their $(8\mathbf{a} + 14\mathbf{b}) + (-2\mathbf{a} - 15\mathbf{b})$ or their $(8\mathbf{a} + 14\mathbf{b}) - (2\mathbf{a} + 15\mathbf{b})$ or $(-2\mathbf{a} - 15\mathbf{b}) + (3\mathbf{a} + \mathbf{b}) + (\mathbf{a} + 6\mathbf{b})$ or $2\mathbf{a} - 8\mathbf{b}$ and their $(8\mathbf{a} + 14\mathbf{b})$ + their $(2\mathbf{a} - 8\mathbf{b}) + (-\mathbf{a} - 6\mathbf{b}) + (-3\mathbf{a} - \mathbf{b})$ or their $(8\mathbf{a} + 14\mathbf{b})$ + their $(2\mathbf{a} - 8\mathbf{b})$ + their $(-4\mathbf{a} - 7\mathbf{b})$	M1dep	$\overrightarrow{FG} + \overrightarrow{GE}$ $\overrightarrow{FG} - \overrightarrow{EG}$ oe $\overrightarrow{GE} + \overrightarrow{ED} + \overrightarrow{DH}$ oe $\overrightarrow{GH}$ oe $\overrightarrow{FG} + \overrightarrow{GH} + \overrightarrow{HD} + \overrightarrow{DE}$ oe $\overrightarrow{FG} + \overrightarrow{GH} + \overrightarrow{HE}$
	$6\mathbf{a} - \mathbf{b}$	A1	SC3 $-6\mathbf{a} + \mathbf{b}$ or $\mathbf{b} - 6\mathbf{a}$

Additional Guidance	
Missing brackets and incorrect addition or subtraction signs can be recovered for all four marks eg $8\mathbf{a} + 14\mathbf{b} - 2\mathbf{a} + 15\mathbf{b}$ recovered to $6\mathbf{a} - \mathbf{b}$ Condone missing brackets for the third mark eg $8\mathbf{a} + 14\mathbf{b} - 2\mathbf{a} + 15\mathbf{b}$ and answer $6\mathbf{a} + 29\mathbf{b}$	M1M1M1A1 M1M1M1A0
To receive marks expressions must be in terms of **a** and **b**	
Allow subtractions shown in vertical form eg $8\mathbf{a} + 14\mathbf{b}$ $-\ 2\mathbf{a} + 15\mathbf{b}$	M1M1M1

Q	Answer	Mark	Comment
22	**Alternative method 1**		
	$0.2\dot{3}$ or 0.23…	M1	implied by $10x = 2.33…$
	$10x = 2.33…$ (and $x = 0.23…$)	M1dep	oe multiplication by a power of 10 any letter
	$10x - x = 2.1$ or $9x = 2.1$	M1dep	oe subtraction to eliminate recurring digits eg $100x - 10x = 23.3… - 2.3…$ or $90x = 21$
	$\frac{21}{90}$	A1	oe fraction eg $\frac{23.1}{99}$
	$\frac{7}{30}$	A1ft	ft full simplification of their $\frac{21}{90}$ with all M marks awarded

This scheme continues on the next page

Q	Answer	Mark	Comment
22 cont	**Alternative method 2**		
	$10x = 6.88\ldots$ (and $x = 0.68\ldots$) or $10y = 4.55\ldots$ (and $y = 0.45\ldots$)	M1	oe multiplication by a power of 10 any letter
	$10x - x = 6.88\ldots - 0.68\ldots$ or $9x = 6.2$ and $10y - y = 4.55\ldots - 0.45\ldots$ or $9y = 4.1$	M1dep	oe subtractions to eliminate recurring digits eg $100x - 10x = 68.8\ldots - 6.8\ldots$ or $90x = 62$ and $100y - 10y = 45.5\ldots - 4.5\ldots$ or $90y = 41$
	$\frac{62}{90}$ and $\frac{41}{90}$	M1dep	oe fractions the fractions do not need to have a common denominator
	$\frac{21}{90}$	A1	oe fraction eg $\frac{23.1}{99}$
	$\frac{7}{30}$	A1ft	ft full simplification of their $\frac{21}{90}$ with all M marks awarded

This scheme continues on the next page

Q	Answer	Mark	Comment
22 cont	**Alternative method 3**		
	$0.2\dot{3}$ or 0.23…	M1	implied by $(0.0\dot{3} =) \frac{3}{90}$ oe fraction
	$(0.0\dot{3} =) \frac{3}{90}$	M1dep	oe fraction
	$\frac{2}{10} + \frac{3}{90}$	M1dep	oe fractions
	$\frac{21}{90}$	A1	oe fraction eg $\frac{23.1}{99}$
	$\frac{7}{30}$	A1ft	ft full simplification of their $\frac{21}{90}$ with all M marks awarded

This scheme continues on the next page

22 cont	**Alternative method 4**		
	$(0.0\dot{8} =) \frac{8}{90}$ or $(0.0\dot{5} =) \frac{5}{90}$	M1	oe fraction
	$(0.0\dot{8} =) \frac{8}{90}$ and $(0.0\dot{5} =) \frac{5}{90}$	M1dep	oe fractions
	$\frac{6}{10} + \frac{8}{90} - (\frac{4}{10} + \frac{5}{90})$	M1dep	oe condone missing brackets
	$\frac{21}{90}$	A1	oe fraction eg $\frac{23.1}{99}$
	$\frac{7}{30}$	A1ft	ft full simplification of their $\frac{21}{90}$ with all M marks awarded
	Additional Guidance		
	For the second mark in alt 1 and the first mark in alt 2, accept multiplication by a power of 10 seen without algebra		
	Accept fractions with non-recurring decimal numerator and/or denominator up to the first A1 eg $\frac{2.1}{9}$		M1M1M1A1
	$\frac{7}{30}$ with no incorrect working		M1M1M1A1A1
	If their incorrect fraction cannot be simplified the final mark cannot be awarded		

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comment</th></tr>
<tr><td rowspan="5">23</td><td>Correct dashed lines for $x = 3$ and $y = 1$
and
correct solid line for $x + y = 7$
and
correct region identified</td><td>B3</td><td>B2
correct dashed lines for $x = 3$ and $y = 1$
and correct solid line for $x + y = 7$
and no or incorrect region identified
or
correct lines for $x = 3$ and $y = 1$ and $x + y = 7$ with any or all of the lines of the wrong type
and correct region identified
B1
correct lines for $x = 3$ and $y = 1$ and $x + y = 7$ with any or all of the lines of the wrong type
and no or incorrect region identified
or
any correct line of the correct type</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">Mark intention to draw correct lines</td><td></td></tr>
<tr><td colspan="2">The region can be identified by being labelled R or being shaded or being left unshaded with all external regions shaded</td><td></td></tr>
<tr><td colspan="2">$x = 3$ must go from (3, 1) to at least (3, 4)
$y = 1$ must go from (3, 1) to at least (6, 1)
$x + y = 7$ must go at least from (3, 4) to (6, 1)</td><td></td></tr>
<tr><td colspan="2">For B2 or B1 ignore other lines on the grid
For B3 ignore other lines on the grid if the correct region is identified</td><td></td></tr>
</table>

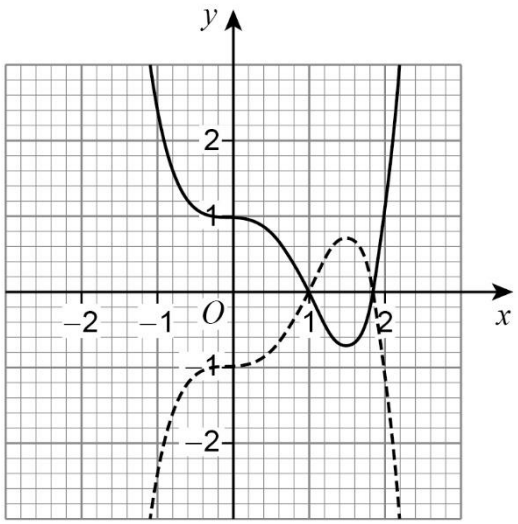
Q	Answer	Mark	Comment
24(a)	$\left(\frac{6}{a} =\right) \frac{24}{4a}$ or converts both fractions to a common denominator or correct unsimplified fraction eg $\frac{26}{8a}$ or $\frac{13a}{4a^2}$ or $\frac{3.25}{a}$	M1	oe eg $\frac{48}{8a}$ and $\frac{22}{8a}$ or $\frac{24a}{4a^2}$ and $\frac{11a}{4a^2}$
	$\frac{13}{4a}$	A1	
	Additional Guidance		
	Do not ignore further work eg $\frac{13}{4a}$ followed by answer $\frac{3.25}{a}$		M1A0
	Allow a division sign rather than a fraction line for M1 only eg $26 \div 8a$ eg $13 \div 4a$		M1A0 M1A0

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comment</th></tr>
<tr><td rowspan="9">24(b)</td><td>$y(y-3)$</td><td>M1</td><td></td></tr>
<tr><td>$(y+7)(y+3)$</td><td>M1</td><td></td></tr>
<tr><td>$(y+3)(y-3)$</td><td>M1</td><td></td></tr>
<tr><td>$y(y+7)$ or y^2+7y</td><td>A1</td><td>SC1
$y^4-3y^3+10y^3-30y^2+21y^2-63y$
or
$y^4+7y^3-9y^2-63y$</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">$y(y+7)$ or y^2+7y with no other working</td><td>M1M1M1A1</td></tr>
<tr><td colspan="2">Answer $\frac{y(y+7)}{1}$ or $\frac{y^2+7y}{1}$</td><td>M1M1M1A0</td></tr>
<tr><td colspan="2">Ignore the consistent use of a different variable within a factorisation</td><td></td></tr>
<tr><td colspan="2">Award SC1 only if there are no correct factorisations
eg correct factorisation to $(y+7)(y+3)$ and correct expansion to $y^4-3y^3+10y^3-30y^2+21y^2-63y$</td><td>M1 only</td></tr>
</table>

Q	Answer	Mark	Comment
25(a)	0	B1	

Q	Answer	Mark	Comment
25(b)	$\frac{1}{2} \times (50 + 30) \times 20$	M1	oe complete method to work out the area of the trapezium eg $\frac{1}{2} \times 10 \times 20 + 20 \times 30 + \frac{1}{2} \times 10 \times 20$ or $50 \times 20 - \frac{1}{2} \times 10 \times 20 - \frac{1}{2} \times 10 \times 20$ or 40×20
	800	A1	
	Additional Guidance		

Q	Answer	Mark	Comment
26	(P(3) =) $\frac{1}{6}$ or (P(1, 2) =) or (P(2, 1) =) $\frac{1}{6} \times \frac{1}{6}$ or $\frac{1}{36}$	M1	oe 3 on first roll or 1 on first roll and 2 on second or 2 on first roll and 1 on second
	$\frac{1}{6}$ and $\frac{1}{6} \times \frac{1}{6}$ or $\frac{1}{6}$ and $\frac{1}{36}$ or $\frac{1}{6} \times \frac{1}{6} \times 2$ or $\frac{1}{36} \times 2$ or $\frac{2}{6} \times \frac{1}{6}$ or $\frac{2}{36}$	M1dep	oe
	$\frac{1}{6} + \frac{1}{6} \times \frac{1}{6} \times 2$ or $\frac{1}{6} + \frac{2}{36}$	M1dep	oe
	$\frac{2}{9}$ or $\frac{8}{36}$ or $\frac{4}{18}$	A1	oe fraction, decimal or percentage
	Additional Guidance		
	For the first and second marks, do not allow $\frac{1}{6}$ seen only as part of a multiplication string, but do allow it seen only in an addition		
	For the first and second marks, do not allow $\frac{1}{6} \times \frac{1}{6}$ (× 2) or $\frac{2}{6} \times \frac{1}{6}$ seen only as part of a longer multiplication string or in $1 - (\frac{1}{6} \times \frac{1}{6})$, but do allow them seen only in an addition		
	Allow working in decimals rounded correctly to at least 2 dp for M marks, but answer must be given correctly as $0.\dot{2}$ or $22.\dot{2}\%$		
	Ignore an incorrect simplification or conversion of a correct value		M1M1M1A1

Q	Answer	Mark	Comment
27	Reflection of given graph in the x-axis	M1	mark intention
	Correct shape of graph from ([–1.5, –1], –3) through (0, –1) through (1, 0) maximum at ([1.4, 1.6], [0.6, 0.8]) through (1.8, 0) to ([2, 2.5], –3)	A1	
	Additional Guidance		
			M1A1
	Feathering or double lines or a split line, but intention to reflect in the x-axis		M1A0

Q	Answer	Mark	Comment
28	(cos 30 =) $\frac{\sqrt{3}}{2}$ or (sin 45 =) $\frac{\sqrt{2}}{2}$ or $\frac{1}{\sqrt{2}}$ or (tan 60 =) $\sqrt{3}$	M1	oe correct trig function may be implied by position in multiplication string may be seen in a table
	$\left(\frac{\sqrt{3}}{2}\times\frac{\sqrt{2}}{2}\times\sqrt{3}\right)^2$ or $\left(\frac{\sqrt{3}}{2}\right)^2 \times \left(\frac{\sqrt{2}}{2}\right)^2 \times \left(\sqrt{3}\right)^2$ or $\frac{3\sqrt{2}}{4}$ or $\frac{3}{2\sqrt{2}}$ or $\frac{\sqrt{18}}{4}$	M1dep	oe with all values correct oe single term not squared
	$\left(\frac{3\sqrt{2}}{4}\right)^2$ or $\left(\frac{3}{2\sqrt{2}}\right)^2$ or $\left(\frac{\sqrt{18}}{4}\right)^2$ or $\frac{3}{4} \times \frac{1}{2} \times 3$ or $\frac{\sqrt{324}}{16}$	M1dep	oe with all values correct oe single term squared oe multiplication string without surds oe single fraction with one surd
	$\frac{9}{8}$ or $1\frac{1}{8}$ or 1.125	A1	oe fraction, mixed number or decimal
	Additional Guidance		
	Ignore an incorrect attempt to simplify or convert a correct answer eg $\frac{9}{8}$ = 1.8		M1M1M1A1