GCSE MATHEMATICS 8300/2H

Higher Tier Paper 2 Calculator

Mark scheme

November 2024

Version: 1.0 Final

24BG8300/2H/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.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

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(a)	diameter	B1	

Q	Answer	Mark	Comments
1(b)	segment	B1	

Q	Answer	Mark	Comments
1(c)	tangent or circumference or arc	B1	

Q	Answer	Mark	Comments
2	Any two of 16 × 5 or 80 22 × 15 or 330 13 × 25 or 325 9 × 35 or 315	M1	implied by 1050
	(their 80 + their 330 + their 325 + their 315) ÷ 60	M1dep	oe must be sum of four numbers condone missing final bracket
	17.5 or $\frac{1050}{60}$	A1	oe value eg $17\frac{1}{2}$
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Ignore simplification or conversion attempt after correct answer seen		
	Answer 17 or 18 with 17.5 seen		M2A1
	17.5 in working with $10 < v \leqslant 20$ on answer line		M2A0
	17.5 then answer doubled		M2A0

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="8">3</td><td>4 squares shaded so that the grid has exactly two lines of symmetry</td><td>B2</td><td>B1 4 squares shaded so that the grid has four lines of symmetry
or
even number of squares shaded so that the grid has exactly two lines of symmetry</td></tr>
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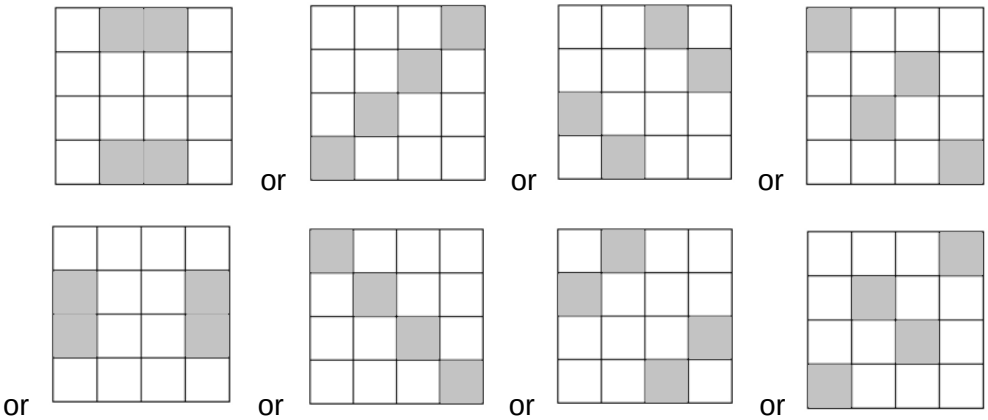
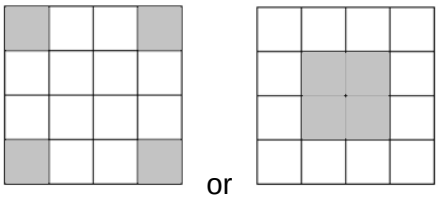
<tr><td colspan="2"> 
or or or
or or or or</td><td>B2</td></tr>
<tr><td colspan="2"> 
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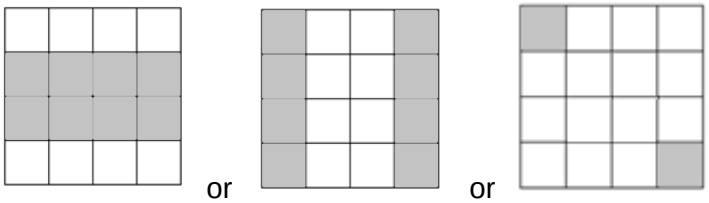
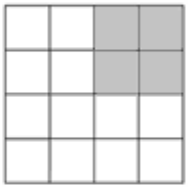
<tr><td colspan="2"> 
or or</td><td>B1</td></tr>
<tr><td colspan="2">  </td><td>B0</td></tr>
<tr><td colspan="2">Mark intention</td><td></td></tr>
<tr><td colspan="2">Part squares shaded</td><td>B0</td></tr>
</table>

Q	Answer	Mark	Comments
4	**Alternative method 1**		
	7 × 4000 ÷ 100 or 280	M2	oe M1 7 × 4000 or 28000 or 7 ÷ 100 or 0.07 or 4000 ÷ 100 or 40
	280 and No	A1	oe eg 20 less and No
	Alternative method 2		
	300 × 100 ÷ 4000 or 7.5	M2	oe M1 300 × 100 or 30000 or 300 ÷ 4000 or 0.075 or 100 ÷ 4000 or 0.025
	7.5 and No	A1	
	Alternative method 3		
	300 × 100 ÷ 7 or 4285(.7...) or 4286	M2	oe M1 300 × 100 or 30000 or 300 ÷ 7 or [42.8, 42.9] or 100 ÷ 7 or [14.2, 14.3]
	[4200, 4300] and No with M2 seen	A1	

Mark scheme and Additional Guidance continue on the next page

4 cont	**Alternative method 4**		
	7 × 4000 or 28000	M1	oe
	300 × 100 or 30000	M1	oe
	28000 and 30000 and No	A1	
	Alternative method 5		
	300 ÷ 4000 or 0.075	M1	oe
	7 ÷ 100 or 0.07	M1	oe
	0.075 and 0.07 and No	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	No may be indicated by selecting the box or a statement in the working lines		
	No cannot be implied only by an inequality		
	A correct value is sufficient to show working eg 280 and No (except in alt 3)		M2A1
	20 less in alt 1 implies M2		

Q	Answer	Mark	Comments
5	X is directly proportional to $\frac{1}{Y}$	B1	

Q	Answer	Mark	Comments
6	**Alternative method 1**		
	$1.7^2 - 1.5^2 = 0.64$ and $\sqrt{0.64} = 0.8$ **or** $2.89 - 2.25 = 0.64$ and $\sqrt{0.64} = 0.8$	B2	accept $0.8^2 = 0.64$ for $\sqrt{0.64} = 0.8$ accept $\sqrt{1.7^2 - 1.5^2} = 0.8$ for B2 accept $1.7^2 - 1.5^2 = 0.8^2$ for B2 B1 1.7^2 and 1.5^2 oe
	Alternative method 2		
	$1.7^2 - 0.8^2 = 2.25$ and $\sqrt{2.25} = 1.5$ **or** $2.89 - 0.64 = 2.25$ and $\sqrt{2.25} = 1.5$	B2	accept $1.5^2 = 2.25$ for $\sqrt{2.25} = 1.5$ accept $\sqrt{1.7^2 - 0.8^2} = 1.5$ for B2 accept $1.7^2 - 0.8^2 = 1.5^2$ for B2 B1 1.7^2 and 0.8^2 oe
	Alternative method 3		
	$0.8^2 + 1.5^2 = 2.89$ and $\sqrt{2.89} = 1.7$ **or** $0.64 + 2.25 = 2.89$ and $\sqrt{2.89} = 1.7$	B2	accept $1.7^2 = 2.89$ for $\sqrt{2.89} = 1.7$ accept $\sqrt{0.8^2 + 1.5^2} = 1.7$ for B2 accept $0.8^2 + 1.5^2 = 1.7^2$ for B2 B1 0.8^2 and 1.5^2 oe
	Additional Guidance		
	B1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	$1.7^2 - 1.5^2 = 0.64$ $x^2 = 0.64$ $x = 0.8$		B2
	Max B1 if any incorrect statement seen eg $1.7^2 - 1.5^2 = \sqrt{0.64} = 0.8$		B1
	Accept 1.7×1.7 for 1.7^2 etc		
	Condone eg $1.5\,\text{cm}^2$ and $1.7\,\text{cm}^2$ for 1.5^2 and 1.7^2 for B1 but must be recovered for B2		
	$0.64 \div 0.8 = 0.8$ is equivalent to $\sqrt{0.64} = 0.8$		

Q	Answer	Mark	Comments
7(a)	125 × 0.32 or 40 or 80 × 0.35 or 28	M1	oe
	12	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	80 × 0.5 = 40		M0

Q	Answer	Mark	Comments
7(b)	No and valid reason involving the number of trials	B1	eg reasons she didn't do the most she did fewer spins Beth did more they should use all 205 spins
	Additional Guidance		
	Ignore irrelevant or incorrect statements alongside a correct statement as long as not contradictory		
	eg1 No and Beth did most but she could have done more		B1
	eg2 No and Beth has more number of spins so there is a higher probability of landing on heads		B1
	eg3 No and Beth did most spins but Lynn did more		B0
	Allow 'she' to refer to Lynn unless clearly referring to Beth eg No and Because she tried 125 times however Lynn tried only 80 times		B1
	No and She did not do as many spins so her answer is less accurate than Beth's		B1
	No and Beth spun the wheel more times. Therefore her probability would be lower		B1
	No and Beth spun more times so her final outcome will be higher		B1
	No and Beth did 125 spins and Lynn did 80 spins		B0
	No and Beth did 125 spins so she has more chance of being accurate		B0

Q	Answer	Mark	Comments
8	digits 537 ÷ digits 895 or answer with only digit 6	M1	eg 537 ÷ 895 or 537 ÷ 895 000 or 537 ÷ 0.895 or 0.006 or 6000
	0.6 or $\frac{3}{5}$	A1	oe value eg $\frac{537}{895}$
	Additional Guidance		
	Ignore simplification or conversion attempt after correct answer seen		
	Condone eg 537 ÷ $895\,000^3$ for M1 but must be recovered for A1		

Q	Answer	Mark	Comments
9	8.5 m ⩽ length < 9.5 m	B2	oe B1 8.5 or 9.5 in correct position SC1 9.5 m ⩽ length < 8.5 m
	Additional Guidance		
	Accept 9.4$\dot{9}$ for 9.5		
	Accept eg 8.50 for 8.5		

Q	Answer	Mark	Comments
10	1 + 0.2 or 1.2 or 100(%) + 20(%) or 120(%)	M1	oe eg $x + 0.2x$ implied by eg 20% = 64 000 or 10% = 32 000
	384 000 ÷ 1.2 or 384 000 ÷ 120 (× 100) or 3200 (× 100)	M1dep	oe eg 64 000 × 5 or 32 000 × 10
	320 000	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	460 800 is M0 unless 1.2 oe seen		
	Correct answer followed by further work		M2A0

Q	Answer	Mark	Comments
11	x^3y or yx^3	B1	
	$5xy^3$ or $5y^3x$	B1	
	$5x^2y^2$ or $5y^2x^2$	B1	
	Additional Guidance		
	Mark the answer lines unless blank		
	Do not allow transcription errors		

Q	Answer	Mark	Comments
12	**Alternative method 1**		
	(guitars =) 80 ÷ 2 or 40	M1	oe
	their 40 ÷ (3 + 4 + 1) or 5	M1dep	oe
	3 × their 5	M1dep	oe $\frac{3}{3+4+1}$ × 40 is M3
	15	A1	
	Alternative method 2		
	80 ÷ (3 + 4 + 1) or 10	M1	oe
	3 × their 10 or 30	M1dep	oe
	their 30 ÷ 2	M1dep	oe
	15	A1	
	Alternative method 3		
	(guitars =) 80 ÷ 2 or 40	M1	oe
	$x + \frac{4}{3}x + \frac{1}{3}x$ = their 40	M1dep	oe equation with x as number of keyboards
	$\frac{14}{3}x$ = their 40	M1dep	oe equation in form $ax = b$
	15	A1	
	Additional Guidance		
	Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Other algebraic approaches are possible eg (guitars =) 80 ÷ 2 or 40 M1 $3x + 4x + x$ = their 40 but does not score 2nd M1 until (x =) their 40 ÷ (3 + 4 + 1)		

Q	Answer	Mark	Comments
13	$\tan 38 = \frac{h}{15}$ or $\left(\frac{15}{\cos 38}\right)^2 - 15^2$ or [137.3, 137.342]	M1	oe eg $\tan(90 - 38) = \frac{15}{h}$ or $\frac{\sin 38}{h} = \frac{\sin 52}{15}$ any letter or phrase for h eg opposite
	$15 \times \tan 38$ or $\sqrt{\left(\frac{15}{\cos 38}\right)^2 - 15^2}$ or [11.7, 11.72]	M1dep	oe eg $15 \div \tan(90 - 38)$ or $\frac{15 \sin 38}{\sin 52}$
	$\sin x = \frac{\text{their}\,[11.7, 11.72]}{14}$ or $\sin x$ = [0.835, 0.84]	M1dep	oe eg $\sin x = \frac{\sin 90}{14} \times$ their [11.7, 11.72] implied by $\sin^{-1}$ [0.835, 0.84]
	[56.6, 57.14012]	A1	
	Additional Guidance		
	Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
14	No and valid explanation	B1	eg No and $0.8 \times 0.9 = 0.72$ or No and saves 28% or No and 10% is off a smaller amount
	Additional Guidance		
	A value may be used in an explanation eg $0.9 \times 0.8 \times 200 = 144$ and $0.7 \times 200 = 140$ so No	B1	
	2nd discount is reducing an already reduced price so No	B1	
	10% off reduced price is not 10% off original price and No	B1	
	Cannot just add the percentages as they are of different amounts so No	B1	
	10% of the already reduced price is not 10% on top of the 20% discount	B1	
	No and 30% is too much	B0	
	Incorrect overall percentage saving stated eg No and saves 22%	B0	

Q	Answer	Mark	Comments
15	14	B4	B3 correct equation eg $2x + 5x + 6 + 5x + 6 = 180$ or $5x + 6 = 90 - x$ or $2x + 90 - x + 5x + 6 = 180$ or $5x + 6 = 174 - 7x$ B2 correct expressions for two angles or two different correct expressions for the same angle B1 correct expression for one angle
	Additional Guidance		
	Correct expressions for angles (which may be seen on the diagram) include angle $AQC = 2x$ angle $APQ = 5x + 6$ angle $AQP = 5x + 6$ angle $APQ = \frac{180 - 2x}{2}$ or $90 - x$ angle $AQP = \frac{180 - 2x}{2}$ or $90 - x$ angle $APQ = 180 - 2x - (5x + 6)$ or $174 - 7x$ angle $AQP = 180 - 2x - (5x + 6)$ or $174 - 7x$ angle $QPB = 180 - (5x + 6)$ or $174 - 5x$ angle $ZPB = 5x + 6$ (Z is the end of line QP produced) angle $ZPA = 180 - (5x + 6)$ or $174 - 5x$ (Z is the end of line QP produced)		
	B2 may be awarded for the same expression for two different angles eg angle $APQ = 5x + 6$ and angle $AQP = 5x + 6$		B2
	Accept eg AQP for angle AQP		
	Do not accept eg (angle) P for angle APQ unless shown on the diagram		
	Ignore reasons		

Q	Answer	Mark	Comments
16	$x^2 + 2x – 5x – 10$ or $x^2 – 3x – 10$	M1	oe quadratic expression 4 terms with at least 3 correct (terms may be seen in a grid) implied by $x^2 – 3x + k$
	their $(x^2 + 2x – 5x – 10) – 6x$ (= 0) or their $(x^2 – 3x – 10) – 6x$ (= 0) or $x^2 – 9x – 10$ (= 0)	M1dep	accept eg $–x^2 + 9x + 10$ (= 0) accept oe equations in the form $px^2 + qx = r$ eg $x^2 – 9x = 10$
	$(x + 1)(x – 10)$ (= 0) or $\frac{--9 \pm \sqrt{(-9)^2 - 4 \times 1 \times -10}}{2 \times 1}$ or $\frac{9 \pm 11}{2}$	M1	oe ft their 3-term quadratic which cannot be $x^2 – 3x – 10$
	–1 and 10	A1	must have both solutions
	Additional Guidance		
	–1 and 10 without working		M3A1
	In the quadratic formula 9^2 is equivalent to $(–9)^2$ but do not accept $–9^2$ unless recovered		
	$x^2 – 3x – 10 = 6x$ $x^2 + 3x – 10 = 0$ $(x + 5)(x – 2) = 0$		M1 M0dep M1
	If first M1 is awarded for 4 terms that are incorrectly simplified to 3 terms, the 2nd M1 can be awarded using the incorrect simplification eg $x^2 + 2x – 5x – 10 = x^2 – 7x – 10$ $x^2 – 7x – 10 – 6x$ (= 0)		M1 M1dep

Q	Answer	Mark	Comments
17	(gradient *LM* =) 4 or (gradient *ST* =) $-\frac{1}{4}$	M1	oe do not allow inclusion of x unless recovered
	Yes and valid reason	A1	valid reasons include $-\frac{1}{4}$ is the negative reciprocal of 4 $-\frac{1}{4} \times 4 = -1$ $-1 \div (-\frac{1}{4}) = 4$

Q	Answer	Mark	Comments
18(a)	2 11 37 82 100	B1	may be implied by plots
	Correct cf diagram with points joined with a smooth curve or lines	B2ft	$\pm\frac{1}{2}$ small square ft their cf values which must be increasing for B2 or B1 B1ft cf diagram with all points plotted at their heights but not at correct horizontal positions or cf diagram with all points plotted at correct horizontal positions with at least 4 of their heights correct or all points plotted correctly at their heights but cf diagram not drawn or drawn poorly
	Additional Guidance		
	Ignore diagram to the left of their (40, 2)		
	For B2ft the diagram must end at (200, their 100) unless followed by a horizontal line		
	Histogram only		Max B1B0
	Histogram and cf diagram		Mark the cf diagram

Q	Answer	Mark	Comments
18(b)	Correct median for their cumulative frequency diagram	B1ft	ft their diagram which must be increasing $\pm\frac{1}{2}$ small square
	Correct comparison of their type P median with 126	B1ft	answers must be in context eg P lasts longer or P is better
	Correct interquartile range for their cumulative frequency diagram	B1ft	ft their diagram which must be increasing $\pm\frac{1}{2}$ small square
	Correct comparison of their type P interquartile range with 57	B1ft	answers must be in context eg P is more consistent or P is more reliable or Q is more varied

Additional Guidance	
2nd and 4th marks - ignore irrelevant or incorrect statements alongside a correct statement as long as not contradictory eg (P median = 132) P lasts longer by 8 (error) minutes	2nd B1
P's average is bigger	2nd B0
P's median is greater	2nd B0
P's spread is smaller	4th B0
P's IQR is lower	4th B0
Q is more spread out	4th B0
2nd and 4th marks can be awarded even if their diagram is not increasing	
2nd and 4th marks can be awarded even if the methods used for P's median and IQR are incorrect	

Q	Answer	Mark	Comments
19	**Alternative method 1 : starts by working out area of phone screen**		
	15 ÷ 6 or 2.5 or 6 ÷ 15 or 0.4 or 420 ÷ 15 or 28	M1	oe
	$420 \div (15 \div 6)^2$ or $420 \times (6 \div 15)^2$ or $420 \div 15 \times (6 \div 15) \times 6$ or 67.2	M1dep	oe
	their 67.2 × $\frac{7000}{100^2}$	M2dep	oe M1dep their 67.2 ÷ 100^2 or 0.00672 or their 67.2 × 7000 or 470 400 M1 $\frac{7000}{100^2}$ or 0.7
	47(.04)	A1	SC3 digits 4704

Mark scheme and Additional Guidance continue on the next page

Q19 cont	**Alternative method 2 : starts by working out cost of tablet screen**		
	$420 \times \frac{7000}{100^2}$ or 294	M2	oe M1 $420 \div 100^2$ or 0.042 or 420×7000 or 2 940 000 or $\frac{7000}{100^2}$ or 0.7
	15 ÷ 6 or 2.5 or 6 ÷ 15 or 0.4	M1	oe
	their 294 ÷ $(15 \div 6)^2$ or their 294 × $(6 \div 15)^2$	M1dep	oe dep on M3
	47(.04)	A1	SC3 digits 4704
	Additional Guidance		
	Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
20	$8 = \frac{24}{u_1} + 4$	M1	oe eg $4 = \frac{24}{u_1}$ accept u_1 replaced by a different variable eg x
	$u_1 = 6$	A1	do not accept $x = 6$ in working with nothing on answer line for u_1
	$u_3 = 7$	B1	SC1 $u_1 = 7$ and $u_3 = 7\frac{3}{7}$ or $\frac{52}{7}$ or [7.4, 7.43] **or** $u_1 = 7$ and $u_3 = 7\frac{3}{13}$ or $\frac{94}{13}$ or [7.2, 7.231]
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Embedded u_1 eg $8 = \frac{24}{6} + 4$		M1

Q	Answer	Mark	Comments
21(a)	Draws a tangent at 2 seconds and [1.5, 2.5]	B2	B1 draws tangent at 2 seconds

Q	Answer	Mark	Comments
21(b)	[88, 95]	B3	B2 (area under curve =) [16, 22] **or** (area under horizontal =) 48 and (area under diagonal =) 24 implied by 72 B1 (area under horizontal =) 48 or (area under diagonal =) 24
	Additional Guidance		
	For B2 and B1 areas may be seen on the diagram		

Q	Answer	Mark	Comments
21(c)	Underestimate and valid reason involving area under the graph	B1ft	ft their area in (b)

Q	Answer	Mark	Comments
22	$(n-15)^2$	M1	
	$(n-15)^2 - 15^2 + 236$ or $(n-15)^2 - 225 + 236$ or $(n-15)^2 + 11$	M1dep	may be embedded in or implied by an inequality or equation eg $(n-15)^2 - 15^2 + 236 = 10$ $(n-15)^2 - 15^2 + 236 > 10$ $(n-15)^2 > -1$
	Valid explanation with M1 seen	A1	eg M1 seen and all the terms must be 11 or more or $(n-15)^2 \geqslant 0$ and 11 is added
	Additional Guidance		
	Condone a different letter used eg x		
	M2 and all the terms must be greater than 11		M2A0
	M2 and the 15th term is the smallest		M2A0
	Least term is 11 with no working for completing the square		M0
	M2 and squaring a bracket always has two digits then adding 11 means it has at least two digits		M2A0
	$(n-15)(n-15)$ is equivalent to $(n-15)^2$		
	$(n-15n)^2$		M0
	Ignore incorrect work after M2 eg $(n-15)^2 + 11 = 0$		M2
	Condone $(n-15)^2$ is positive and 11 is added		M2A1

Q	Answer	Mark	Comments
23(a)	**Alternative method 1**		
	angle *ACB* = 53	M1	may be seen on diagram
	106	A1	
	Alternative method 2		
	angle *OAB* = 90 – 53 or 37 or angle *OBA* = 90 – 53 or 37	M1	may be seen on diagram
	106	A1	
	Additional Guidance		
	Accept eg *ACB* for angle *ACB*		
	Accept (angle) *C* for angle *ACB*		
	Do not accept eg (angle) *A* for angle *OAB* unless shown on the diagram		
	Ignore reasons		

Q	Answer	Mark	Comments
23(b)	g = 180 – 63 or 117	M1	may be seen on diagram
	f = their 117 ÷ 3 × 2 or 78	M1dep	oe may be seen on diagram
	h = 180 – their 78 or 102	M1dep	may be seen on diagram equivalent ratios to 13 : 17 implies M3
	13 : 17	A1	accept 1 : $\frac{17}{13}$ or $\frac{13}{17}$: 1
	Additional Guidance		
	Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Ignore reasons		

Q	Answer	Mark	Comments
24	Response showing that *GD* bisects angle *ADF* and all reasons	B4	B3 response showing that *GD* bisects angle *ADF* B2 correct expressions for two angles in terms of x (angles must be above *AD*) or two correct statements about a pair of angles (angles must be above *AD*) B1 correct expression for one angle in terms of x (angle must be above *AD*) or one correct statement about a pair of angles (angles must be above *AD*)

Additional Guidance is on the next page

	Additional Guidance	
24 cont	Correct expressions for angles (which may be seen on the diagram) include angle *DAG* = x angle *ADF* = $180 - x$ angle *ADG* = $\frac{180 - x}{2}$ or $90 - \frac{x}{2}$ angle *AGD* = $\frac{180 - x}{2}$ or $90 - \frac{x}{2}$ angle *GDF* = $180 - x - \frac{180 - x}{2}$ or $\frac{180 - x}{2}$ or $90 - \frac{x}{2}$ angle *DGF* = $\frac{x}{2}$	
	Expressions must be explicit eg do not accept angle *ADF* + x = 180 unless recovered	
	Correct statements about a pair of angles include angle *AGD* = angle *GDF* angle *AGD* = angle *ADG* angle *ADG* = angle *GDF* angle *AGD* = 90 – angle *DGF* angle *GDF* = 90 – angle *DGF*	
	Accept eg angle *AGD* and angle *ADG* both labelled y as a correct statement about a pair of angles	
	Accept eg *DAG* for angle *DAG*	
	Do not accept a single upper case letter for an angle unless shown on the diagram	
	For up to B2 allow assumption that *GD* bisects angle *ADF*	
	Reasons needed will depend on the approach used and will include some of alternate angles (are equal) (base) angles of isosceles triangle (are equal) angles in rectangle are 90 angles of triangle (add up to 180) (adjacent) angles on a (straight) line (add to 180)	