GCSE MATHEMATICS 8300/3H

Higher Tier Paper 3 Calculator

Mark scheme

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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

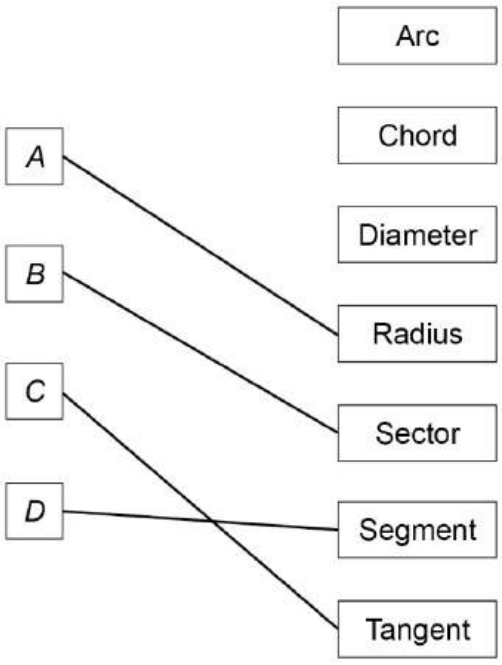
Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

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	8.25 ÷ 2.2	M1	oe
	3.75	A1	oe accept 3.8 if 3.75 seen in working
	Additional Guidance		
	Do not ignore further working after 3.75 seen		
	3750g		M1A0
	2.2 × 3.75 = 8.25 embedded answer		M1A0

Q	Answer	Mark	Comments
2	23(°C)	B1	

Q	Answer	Mark	Comments
3	B is Sector C is Tangent D is Segment	B3	B1 each correct match
	Additional Guidance		
			B3
	Two lines from a left-hand box is choice		

Q	Answer	Mark	Comments
4	$6x - 8 = 2x + 12$	M1	oe equation in terms of x any letter
	$6x - 2x = 12 + 8$ or $-8 - 12 = 2x - 6x$ or $4x = 20$ or $(x =)\ 5$	M1dep	oe collection of terms eg $4x - 20 = 0$
	6 × their 5 – 8 or 2 × their 5 + 12 or 22	M1dep	a combination of sides may be used eg 14 × 5 – 4 or 10 × 5 + 16
	66	A1	
	Additional Guidance		
	5 or 22 may be shown on diagram		
	Trial and improvement with 22 selected as length of side		M3
	Trial and improvement with 5 selected as value of x		M2
	$8x + 4 = 180$ and $x = 22$		M0

Q	Answer	Mark	Comments
5	**Alternative method 1: proportion using angles**		
	$\frac{132}{180}$ or [0.73, $0.7\dot{3}$] or $\frac{132}{360}$ or [0.36, 0.37] or $\frac{48}{180}$ or [0.26, 0.27] or $\frac{48}{360}$ or [0.13, $0.1\dot{3}$] or 132 : 48 or 11 : 4	M1	oe fraction or percentage oe either order
	or $\frac{132}{180} \times 30$ or $\frac{48}{180} \times 30$ or 8 or 22 : 8 or 8 : 22 (not oe)	M1dep	oe eg [0.73, $0.7\dot{3}$] × 30 $\frac{132}{360} \times 30 \times 2$ or $\frac{48}{360} \times 30 \times 2$ is M2
	22	A1	SC1 11
	Alternative method 2: using the number of degrees per match		
	(360 – 132 – 48) ÷ 30 or 180 ÷ 30 or 360 ÷ (30 × 2) or 6	M1	oe
	132 ÷ their 6 or 48 ÷ their 6 or 8	M1dep	oe $\frac{132}{360 \div (30 \times 2)}$ or $\frac{48}{360 \div (30 \times 2)}$ is M2
	22	A1	SC1 11

The mark scheme for Question 5 continues on the next page

Q	Answer	Mark	Comments
5 cont	**Alternative method 3: using the number of matches per degree**		
	$\frac{30}{180}$ or $\frac{30\times2}{360}$ or [0.16, 0.17]	M1	oe fraction or percentage eg $\frac{1}{6}$
	or $\frac{30}{180} \times 132$ or $\frac{30}{180} \times 48$ or 8	M1dep	oe eg [0.16, 0.17] × 132
	22	A1	SC1 11
	Additional Guidance		
	SC1 is for using 30 matches in total		
	0.17 × 132 = 22.44 with answer 22		M1M1A0
	30 ÷ 2 = 15 and 15 ÷ 2 = 7.5 and 15 + 7.5 = 22.5 with answer 22		M1M1A1
	30 ÷ 2 = 15 and 15 ÷ 2 = 7.5 and 15 + 7.5 = 22.5		M0
	30 ÷ 2 = 15 and 15 ÷ 2 = 7.5 and 7.5 → 8		M1M1
	360 ÷ 30 = 12		M0

Q	Answer	Mark	Comments
6(a)	[5.3, 5.7]	B1	oe eg 5 and a half may be seen on diagram
	$\frac{\text{their } [5.3, 5.7] \times 200\,000}{100 \times 1000}$	M2	oe M1 correct step using one operator eg1 their [5.3, 5.7] × 200 000 eg2 their [5.3, 5.7] ÷ 100 eg3 200 000 ÷ 1000 eg4 100 × 1000 their [5.3, 5.7] < 10 [1 060 000, 1 140 000] implies B1M1
	[10.6, 11.4]	A1	implies B1
	Additional Guidance		
	Answer 10.8 without [5.3, 5.7]		B1M2A1

Q	Answer	Mark	Comments
6(b)	135(°)	B1	

Q	Answer	Mark	Comments
7(a)	$\frac{7}{4}$	B1	
	Additional Guidance		
	Do not accept $1\frac{3}{4}$ or 1.75		B0

Q	Answer	Mark	Comments
7(b)	4.875 or $\frac{39}{8}$ or $4\frac{7}{8}$	B1	oe decimal, fraction or mixed number eg $\frac{273}{56}$ accept 4.88 or 4.9 if 4.875 seen in working
	Additional Guidance		
	$\frac{2.73}{0.56}$		B0
	Units included		B0

Q	Answer	Mark	Comments
7(c)	$\left(\frac{1}{5}=\right)\frac{2}{10}$ or $\left(\frac{7}{10}=\right)\frac{3.5}{5}$ or $\frac{1/5}{7/10}$ or $\frac{1}{5}\times\frac{10}{7}$ or $\frac{0.2}{0.7}$ or 2 : 7	M1	oe both fractions with a common denominator oe ratio
	$\frac{2}{7}$	A1	oe fraction condone (A =) $\frac{2}{7}$B SC1 $\frac{7}{2}$
	Additional Guidance		
	0.2 : 0.7 with answer $\frac{2}{7}$		M1A1
	0.2 : 0.7		M0
	$\frac{1}{3.5}$		M1

Q	Answer	Mark	Comments
8	$(18-6)\div 3$ or 4	M1	oe implied by 10 and 14
	$4n-2$	A2	oe A1 for $4n+c$ oe
	Additional Guidance		
	Condone use of N or other variables		
	Condone $n=4n-2$		M1A2
	$4n+-2$		M1A1
	$4n$ may be seen as $4\times n$ or $n\times 4$ or $n4$ for M1A1 but not M1A2		
	$n+4$		M1A0

Q	Answer	Mark	Comments
9	**Alternative method 1: works with the amount first**		
	280 ÷ 2 × 3 or 420	M1	oe
	their 420 ÷ 12 × 5	M1dep	oe eg 35 × 5 their 420 cannot be 280
	175	A1	SC2 77.77 or 77.78
	Alternative method 2: works with the ratio first		
	$\frac{2}{3}\times 12$ or 8	M1	oe may be embedded in a ratio
	280 ÷ their 8 × 5	M1dep	oe eg 35 × 5
	175	A1	SC2 77.77 or 77.78
	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		
	SC2 is for using $\frac{2}{3}$ of Cat's amount		
	5 : 12 : 8 in any order		M1

Q	Answer	Mark	Comments
10	$2 \times (30 + 20)$ or 100 or $20 + 30 - 6$ or $50 - 6$ or $x + 6 = 50$	M1	oe oe equation
	44	A1	may be seen in correct position on diagram
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
11(a)	$y = 2x + c$ or $y - 2x = c$	B1	oe $c \neq 9$
	Additional Guidance		
	Answer $y = 2x + c$ or $y - 2x = c$ (any letter for c)		B0
	$y - 2x + 1 = 9$		B1
	$y - 2x + 1 = 10$		B0

Q	Answer	Mark	Comments
11(b)	$y = 5x - 8$	B1	

Q	Answer	Mark	Comments
12	22.5 × 16 or 360 and 27.5 × 32 or 880 and 35 × 24 or 840 and 50 × 8 or 400 or 2480	M1	allow one incorrect midpoint
	(their 360 + their 880 + their 840 + their 400) ÷ 80 or 2480 ÷ 80 or 31	M1	condone bracket error seen eg 360 + 880 + 840 + 400 ÷ 80 their values must come from 'midpoints' within or on class bounds multiplied by correct frequencies
	(their 31 – 25) ÷ 25 (× 100) or 6 ÷ 25 (× 100) or 0.24 (× 100) or their 31 ÷ 25 (× 100) or 1.24 (× 100) or 124	M1	their 31 must be > 25
	24	A1	
	Additional Guidance		
	20 × 16 + 25 × 32 + 30 × 24 + 40 × 8 = 2160, 2160 ÷ 80 = 27, 2 ÷ 25 × 100 = 8		M0M1M1A0
	2480 ÷ 4 = 620, 620 – 25 = 595, 595 ÷ 25 × 100 = 2380		M1M0M1A0
	2160 ÷ 80 = 27, 2 ÷ 25 × 100 = 8		M0M0M1A0
	16 + 32 + 24 + 8 = 80, 80 ÷ 4 = 20 cannot score, as 20 < 25		M0M0M0A0

Q	Answer	Mark	Comments
13(a)	80, 85, 87, 90	B1	may be implied by correct graph

Q	Answer	Mark	Comments
13(b)	Six points plotted using upper class bounds and their cf values	B1ft	$\pm \frac{1}{2}$ square ft their cf values from **part (a)**, which must be increasing may be implied by correct graph
	Polygon or smooth curve through (20 000, 44), (40 000, 66), (60 000, 80), (80 000, 85), (100 000, 87) and (120 000, 90)	B1	$\pm \frac{1}{2}$ square ignore any bars drawn
	Additional Guidance		
	For B2 the graph must start at (0, 0) or (20 000, 44) and end at (120 000, 90) unless followed by a horizontal line		

Q	Answer	Mark	Comments
13(c)	Vertical line drawn from 32 000 to curve or polygon	M1	$\pm \frac{1}{2}$ square implied by a mark at the correct place on the curve or the vertical axis
	[56, 60] or correct reading for their increasing curve or polygon	A1ft	ft their increasing curve or polygon
	Additional Guidance		
	Do not ignore further working when their increasing curve or polygon is used		
	Value in range on answer line		M1A1

Q	Answer	Mark	Comments	
14(a)	**Alternative method 1: uses the upper bounds**			
	750 or 850 or 187.5 or 192.5 or 162.5 or 163.5	B1	condone 849.99… for 850 condone 192.49… for 192.5 condone 163.49… for 163.5	
	850 and 192.5 and 163.5	B1		
	(800, 900] + (190, 195] + (163, 164]	M1		
	1206 and No	A1	oe 6 kg too heavy and No	
	Alternative method 2: uses other values			
	Correct sum of three possible values that exceeds 1200 and No	B4	possible values must lie between the bounds, on the lower bound or on the upper bound eg 849 + 192 + 163 = 1204 and No	
	Additional Guidance			
	Units not required			
	850 and 195 and 163.5 with answer 1208.5			B1B0M1A0
	900 and 195 and 164 with answer 1259			B0B0M1A0
	There are no part marks for Alt method 2			
	Mark to the Alt method which favours the student eg 849 and 192 and 163.5 with answer 1204.5 and 'No' could score B1B0M1A0 using Alt method 1, but scores B4 using Alt method 2			
	845 + 194 + 163 = 1202 and No does not score using either Alt method			

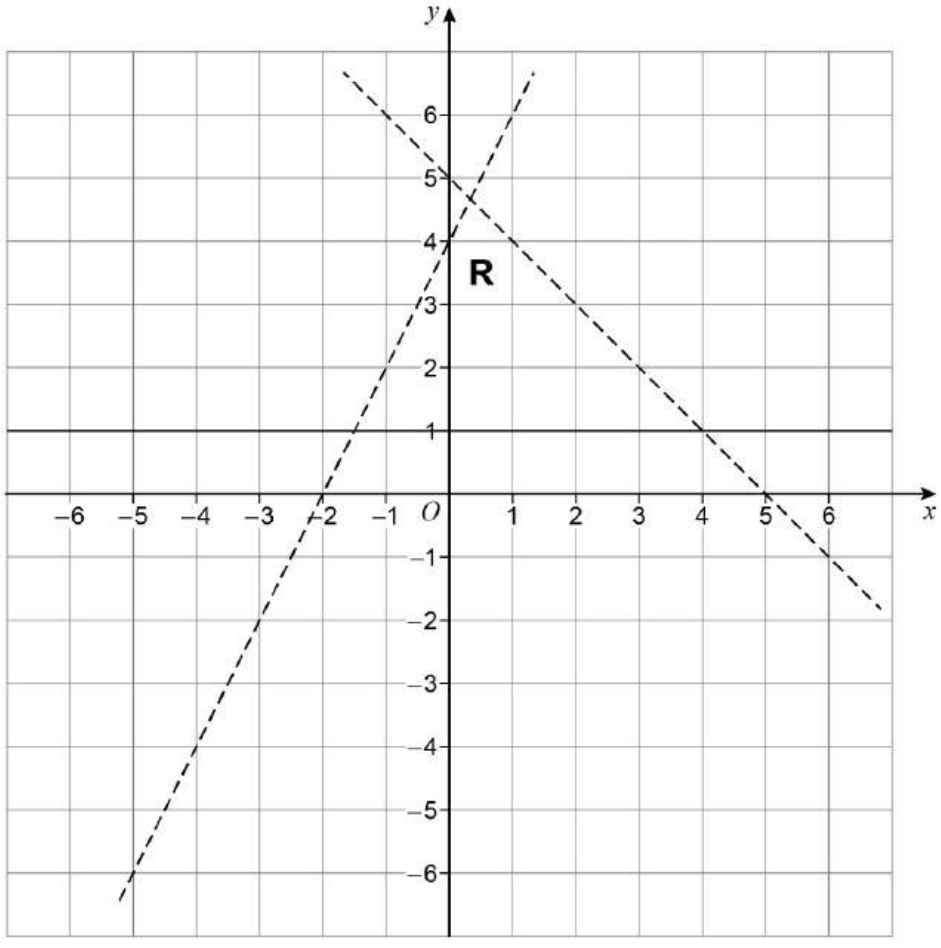
Q	Answer	Mark	Comments
14(b)	(Speed =) 500	B1	implied by 500 as highest point plotted or marked accept 8.33… with correct units miles per minute stated or implied
	Vertical axis labelled 'Speed' with a linear scale to at least their 500 and Horizontal axis labelled 'Time' with a linear scale to at least 2 hours 30 minutes or 150 minutes	B1ft	ft their 500 which must not be 1250 accept their speed as the only value on the vertical axis and 2 hours 30 minutes as the only value on the horizontal axis ignore all units shown on their graph
	Horizontal line from (0, their 500) stopping at (2 hours 30 minutes, their 500) or (150 minutes, their 500)	B1ft	ft their 500 which must not be 1250 ignore any vertical line at 2 hours 30 minutes
	Additional Guidance		
	'Speed' and 'Time' are the only acceptable labels		
	Use of a distance/time graph is a maximum of B1 for 500 seen		
	1250/150 = 8.33… miles per minute and correctly plotted with correct labelling and scales		B1B1ftB1ft
	1250 ÷ 2.3 = 543…, with horizontal line from (0, 543) to (2 hours 30 minutes, 543) with correct labelling and scales		B0B1ftB1ft

Q	Answer	Mark	Comments
15	(Amy) $2 \times 10 \times 5$ with at least one correct or 100	M1	must be product of three integers
	(Becky) $9 \times 10 \times 5$ with at least one correct or 450	M1	must be product of three integers
	350	A1	
	Additional Guidance		
	$2 + 10 + 5$		M0
	Use of fractions, decimals or percentages is M0 unless recovered		

Q	Answer	Mark	Comments
16	When $x = 2$, ($y =$) 24 or when $x = 2$, negative (×) negative (×) positive = positive	B1	oe
	When $x = 4$, ($y =$) -10 or when $x = 4$, positive (×) negative (×) positive = negative	B1	oe
	When $x = 6$, ($y =$) 36 or when $x = 6$, positive (×) positive (×) positive = positive	B1	oe SC1 correct value of y for any positive even value of x greater than 6
	Additional Guidance		
	SC1 should only be considered when the response scores B0B0B0		
	Ignore any other evaluation attempts or written statements alongside correct responses		
	A value of x may be implied by consistent substitution into the equation eg $(2-3)(2-5)(2+6) = 24$ implies $x = 2$		B1
	For any response using negative/positive, $x = 2$ can be implied by stating 'below 4' and $x = 6$ can be implied by stating 'above 4', or equivalent		
	For any response using negative/positive, multiplication must be shown, referred to or implied, and the sign of the result must be stated		

Q	Answer	Mark	Comments
17	$\frac{x}{\sin 119} = \frac{6.3}{\sin 31}$	M1	oe eg $(x =) \frac{6.3 \times \sin 119}{\sin 31}$ or $(x =)$ 12.2(3…) × sin 119
	[10.698, 10.7]	A1	allow 11 with correct equation seen
	Additional Guidance		
	Ignore incorrect notation only if recovered eg $\sin x = \frac{6.3 \times \sin 119}{\sin 31}$ with answer 10.7		M1A1
	10.698 in working, condone 10.6 on answer line for M1A1		

Q	Answer	Mark	Comments
18	$2n^2 + 3n + 1$ **or** $a = 2$ and $b = 3$ and $c = 1$	B3	B2 $2n^2 + 3n\ (+ c)$ or $a = 2$ and $b = 3$ or $2n^2\ (+ bn) + 1$ or $a = 2$ and $c = 1$ B1 $2n^2\ (+ bn + c)$ or $a = 2$ or $an^2\ (+ bn) + 1$ with $a \neq 0$ or $c = 1$ or second difference = 4
	Additional Guidance		
	Terms may be in any order		
	Second difference = 4 scores B1 even if used incorrectly eg answer $8n$		
	4 must be the second difference to score B1 eg answer $5n + 4$ with no working or statement that 4 is the second difference		B0
	Condone $n = 2n^2 + 3n + 1$		B3
	Condone $2n^2 + 3n + 1 = 0$		B2
	Condone $2x^2 - 5$ etc		B1

Q	Answer	Mark	Comments
19	$x + y = 5$ and $y = 2x + 4$ drawn as dashed line and $y = 1$ drawn as a solid line and correct region identified	B4	B3 $x + y = 5$, $y = 2x + 4$ and $y = 1$ drawn as dashed or solid lines B2 two of $x + y = 5$, $y = 2x + 4$ and $y = 1$ drawn as dashed or solid lines B1 $x + y = 5$ or $y = 2x + 4$ or $y = 1$ drawn as dashed or solid line
	Additional Guidance		
	Allow any unambiguous identification of the correct region, eg labelled R or shaded in or shaded out		
	If there are more than three lines plotted, treat as choice for positive gradients, negative gradients or horizontal/vertical lines. A shaded region may imply the chosen lines		
	Mark intention for straight lines		
			

Q	Answer	Mark	Comments
20(a)	$(3n + 2)(n + 1)$	B2	oe product of brackets any consistent letter condone = 0 ignore any attempt to solve B1 $(3n + 2)$ or $(n + 1)$ seen in a product of 2 linear brackets or $3n(n + 1) + 2(n + 1)$ or $n(3n + 2) + (3n + 2)$
	Additional Guidance		
	$(3n + 2)(n + 1) + k$		B1

Q	Answer	Mark	Comments
20(b)	No and valid reason	B1	valid reasons include the sequence is always even and greater than 2 $n + 1$ and $3n + 2$ cannot be equal to 1 each term can be made by multiplying (whole) numbers together not equal to 1 $n + 1$ and $3n + 2$ are factors not equal to 1
	Additional Guidance		
	Yes ticked		B0
	No reason given		B0
	No ticked, and every term in the sequence is even and the first term is 10		B1
	No ticked, and odd + odd + 2 is even, even + even + 2 is even and first term is 10		B1
	No ticked, and every term in the sequence is even		B0
	No ticked, and $3n^2$ can never be prime		B0
	No ticked, and + 2 means it can never be prime		B0

Q	Answer	Mark	Comments
21	**Alternative method 1: uses *r* as a variable**		
	$5 \times 2r$ or $10r$	M1	may be seen on diagram or as part of a calculation
	$(\pi)r^2 \times$ their $10r$ or $10(\pi)r^3$	M1	oe their $10r$ must be of the form kr
	$\dfrac{5\times\frac{4}{3}(\pi)r^3}{(\pi)r^2\times\text{their}10r}$	M1dep	oe eg $\dfrac{\frac{20}{3}}{10}$ or $\dfrac{20}{3} \div 10$ must be seen consistently with or without π to match cylinder formula dep on 2nd M1
	$\frac{2}{3}$ with M3 awarded	A1	oe fraction eg $\frac{20}{30}$

The mark scheme for Question 21 continues on the next page

Q	Answer	Mark	Comments
21 cont	**Alternative method 2: uses a value for r**		
	Method to calculate the cylinder length using their value of r	M1	their value of r must be stated or may be implied on the diagram or from their working eg r = 1 and cylinder length = 10
	Substitutes the same value of r and their cylinder length into $(\pi)r^2h$	M1dep	the substitution must be shown accept without use of π eg $\pi \times 1^2 \times 10$ or $1^2 \times 10$
	Substitutes the same value of r into $5 \times \frac{4}{3}(\pi)r^3$ and writes a fraction with their volume for the 5 spheres over their volume for the cylinder	M1dep	the substitution must be shown must be seen consistently with or without π to match cylinder formula eg $5 \times \frac{4}{3} \times \pi \times 1^3$ and $\frac{\frac{20\pi}{3}}{10\pi}$ dep on M2
	$\frac{2}{3}$ with M3 awarded	A1	oe fraction eg $\frac{20}{30}$
	Additional Guidance		
	(Length =) $5r$ $\pi r^2 \times 5r$ $\frac{5 \times \frac{4}{3}\pi r^3}{\pi r^2 \times 5r}$		M0M1M1
	Condone $\frac{66.\dot{6}}{100}$ for $\frac{2}{3}$		
	Do not accept a misread for the volume of a sphere		
	Ignore any attempt to convert the correct fraction to a decimal or percentage		
	Ignore any attempt to simplify the fraction once the correct answer has been seen		

Q	Answer	Mark	Comments
22	$2x^2 + 5x - 12\ (> 0)$ or $12 - 5x - 2x^2\ (< 0)$	B1	oe may be implied by 1.5 and -4
	Correct method to solve their three-term quadratic	M1	eg $(2x - 3)(x + 4)\ (> 0)$ or $2(x + \frac{5}{4})^2 - \frac{121}{8}\ (> 0)$ or $\frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times -12}}{2 \times 2}$ any of these imply B1M1
	1.5 and -4	A1ft	oe ft their three-term quadratic
	Both $x > 1.5$ and $x < -4$ stated	B1ft	oe ft B0M1 or B1M1A0 ft their two solutions for their three-term quadratic correct for their inequality in the form $ax^2 + bx + c > 0$ or $ax^2 + bx + c < 0$, which must be seen if it is not the correct inequality
	Additional Guidance		
	For the first B1 and the M1 condone $= 0$ in place of > 0 or < 0		
	Trial and Improvement is 0, 3 (for 1.5 and -4) or 4 marks		
	Incorrectly joined inequalities cannot score the final B1 eg $1.5 < x < -4$		B1M1A1B0
	Example where 1.5 and -4 do not imply first B1: $2x^2 + 5x - 12 < 0$, $(2x - 3)(x + 4) < 0$, $x = 1.5$ and $x = -4$, $-4 < x < 1.5$ final B1ft is only awarded if B0M1 or B1M1A0 is scored		B0M1A1B1ft
	$2x^2 - 5x - 12 < 0$, $(2x + 3)(x - 4) < 0$, $x = -1.5$ and $x = 4$, $-1.5 < x < 4$ joined inequality is correct for their three-term quadratic inequality		B0M1A1ftB1ft

Q	Answer	Mark	Comments
23	Any two from valid criticism about the h-intercept or valid criticism about the maximum point or valid criticism about the non-linear scaling on the horizontal axis	B2	eg graph should go through (0, 0) graph should intercept when $h = 0$ y-intercept should be 0 eg the maximum point should be (7, 49) at $t = 7$, h should be 49 eg 0, 7 and 14 should be evenly spaced B1 any one valid criticism
	Additional Guidance		
	Allow use of y for h or use of x for t		
	Each criticism may be implied by a correct, unambiguous graph drawn		
	Examples of valid criticisms		
	The intersection of the y-axis is wrong		
	The height at the beginning should not be 49		
	It should start at zero/ground level		
	The maximum/turning point is wrong		
	Goes higher than 49		
	Spacing of numbers on the x-axis is not equal		
	Examples of invalid criticisms		
	The y-axis is wrong		
	Wrong graph		
	Should be more symmetrical		
	The maximum point not labelled correctly		
	The coordinates are wrong		
	Needs more labels		
	The labels on the t-axis are wrong		
	Scales not easy to read		

Q	Answer	Mark	Comments
24	$0.5 \times 6 \times x \times \sin 127 = 26.355$ or $26.355 \div 6 \div \sin 127 \times 2$ or $26.355 \div 6 \div [0.7986, 0.8] \times 2$ or [10.98, 11.001]	M1	length *BC* oe any letter
	their [10.98, 11.001] ÷ 4.4 or [2.495, 2.50023] or 4.4 ÷ their [10.98, 11.001] or [0.39996, 0.40073]	M1dep	length scale factor oe implied by [2.3997, 2.405] for length of *DF*
	6 ÷ their [2.495, 2.50023] or 6 × their [0.39996, 0.40073] or [2.3997, 2.405] and 0.5 × 4.4 × their [2.3997, 2.405] × sin 127 or 0.5 × 4.4 × their [2.3997, 2.405] × [0.7986, 0.8] **or** 26.355 ÷ (their [2.495, 2.50023])^2 or 26.355 × (their [0.39996, 0.40073])^2	M1dep	length DF and area oe area ratio and area $26.355 \div \frac{[10.98,11.001]^2}{4.4^2}$ or $26.355 \times \frac{4.4^2}{[10.98,11.001]^2}$ scores M3
	[4.2, 4.234]	A1	SC2 [16.8, 16.94]
	Additional Guidance		
	SC2 is for omitting the 0.5 in the area formula		