GCSE
MATHEMATICS
8300/1H

Higher Tier

Paper 1 Non-Calculator

Shadow paper based on 2020 question paper

Mark scheme

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.

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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	Comments
1	$\frac{15}{4}$	B1	

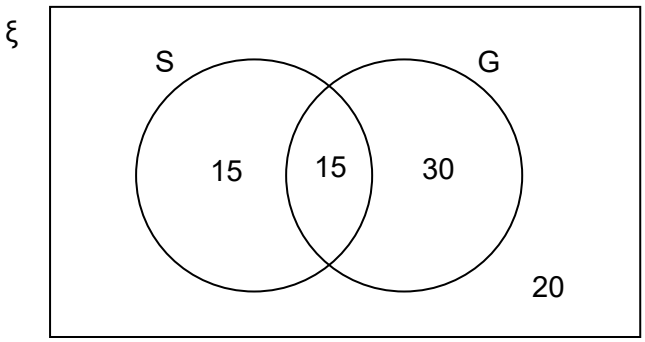
Q	Answer	Mark	Comments
2	$\begin{pmatrix} 6 \\ -4 \end{pmatrix}$	B1	

Q	Answer	Mark	Comments
3	64	B1	

Q	Answer	Mark	Comments
4	$-\frac{1}{6}$	B1	

Q	Answer	Mark	Comments
5	**Alternative method 1**		
	cos and $\frac{12}{24}$ oe identified	M1	
	60	A1	
	Alternative method 2		
	sin and $\frac{\sqrt{24^2 - 12^2}}{24}$ identified or tan and $\frac{\sqrt{24^2 - 12^2}}{12}$ identified	M1	
	60	A1	
	Additional Guidance		
	Accept an embedded answer, eg cos 60 = $\frac{12}{24}$ with no further working		M1A1
	$180 \div 3 = 60$		M0A0

Q	Answer	Mark	Comments
6	Graph A No correlation	B1	allow 'No' or 'None'
	Graph B Strong negative	B1	
	Additional Guidance		
	Condone incorrect spelling if intention is clear		
	Allow clear link(s) from the table to the answer line eg an arrow from 'Strong negative' to the Graph B answer line		

Q	Answer	Mark	Comments
7	15 in correct position (S only)	B1	
	20 in correct position	B1	
	15 in correct position (S∩G) or 30 in correct position or their value in G only is three times their value in the intersection or their four values sum to 80	B1ft	ft $\frac{1}{3}$ × (80 – 15 – their 20) ft $\frac{2}{3}$ × (80 – 15 – their 20) for this mark allow non-integers or values rounded or truncated to the nearest integer
	15, 20, 15 and 30 in correct positions	B1	
	Additional Guidance		
	Mark the Venn diagram only		
			B1B1B1B1

Q	Answer	Mark	Comments
8	**Alternative method 1**		
	9.5×8 or 76 or 9.5×6 or 57	M1	oe
	$\frac{9.5\times8-2\times9.5}{2}$ or $\frac{76-19}{2}$ or $\frac{9.5\times6}{2}$ or $\frac{57}{2}$	M1dep	oe division may be implied eg $\frac{6}{8}$ = 57, $\frac{3}{8}$ = 28.5 scores M1M1
	28.5 or $28\frac{1}{2}$ or $\frac{114}{4}$	A1	oe
	Alternative method 2		
	9.5×8 or 76 or 9.5×6 or 57	M1	oe
	$\frac{9.5\times8}{2} - 9.5$ or $9.5 \times 4 - 9.5$	M1dep	oe eg $9.5 \times (4 - 1)$ or 9.5×3
	28.5 or $28\frac{1}{2}$ or $\frac{114}{4}$	A1	oe
	Additional Guidance		
	Answer 28 or 29 with 28.5 in working		M1M1A1
	Answer 28 or 29 without 28.5 in working		A0

Q	Answer	Mark	Comments
9(a)	First term 3 and Third term 27	B2	B1 one correct or First term 3^1 or Third term 3^3 or First term -3 and Third term -27 or $3x^2 = 27$ (any letter) oe equation or $ar = 9$ and $ar^3 = 81$
	Additional Guidance		
	If answer lines are blank, mark progression first and then working lines		
	Correct answer for 1st term or 3rd term in the progression, but incorrect numerical term on answer line		B0 for that term
	Correct answer for 1st term or 3rd term in the progression, with non-contradictory algebraic term on answer line		B1 for that term
	Correct answers for 1st term and 3rd term in the progression, with non-contradictory algebraic terms on answer lines		B2
	First term 3 Third term 3^3		B1
	First term –27 Third term 45		B0
	$3x = \frac{27}{x}$ (any letter)		B1

Q	Answer	Mark	Comments	
9(b)	**Alternative method 1**			
	3rd term = $7q$	M1	oe implied by a total of $12q$	
	$q + 4q +$ their 3rd term $= 84$ or $12q = 84$	M1	oe their 3rd term must be a linear expression in terms of q 84 ÷ 12 implies M1M1	
	7	A1ft	ft their 3rd term, which must be a linear expression in q, or their equation in the form sum of 3 linear terms in $q = 84$ allow ft answers rounded to 1dp or better	
	Alternative method 2			
	84 ÷ 3 or 28	M1	oe	
	$4q =$ their 28	M1dep	oe	
	7	A1		
	Additional Guidance			
	For A1ft, if not an integer, the answer must be given as a decimal, fully simplified fraction or fully simplified mixed number Once awarded, ignore further incorrect conversions eg $q+4q+15q=84$, $20q = 84$, $q = \frac{84}{20}$, $q = 4$ (ignore conversion)			M0M1A1ft
	Their 3rd term may first appear in their addition, eg $q + 4q + 8q = 84$ implies that $8q$ is their 3rd term			M0M1
	(3rd term $4q + 3$), $q + 4q + 4q + 3 = 84$, $q = 9$			M0M1A1ft
	(3rd term $8q$), $q + 4q + 8q = 84$, $q = 6.46…$			M0M1A1ft
	Sum $12q$ and/or answer 7 may come from incorrect 3rd term, eg eg1 (3rd term $8q$), $q + 4q + 8q = 12q$, $(12q = 84)$, $q = 7$ receives 2nd mark only; they have an incorrect 3rd term and an incorrect total for their 3 terms, but their answer is correct for their total, so equating to 84 is implied even if not seen eg2 (3rd term $8q$), q, $4q$, $8q$, $13q = 84$, $q = 7$			M0M1A0ft M0M0A0ft
	If their 3rd term has an algebraic coefficient the 2nd mark can be awarded for a correct equation, but A1 cannot be awarded eg (3rd term nq), $q + 4q + nq = 84$			M0M1A0

Q	Answer	Mark	Comments
10	**Alternative method 1**		
	3300 ÷ (4 + 7) or 3300 ÷ 11 or 300	M1	oe accept $\frac{1}{11}$ of 3300
	7 × their 300 or 2100 or 4 × their 300 or 1200 or their 300 ÷ 6 or 50	M1dep	oe
	7 × their 300 ÷ 6 or (3300 – 4 × their 300) ÷ 6 or 2100 ÷ 6	M1dep	oe
	350	A1	
	Alternative method 2		
	3300 ÷ 6 or 550	M1	oe
	their 550 ÷ (4 + 7) or 50	M1dep	oe 3300 ÷ 66 scores M1M1
	7 × their 50 or 550 – (4 × their 50)	M1dep	oe
	350	A1	
	Additional Guidance		
	Answer 550 with 2100 or 1200 in working		M1M1M0A0
	Answer 550 with 350 in working		M1M1M1A0
	Condone incorrect representation of a division if recovered eg 11 ÷ 3300 = 300		M1

Q	Answer	Mark	Comments
11	**Alternative method 1**		
	0.325 × 3 or 0.975 or 0.325 ÷ 10 or 0.0325	M1	oe
	0.0975	A1	
	Alternative method 2		
	0.09… from division of 39 by 400 or 0.09… from division of 3.9 by 40	M1	
	0.0975	A1	
	Alternative method 3		
	$39 \times \frac{1000}{400}$ or 39 × 2.5 or 39 ÷ 4 or 0.39 ÷ 4 or digits 975	M1	oe
	0.0975	A1	

Q	Answer	Mark	Comments
12(a)	36 ÷ 9 × 2 (= 8) or 36 ÷ 4 = 9 and 8 ÷ 4 = 2 or 36 ÷ 9 = 4 and 8 ÷ 2 = 4 or 9 × 4 = 36 and 2 × 4 = 8	B1	oe eg 8 ÷ 2 = 4 and 9 × 4 = 36
	Additional Guidance		
	4 × 2 (= 8)		B0
	9 : 2 (=) 36 : 8 with no other working		B0
	9 : 2 (=) 36 : 8 with multiplication by 4 shown by arrow(s)		B1
	9 : 2 (=) 18 : 4 (=) 36 : 8		B1
	Do not condone incorrect representation of a division eg 9 ÷ 36 = 4		B0
	Do not condone incorrect mathematical representation eg 36 ÷ 9 = 4 × 2 = 8		B0
	36 ÷ 8 = 4.5, 4.5 × 2 = 9		B1
	36 × 2 = 72, 72 ÷ 9 = 8		B1

Q	Answer	Mark	Comments
12(b)	**Alternative method 1**		
	$2 \times \pi \times 36$ or $\pi \times 72$ or 72π or [226, 226.224]	M1	oe condone [3.14, 3.142] for π
	$2 \times \pi \times 8 \div 4$ or $\pi \times 16 \div 4$ or 4π or [12.56, 12.6]	M1	oe arc length of quarter circle condone [3.14, 3.142] for π
	$(2 \times \pi \times 4 \div 2) + (2 \times 8)$ or $4\pi + 16$ or [28.56, 28.6]	M1dep	oe dep on 2nd M1 this does not imply M1M1M1
	$76\pi + 16$	A1	
	Alternative method 2		
	$2 \times \pi \times 36$ or $\pi \times 72$ or 72π or [226, 226.224]	M1	oe condone [3.14, 3.142] for π
	$2 \times \pi \times 36$ and $2 \times \pi \times 8 \div 4$ or 72π and 4π or $2 \times \pi \times 36 + 2 \times 8$ or $72\pi + 16$ or [242, 242.224]	M1dep	oe eg 72π and [12.56, 12.6] or [226, 226.224] and 4π
	$2 \times \pi \times 36 + 2 \times \pi \times 8 \div 4$ or $72\pi + 4\pi$ or 76π or [238.76, 238.8]	M1dep	oe eg 72π + [12.56, 12.6] or [226, 226.224] + 4π
	$76\pi + 16$	A1	

Additional guidance for this question is on the next page

	Additional Guidance	
12(b) cont	Condone $4(19\pi + 4)$	M1M1M1A1
	Condone, for example, $\pi 72$ for up to M1M1M1	
	$36\pi + 4\pi + 16$	M0M1M1A0 on alt 1
	$1296\pi + 4\pi + 16$	M0M1M1A0 on alt 1
	$72\pi + 64\pi + 16$	M1M1M0A0 on alt 2
	$1296\pi + 64\pi + 16$	M0M0M0A0
	Using πr^2 instead of $2\pi r$ throughout	M0M0M0A0
	$76\pi + 16$ in working with incorrect further work, eg $76\pi + 16 = 92\pi$	M1M1M1A0

Q	Answer	Mark	Comments
13(a)	$(x+1)(x-20)$ or $(k=)-19$ or $(x+2)(x-10)$ or $(k=)-8$ or $(x+4)(x-5)$ or $(k=)-1$ or $(x+5)(x-4)$ or $(k=)1$ or $(x+10)(x-2)$ or $(k=)8$ or $(x+20)(x-1)$ or $(k=)19$ or $s=20$ and $t=1$ or $20-1$	M1	oe correct factorisation
	19	A1	condone embedded answer $x^2+19x-20$
	Additional Guidance		
	$x^2+sx-tx-st$ with no further working		M0A0
	Ignore incorrect factorisations in working		

Q	Answer	Mark	Comments
13(b)	Valid reason	B1	eg it should be –8 or 5 × 16 isn't 0 or (8 – 3)(8 + 8) = 80 or 8 + 8 = 16 or 8 + 8 ≠ 0

Additional Guidance	
'He didn't change the sign on the right'	B1
'If you substitute 8 it does not give 0'	B1
$x = 8$ is wrong	B1
$x = -8$ (and $x = 3$)	B1
$x = 8$ and $x = -3$	B0
'One solution is wrong' or 'Only one answer is correct'	B0
$x = 8$	B0
Ignore statements which do not contradict a correct answer	

Q	Answer	Mark	Comments
14(a)	(15 =) 3×5	M1	oe eg (15 =) $3^1 \times 5^1$ allow 3 and 5 in a factor tree
	$2^{10} \times 3^2 \times 5^7$	A1	any order SC1 720 000 000
	Additional Guidance		
	M1 may be implied eg 1: $3 \times 5 \times 2^{10} \times 3 \times 5^6$ eg 2: $2^{10} \times 3 \times 3 \times 5 \times 5^6$		M1 M1
	Condone a multiplier of 1 for M1 only if not recovered eg 1: $1 \times 3 \times 5$ eg 2: $1 \times 2^{10} \times 3^2 \times 5^7$		M1 M1A0
	Allow the prime factorisation of 15 within the prime factorisation of a larger number eg $45 \times 2^{10} \times 5^6$ and $45 = 5 \times 3^2$ oe		M1

Q	Answer	Mark	Comments
14(b)	$\sqrt[3]{2^9 \times 7^3}$ or $\sqrt[3]{512 \times 7^3}$ or $2^3 \times 7$ or 8×7 or $\sqrt[3]{175616}$	M1	oe with no fraction in the surd eg $\sqrt[3]{512 \times 343}$ oe eg $2^{(9 \div 3)} \times 7^{(3 \div 3)}$ or $2^3 \times 7^1$
	56	A1	

Q	Answer	Mark	Comments
15	6 : 1	B1	

Q	Answer	Mark	Comments
16	0.8	B1	oe
	–20	B1ft	ft any value other than 1
	Additional Guidance		
	If they show $u_2 = \frac{4}{5}$ but simplify or convert it incorrectly, award B1 for the 1st mark, but do not award B1(ft) for the 2nd mark eg $u_2 = \frac{4}{5}$, $u_3 = \frac{4}{-0.25} = -16$		B1B0
	0.8 (oe) and –20 worked out, with –20 on the u_2 answer line		B0B1
	Non-integer answers must be given as correct decimals or correct fractions with integer numerator and denominator If ft, award the 2nd mark for a correct fraction with integer numerator and denominator even if then incorrectly simplified or converted		
	If the answer line for u_2 is incorrect, do not award the 1st mark in working		

Q	Answer	Mark	Comments
17	$l = 3m + 20$ or $l = 20 + 3m$	B3	oe in the form $l =$ B2 correct equation not in the form $l =$ or $3m + 20$ or $20 + 3m$ or $l = 3m\ (+ k)$ (k is a number or letter) or $l = (k +)\ 3m$ (k is a number or letter) or $l = am + 20\ (a \neq 0)$ or $l = 20 + am\ (a \neq 0)$ B1 $3m\ (+ k)$ (k is a number or letter) or $(k +)\ 3m$ (k is a number or letter) or $am + 20\ (a \neq 0)$ or $20 + am\ (a \neq 0)$ SC1 $m = 3l + 20$

Additional Guidance	
Allow l = in working but omitted on answer line For an equation in the form $l =$ in working, but rearranged (correctly or incorrectly) for the answer line, award 1 mark less than the $l =$ form	
Condone an unsimplified fraction for 3 if it has integer numerator and denominator eg $l = \frac{12}{4}m + 20$	B3
An unsimplified fraction for 3 can still score marks if it does not have integer numerator and denominator eg $l = \frac{32 - 20}{4}m + 20$	B2
Allow $3 \times m$ or $m \times 3$ for $3m$	
Ignore units	
Condone capital L or M, but for incorrect variable(s) award 1 mark less than correct variable(s) would get eg 1: $l = 3x + 20$ or $y = 3x + 20$ eg 2: $3x + 20$ eg 3: $3x$	B2 B1 B0

Q	Answer	Mark	Comments
18	**Alternative method 1: substitutes for $6y$ in first equation then substitutes value of x**		
	$2x + 2(3x + 9) = 6$ or $8x = -12$	M1	oe correct elimination of y
	$(x =) -1\frac{1}{2}$ or $(x =) -1.5$	A1	oe eg $(x =) -\frac{3}{2}$
	$2 \times$ their $-1\frac{1}{2} + 6y = 6$ or $3y = 3 \times$ their $-1\frac{1}{2} + 9$	M1dep	oe substitution of their x into either equation
	$(y =) \frac{3}{2}$ or $(y =) 1\frac{1}{2}$ or $(y =) 1.5$	A1	oe eg $(y =) \frac{6}{4}$
	Alternative method 2: equates coefficients		
	Equates coefficients for one unknown and if necessary, rearranges into appropriate form and adds or subtracts equations appropriately	M1	eg 1 changes 1st equation to $x + 3y = 3$, rearranges 2nd equation to $3y - 3x = 9$ and subtracts to eliminate y eg 2 changes 2nd equation to $6y = 6x + 18$ and subtracts to eliminate y
	Correct value for x or y	A1	
	Substitutes their value into an equation	M1dep	
	Both values correct	A1	

Mark scheme and Additional Guidance continues on next page

Q	Answer	Mark	Comments
18 cont	**Alternative method 3: substitutes for $3x$ in second equation then substitutes value of y**		
	$3y = (9 - 9y) + 9$ or $12y = 18$	M1	oe correct elimination of x
	$(y =) \frac{3}{2}$ or $(y =) 1\frac{1}{2}$ or $(y =) 1.5$	A1	oe eg $(y =) \frac{6}{4}$
	$2x + 6 \times$ their $\frac{3}{2} = 6$ or $3 \times$ their $\frac{3}{2} = 3x - 9$	M1dep	oe substitution of their y into either equation
	$(x =) -1\frac{1}{2}$ or $(x =) -1.5$	A1	oe eg $(x =) -\frac{3}{2}$
	Alternative method 4: solves each unknown separately - substitutes for $6y$ in first equation then substitutes for $3x$ in second equation		
	$2x + 2(3x + 9) = 6$ or $8x = -12$	M1	oe correct elimination of y
	$(x =) -1\frac{1}{2}$ or $(x =) -1.5$	A1	oe eg $\left(x =\right) -\frac{15}{10}$
	$3y = (9 - 9y) + 9$ or $12y = 18$	M1	oe correct elimination of x
	$(y =) \frac{3}{2}$ or $(y =) 1\frac{1}{2}$ or $(y =) 1.5$	A1	oe eg $(y =) \frac{6}{4}$
	Additional Guidance		
	Note that in alt 4 the 2nd M mark is not dependent		
	In alt 4, allow alt 2 method for each unknown		
	Both answers correct		M1A1M1A1

Q	Answer	Mark	Comments
19	$\frac{6x}{10}$	B1	

Q	Answer	Mark	Comments
20(a)	1	B1	

Q	Answer	Mark	Comments
20(b)	$\frac{1}{16}$ or 0.0625	B2	B1 correct expression including at least one of changes 64 to 2^6 shows that the negative index means the reciprocal shows that index $\frac{1}{3}$ means cube root splits the index into the multiplication of two indices

Q	Answer	Mark	Comments
21	Smallest 15.5 2^4 $4\sqrt{18}$ Largest $\frac{55}{3}$	B2	B1 three values in correct order if the other value were removed eg Smallest 15.5 2^4 $4\sqrt{18}$ Largest $\frac{55}{3}$
	Additional Guidance		
	Mark the answer only		
	Accept equivalent values used on answer lines		

Q	Answer	Mark	Comments
22(a)	$y = kx^3$ or $24 = 3^3k$	M1	oe
	$k = 24 \div 3^3$ or $k = 24 \div 27$ or $k = \frac{24}{27}$ or $\frac{8}{9}x^3$	M1dep	oe in the form $k =$
	$y = \frac{8}{9}x^3$ or $y = 0.888\ldots x^3$	A1	oe equation eg $27y = 24x^3$ SC2 $y = \frac{24}{3^3}x^3$ or $y = \frac{24}{27} \times 3^3$
	Additional Guidance		
	Allow the proportion sign instead of = for M1 only		

Q	Answer	Mark	Comments
22(b)	× 2	B1	

Q	Answer	Mark	Comments
23	**Alternative method 1: works out the value of x using two different methods and shows they are different**		
	Any one of $6x + 95 = 180$ or $4x + 30 + x + 62 = 180$ or $5x + 92 = 180$ or $6x + x + 62 + 4x + 30 + 95 = 360$ or $11x + 173 = 360$	M1	oe
	$(x =)\ 14\frac{1}{6}$ with M1 seen or $(x =)$ 17.6 with M1 seen or $(x =)$ 17 with M1 seen	A1	must be correct value for corresponding equation
	A different one of $6x + 95 = 180$ or $4x + 30 + x + 62 = 180$ or $5x + 92 = 180$ or $6x + x + 62 + 4x + 30 + 95 = 360$ or $11x + 173 = 360$	M1	oe
	Any two of $(x =)\ 14\frac{1}{6}$ with M1 seen or $(x =)$ 17.6 with M1 seen or $(x =)$ 17 with M1 seen and should be equal	A1	must be correct values for corresponding equations oe statement

Mark scheme and Additional Guidance continue on the next page

Q	Answer	Mark	Comments
23 cont	**Alternative method 2: uses angle sum of quadrilateral to work out x and then shows opposite angles do not sum to 180°**		
	$6x + x + 62 + 4x + 30 + 95 = 360$ or $11x + 173 = 360$	M1	oe
	$(x =)$ 17 with M1 seen	A1	
	6 × their 17 + 95 or 4 × their 17 + 30 + their 17 + 62	M1dep	oe
	6 × their 17 + 95 = 197 and should be 180 or 4 × their 17 + 30 + their 17 + 62 = 177 and should be 180	A1	oe oe statement oe oe statement
	Alternative method 3: uses angle sum of $6x$ and 95° to work out x and then shows other angles do not sum to 180° or all angles do not sum to 360°		
	$6x + 95 = 180$	M1	oe
	$(x =)$ $14\frac{1}{6}$ with M1 seen	A1	
	4 × their $14\frac{1}{6}$ + 30 + their $14\frac{1}{6}$ + 62 or 4 × their $14\frac{1}{6}$ + 30 + 6 × their $14\frac{1}{6}$ + 95 + their $14\frac{1}{6}$ + 62	M1dep	oe
	4 × their $14\frac{1}{6}$ + 30 + their $14\frac{1}{6}$ + 62 = $162\frac{5}{6}$ and should be 180 or 4 × their $14\frac{1}{6}$ + 30 + 6 × their $14\frac{1}{6}$ + 95 + their $14\frac{1}{6}$ + 62 = $342\frac{5}{6}$ and should be 360	A1	oe oe statement oe oe statement

Mark scheme and Additional Guidance continue on the next page

Q	Answer	Mark	Comments
23 cont	**Alternative method 4: uses angle sum of $4x + 30$ and $x + 62°$ to work out x and then shows other angles do not sum to 180° or all angles do not sum to 360°**		
	$4x + 30 + x + 62 = 180$ or $5x + 92 = 180$	M1	oe
	$(x =)$ 17.6 with M1 seen	A1	
	6 × their 17.6 + 95 or 4 × their 17.6 + 30 + their 17.6 + 62 + 6 × their 17.6 + 95	M1dep	oe
	6 × 17.6 + 95 = 200.6 and should be 180 or 4 × 17.6 + 30 + 17.6 + 62 + 6 × 17.6 + 95 = 380.6 and should be 360	A1	oe oe statement oe oe statement
	Additional Guidance		
	Alts 1 and 2 x = 17 with M1 not seen		Zero
	Alts 1 and 3 $x = 14\frac{1}{6}$ with M1 not seen		Zero
	Alts 1 and 4 x = 17.6 with M1 not seen		Zero

Q	Answer	Mark	Comments
24	sin x > 0 and cos x > 0	B1	

Q	Answer	Mark	Comments
25	5×2 or 10 or 10×3 or 30 or 5×4 or 20	M1	oe may be written on bars
	$84 - 5 \times 2 - 10 \times 3 - 5 \times 4$ or $84 - 10 - 30 - 20$ or 24	M1dep	oe bar of area 24 implies M2
	their $24 \div 10$ or 2.4	M1dep	implied by correct bar for their 24
	Bar drawn from 190, width 10 and height 2.4	A1	
	Additional Guidance		
	Bar from 190 to 195 with height 4.8		M1M1M0A0

Q	Answer	Mark	Comments
26(a)	$\frac{33}{\sqrt{11}} \times \frac{\sqrt{11}}{\sqrt{11}}$ or $\frac{33\sqrt{11}}{11}$	M1	
	$3\sqrt{11}$	A1	do not award if further work eg $\sqrt{33}$
	Additional Guidance		
	Correct answer with no working		M1A1

Q	Answer	Mark	Comments
26(b)	270	B3	B2 any correct single value of the form $a\sqrt{b}$ where $a \geqslant 3$ eg $27\sqrt{100}$ or $9\sqrt{900}$ or $3\sqrt{8100}$ or correct product of two or more integers eg 27×10 or 9×30 or 6×45 B1 $(\sqrt{27} =) 3\sqrt{3}$ or correct product of two surds eg $3\sqrt{300} \times \sqrt{27}$ or $3\sqrt{270} \times \sqrt{30}$ or $3\sqrt{10} \times \sqrt{810}$ or $\sqrt{90} \times \sqrt{30} \times \sqrt{27}$ or $3\sqrt{10 \times 30 \times 27}$ or $\sqrt{90 \times 30 \times 27}$ or $3\sqrt{2 \times 5 \times 2 \times 3 \times 5 \times 3 \times 3 \times 3}$ or $\sqrt{2^2 \times 5^2 \times 3^6}$ or $\sqrt{72900}$
	Additional Guidance		
	$\sqrt{30} \times 3\sqrt{3} \times 3\sqrt{10}$		B1
	$\sqrt{30} \times 3\sqrt{3} \times \sqrt{90}$		B1

Q	Answer	Mark	Comments
27	16 : 9	B1	oe ratio
	4 : 3	B1	oe ratio allow $\sqrt{16}$: $\sqrt{9}$
	Additional Guidance		
	9 : 16		B0
	3 : 4		B0
	Answers transposed		B0B0

Q	Answer	Mark	Comments
28	$9(5+x)(5-x)$ or $-9(x+5)(x-5)$	B2	oe with full factorisation B1 $(15+3x)(15-3x)$ or $3(5+x)(15-3x)$ or $(15+3x)3(5-x)$ or $3(5+x)3(5-x)$ or $9(25-x^2)$ oe
	Additional Guidance		
	$3(75-3x^2)$		B0
	Condone multiplication signs for B1 or B2 eg1 $9\times(5+x)\times(5-x)$ eg2 $(15+3x)\times(15-3x)$ eg3 $(15+3\times x)\times(15-x\times 3)$		B2 B1 B1
	Condone missing final bracket eg1 $9(5+x)(5-x$ eg2 $(15+3x)(15-3x$		B2 B1
	Do not allow $x2$ for $2x$		
	Ignore attempts to solve $225-9x^2=0$		

Q	Answer	Mark	Comments
29	$(x + 3)^3$	B1	$(x - 3)^3$ is B0
	$x^2 + 3x + 3x + 9$ with 3 terms correct or $x^2 + 6x + k$ where k is a non-zero constant	M1	ft $(x - 3)^3$ only
	$x^3 + 3x^2 + 3x^2 + 9x + 3x^2 + 9x + 9x + 27$ (– 6) or $x^3 + 9x^2 + 27x + 27$ (– 6)	M1dep	oe full expansion of their 4 terms by $(x + 3)$ with at least 4 terms correct or full expansion of their 3 terms by $(x + 3)$ with at least 3 terms correct ft $(x - 3)^3$ only
	$x^3 + 9x^2 + 27x + 21$	A1	
	Additional Guidance		
	Using $(x - 3)^3$ can score a maximum of B0M1M1A0 $x^2 - 3x - 3x + 9$ with 3 terms correct or $x^2 - 6x + k$ where k is a non-zero constant		B0M1
	$x^3 - 6x^2 + 18x - 3x^2 + 9x - 27$ (– 6) or $x^3 - 9x^2 + 27x - 27$ or $x^3 - 9x^2 + 27x + 33$		B0M1M1A0