GCSE
MATHEMATICS
8300/2H

Higher Tier Paper 2 Calculator

Mark scheme

June 2019

Version: 1.0 Final

196g83002H/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 Assessment Writer.

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 $a \leq$ value $< b$
3.14…	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

Questions which ask students to show working

Instructions on marking will be given but usually marks are not awarded to students who show no working.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

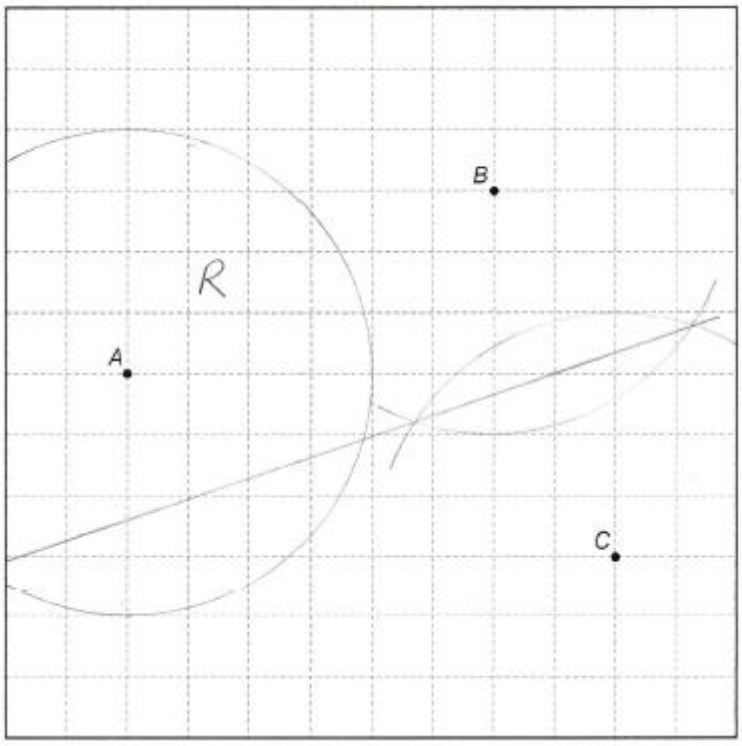
Premature approximation

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

Continental notation

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.

Question	Answer	Mark	Comments
1	(–1, 6)	B1	
	Additional Guidance		
2	11.5 m ⩽ height < 12.5 m	B1	
	Additional Guidance		
3	5 : 2	B1	
	Additional Guidance		
4	A ∩ B	B1	
	Additional Guidance		

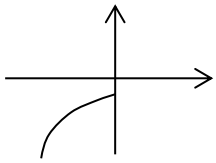
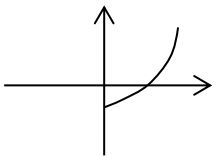
Question	Answer	Mark	Comments
5	Arc, centre *A*, radius 4 cm on grid	B1	at least a quarter-circle ± 2 mm radius ignore any other arcs
	Correct straight line equidistant from *B* and *C*	B1	their line must intersect any two of the five grid vertices (0, 3), (3, 4), (6, 5), (9, 6), (12, 7) ± 2 mm
	Correct enclosed region identified	B1	± 2 mm for the line at (0, 3), (6, 5) and the arc at (6, 6), (2, 10) region may be identified by labelling R or by shading implies B3
	Additional Guidance		
			B1B1B1
	Arc must be drawn using compasses for the first and third marks		
	If a quarter-circle is in tolerance, ignore the rest of the arc for first B1		
	Grid points are based on the origin being bottom left		
	Use (6, 5) not the intersection of the arc and the line to test the region		
	Lines may be dotted		

Question	Answer	Mark	Comments
6	**Alternative method 1**		
	18 ÷ 36 or 0.5 or 30	M1	oe implied by 3.5 or 3 h 30 min or 3.3(0) or 210 seen
	$\frac{200-18}{4-\text{their } 0.5}$ or $\frac{182}{3.5}$ or $\frac{200-18}{4\times 60-\text{their } 30}$ or $\frac{182}{210}$ or 0.86(6…) or 0.87	M1dep	oe method for miles per hour or miles per minute implied by $\frac{182}{3\text{ h }30\text{ min}}$ or $\frac{182}{3.3(0)}$
	52	A1	
	Alternative method 2		
	18 ÷ 36 or 0.5 or 30	M1	implied by 7
	$\frac{200}{4}+\frac{50-36}{7}$ or 50 + 2	M1dep	oe
	52	A1	
	Additional Guidance		
	Allow the first mark even if not subsequently used		
	Ignore units for the M marks		
	Answer 0.86(6…) or 0.87		M1M1A0
	Answer 0.86(6…) or 0.87 with mph crossed out and replaced by miles per min oe		M1M1A1
	Working for 52 then (52 + 36) ÷ 2		M1M1A0
	NB 50 + 2 = 52 from 200 ÷ 4 = 50 and 36 ÷ 18 = 2		Zero

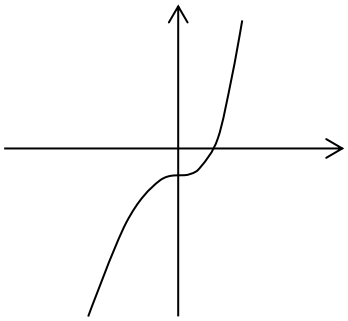
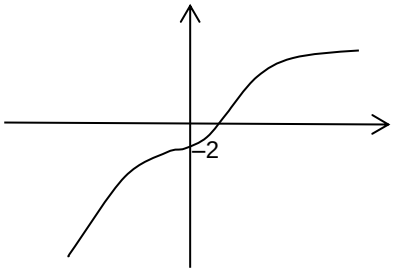
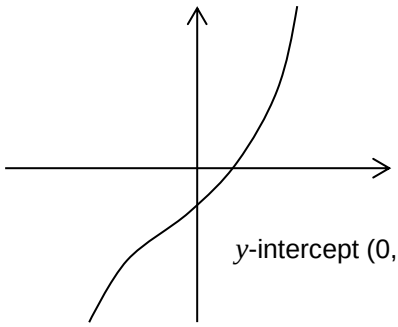
Question	Answer	Mark	Comments
7	**Alternative method 1**		
	8^2 or 64 and 17^2 or 289	M1	
	$\sqrt{17^2 - 8^2}$ or $\sqrt{225}$ or 15	M1dep	oe implies M2 may be seen on diagram
	8 × 3 × their 15 or 24 × their 15	M1dep	dep on M2 oe eg (8 + 16) × their 15 or 0.5 × 8 × their 15 × 6
	360	A1	SC2 [448.8, 456]
	Alternative method 2		
	$\cos C = \frac{8}{17}$ or C = [61.9, 62]	M1	may be seen on diagram
	17 × sin their [61.9, 62] or [14.9, 15.1]	M1dep	may be seen on diagram oe eg 8 × tan their [61.9, 62]
	8 × 3 × their [14.9, 15.1] or 24 × their [14.9, 15.1] or [357.6, 362.4]	M1dep	dep on M2 oe eg (8 + 16) × their [14.9, 15.1] or 0.5 × 8 × their [14.9, 15.1] × 6
	360	A1	SC2 [448.8, 456]
	Alternative method 3		
	$\sin A = \frac{8}{17}$ or A = [28, 28.1]	M1	may be seen on diagram
	17 × cos their [28, 28.1] or [14.9, 15.1]	M1dep	may be seen on diagram oe eg 8 ÷ tan their [28, 28.1]
	8 × 3 × their [14.9, 15.1] or 24 × their [14.9, 15.1] or [357.6, 362.4]	M1dep	dep on M2 oe eg (8 + 16) × their [14.9, 15.1] or 0.5 × 8 × their [14.9, 15.1] × 6
	360	A1	SC2 [448.8, 456]

Alternative method and Additional Guidance continued on the next page

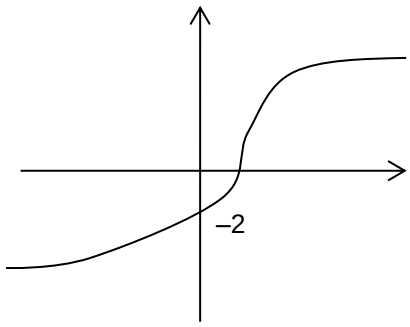
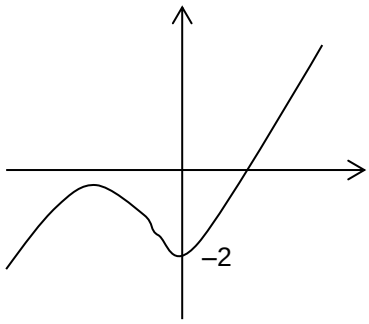
Question	Answer	Mark	Comments
7 cont	**Alternative method 4**		
	cos $C = \frac{8}{17}$ or C = [61.9, 62]	M1	may be seen on diagram
	$\frac{1}{2}$ × 8 × 17 × sin their [61.9, 62] or [59.9, 60.1]	M1dep	oe
	6 × their [59.9, 60.1] or [357.6, 362.4]	M1dep	oe
	360	A1	SC2 [448.8, 456]
	Additional Guidance		
	15 without a contradictory value for *AB* scores the first two marks on Alt method 1, even if not subsequently used		M1M1
	$\sqrt{17^2 + 8^2}$		M1M0
	3rd M1 is for the total area and may be calculated in various ways eg using a trapezium + a triangle		
	3rd M1 is for the total area so further work will lose the mark eg 360 seen followed by 360 – 60, answer 300		M1M1M0A0
	May use sine rule or cosine rule but must reach *AB* = …. to award the second M1 in Alt 2 or 3		

Question	Answer	Mark	Comments
8	Fully correct curve and point (0, –2) indicated	B2	B1 fully correct curve or partially correct curve with point (0, –2) indicated
	Additional Guidance		
	A partially correct curve must start in the 3rd quadrant and finish in the 1st quadrant, passing through the 4th quadrant not include a section with negative gradient		
	A fully correct curve must have all the properties of a partially correct curve have only a decreasing gradient to the left of the y-axis  have only an increasing gradient to the right of the y-axis  Condone a positive gradient at the y-intercept Condone straight line segments at each end of the curve		
	Fully correct curve with y-intercept labelled –2		B2
	Partially correct curve with y-intercept labelled –2		B1
	y-intercept labelled (–2, 0) is incorrect and can score a maximum of B1		
	Ignore any numbers on the axes other than the y-intercept		
	y-intercept (0, – 2) stated does indicate the point (0, –2)		

Additional Guidance continues on the next two pages

8 cont	**Additional Guidance**	
	Unlabelled notches do **not** indicate the point (0, –2)	
	A table of values does **not** indicate the point (0, –2)	
	Graph consisting only of straight lines	B0
	A fully correct curve but point (0, –2) is not indicated 	B1
	Partially correct curve with point (0, –2) indicated 	B1
	Fully correct curve with point (0, –2) indicated 	B2

Additional Guidance continues on the next page

8 cont	**Additional Guidance**	
	Partially correct curve with point (0, –2) indicated  	B1
	Curve includes a negative gradient so not partially correct  	B0

Question	Answer	Mark	Comments
9(a)	continuous grouped	B1	both circled
	Additional Guidance		

9(b)	**Alternative method 1**		
	380 ÷ 2 or (380 + 1) ÷ 2 or 381 ÷ 2 or 190 or 190.5 or 191	M1	oe eg $\frac{59+158+106+45+12}{2}$ may be seen by the table
	$2 < t \leqslant 4$ with 190 or 190.5 or 191 seen	A1	
	Alternative method 2		
	$2 < t \leqslant 4$ with 59 + 158 – 106 – 45 – 12 = 54 seen	B2	oe calculation eg 217 – 163 = 54 B1 59 + 158 – 106 – 45 – 12 = 54 oe
	Additional Guidance		
	$2 < t \leqslant 4$ with 190 or 190.5 or 191 not seen		M0A0
	Condone 2 – 4 in both or one of the spaces on answer line if 190 or 190.5 or 191 seen		M1A1
	Condone missing brackets if recovered		
	Alt 2 54 with calculation not seen		B0
	Alt 2 $2 < t \leqslant 4$ and 54 with calculation not seen		B0

Question	Answer	Mark	Comments
9(c)	$\frac{45+12}{380}$ or $\frac{57}{380}$ or $\frac{3}{20}$ or 0.15 or $100 \div \frac{380}{57}$ or $57 \div 3.8$	M1	oe proportion or calculation must use 380
	15	A1	
	Additional Guidance		
	$1 - \frac{59+158+106}{380}$ or $1 - \frac{323}{380}$ or $1 - \frac{17}{20}$ or $1 - 0.85$	M1	
	Correct proportion seen even if not subsequently used	M1A0	
	Do not allow misreads of 380		
	Build-up eg 10% = 380 ÷ 10 or 38 5% = 38 ÷ 2 or 19 38 + 19 = 57 is M0A0 unless answer 15		

Question	Answer	Mark	Comments
10	–1 0 1 2	B3	B2 three correct values with no incorrect values or –3 –2 –1 0 1 2 and –1 0 1 2 3 4 5 or interval that contains only the integers –1 0 1 2 B1 –3 –2 –1 0 1 2 or –1 0 1 2 3 4 5 SC2 answer 2 3 4 5
	Additional Guidance		
	Examples of intervals that contain only the integers –1 0 1 2 $-1 \leqslant x \leqslant 2$ or [–1, 2] or $-2 < x < 3$ or (–2, 3)		
	–1 0 1 2 3 4 5 may be shown as an interval that contains only these integers eg $-1 \leqslant x < 6$ or [–1, 6)		
	Intervals can be shown on a number line		
	–3 –2 –1 0 1 2 can **not** be shown as an interval or on a number line		
	Lists may be in any order eg 1 2 3 4 5 –1 0		B1
	Condone repeats in lists eg –1 0 1 1 2		B3
	Ignore commas/and/or between numbers in lists		
	–3 –2 –1 0 1 2 3 4 5 with no other valid working		B0

Question	Answer	Mark	Comments
11	**Alternative method 1**		
	(65% =) $\frac{13}{20}$ or 7 : 13	M1	
	13	A1	must be selected as the answer
	Alternative method 2		
	(100 – 35) ÷ 35 × 7 or 7 ÷ 35 × 100 – 7 or 20 – 7	M1	oe eg 35 ÷ 7 = 5 and 65 ÷ 5
	13	A1	must be selected as the answer
	Alternative method 3		
	$\frac{35}{7} \times n = 100 - 35$ or $5n = 65$	M1	oe equation eg $\frac{7}{n} = \frac{35}{100-35}$ or $35n = 455$
	13	A1	must be selected as the answer
	Additional Guidance		
	35 : 65 with no other valid working		M0
	Condone answer £13		M1A1
	Answer 13% or 13n		M1A0
	65% = 0.65		M0
	Alt 2 65 ÷ 35 = 1.9 1.9 × 7 = 13.3 (evidence of premature approximation) Answer 13		 M1 A0
	Alt 2 65 ÷ 35 = 1.9 1.9 × 7 = 13 (assume full calculator value used)		M1 A1

Question	Answer	Mark	Comments
12	0.3	B1	
	Additional Guidance		
13	**Alternative method 1**		
	Any three of [9.5, 10.5] × 22 or [209, 231] and [29.5, 30.5] × 9 or [265.5, 274.5] and [49.5, 50.5] × 6 or [297, 303] and [69.5, 70.5] × 3 or [208.5, 211.5] or 1000	M1	
	(their [209, 231] + their [265.5, 274.5] + their [297, 303] + their [208.5, 211.5]) ÷ 40 or 1000 ÷ 40	M1dep	oe condone bracket error if working seen eg 220 + 270 + 300 + 210 ÷ 40
	25	A1	
	$\frac{35}{\text{their } 25}$ or $\frac{7}{5}$ or 1.4	M1	oe eg $1 + \frac{35 - \text{their } 25}{\text{their } 25}$
	140	A1ft	ft their 25 with 3rd M1 scored

Mark scheme and Additional Guidance continue on the next two pages

Question	Answer	Mark	Comments
13 cont	**Alternative method 2**		
	Any three of [9.5, 10.5] × 22 or [209, 231] and [29.5, 30.5] × 9 or [265.5, 274.5] and [49.5, 50.5] × 6 or [297, 303] and [69.5, 70.5] × 3 or [208.5, 211.5] or 1000	M1	
	35 × 40 or 1400	M1	
	1000 and 1400	A1	
	$\frac{\text{their 1400}}{\text{their 1000}}$ or $\frac{7}{5}$ or 1.4	M1dep	oe eg $1 + \frac{\text{their 1400} - \text{their 1000}}{\text{their 1000}}$ dep on M2
	140	A1ft	ft their 1400 and their 1000 with M3 scored

Additional Guidance is on the next page

13 cont	**Additional Guidance**	
	Alt 1 Correct products seen in the table but a different method not using their products used for the mean shown in the working lines eg 40 ÷ 4 = 10 can score a maximum of M0M0A0M1A1ft	
	Alt 1 1000 ÷ 4 (= 250) is not a misread	
	NB The dependency of the M marks and the requirement for applying A1ft are different for the two alternative methods	
	Alt 1 3rd M1 Allow any number for their 25 (unless it contradicts their mean)	
	Alt 1 3rd M1 and A1ft If there is a mean for the boys allow the M mark to be implied by a correct ft answer eg from a mean of 250 allow M1A1ft for 14%	
	For A1ft allow answers to the nearest whole number or better	
	Further work after working out the percentage is 3rd M0 eg Mean = 25 $\frac{35}{\text{their } 25} \times 100 = 140$ 140 – 100 = 40 Answer 40	M1M1A1 M0A0

Question	Answer	Mark	Comments
14(a)	(Ali) 5 × 4 × 3 or 60 or (Mel) 4 × 3 × 2 or 24	M1	oe eg (Ali) 5 × 12 or (Mel) 4!
	5 × 4 × 3 – 4 × 3 × 2 or 60 – 24	M1dep	oe implies M2
	36 with no incorrect method seen	A1	SC1 answer 61
	Additional Guidance		
	Ignore any listing of possible codes		
	48 – 12 = 36 (incorrect method seen)		M0M0A0
	1st M1 Further work eg1 60 followed by 60 × 3 eg2 6 × 4 = 24 followed by 24 × 2 = 48		M0

14(b)	✓ It is bigger than my answer to part (a) ☐ It is smaller than my answer to part (a) ☐ It is the same as my answer to part (a)	B1	
	Additional Guidance		

Question	Answer	Mark	Comments
15	$y = -\frac{3}{2}x + 3$	B4	oe eg $2y + 3x = 6$ or $y = -1.5x + 3$ B3 $-\frac{3}{2}x + 3$ or gradient = $-\frac{3}{2}$ stated or equation of line with gradient $-\frac{3}{2}$ B2 scales on both axes identified correctly or scale on one axis identified correctly and correct gradient of L for their two scales seen B1 scale on one axis identified correctly or correct gradient of L for their two scales seen SC2 $y = -\frac{3}{4}x + 3$ oe or $y = \frac{3}{2}x + 3$ oe SC1 $-\frac{3}{4}x + 3$ or gradient = $-\frac{3}{4}$ stated or equation of line with gradient $-\frac{3}{4}$
	Additional Guidance		
	Examples of scale on y-axis identified correctly include intersection of $y = x - 1$ with y-axis labelled –1 or intersection of line L with y-axis labelled 3 or equation of line with y-intercept 3		
	Examples of scale on x-axis identified correctly include intersection of $y = x - 1$ with x-axis labelled 1 or intersection of line L with x-axis labelled 2		

Question	Answer	Mark	Comments
16	$\frac{1}{2} \times 14 \times AC = 80.5$	M1	oe eg $7AC = 80.5$ any letter for AC
	$\frac{80.5 \times 2}{14}$ or $\frac{161}{14}$ or 11.5	M1dep	oe eg $\frac{80.5}{7}$ implies M2 may be seen on diagram
	$\frac{1}{2} \times 19 \times$ their 11.5 $\times \sin 36$ or 64.21... or 64.22 or 64	M1	oe 64.21... or 64.22 or 64 scores M3 if no incorrect formula used
	64.2 with no incorrect formula used	A1	
	Additional Guidance		
	Answer 64.2 with no incorrect working		M3A1
	11.5 scores M2 even if not subsequently used		
	Answer 64.2 from using 'bh' and '$ab\sin C$' (unless clear explanation that $\frac{1}{2}$ has been cancelled in both area formulae) $14 \times AC = 80.5$ $\frac{80.5}{14} = 5.75$ $19 \times 5.75 \times \sin 36$ 64.2		M0 M0 M0 A0
	3rd M1 can be scored if they have a value for AC eg $AC = 6$ (may be seen on diagram) $\frac{1}{2} \times 19 \times 6 \times \sin 36 = 33.5$		M0M0 M1A0
	3rd M1 may be seen in stages eg1 $11.5 \times \sin 36$ or [6.7, 6.8] $\frac{1}{2} \times 19 \times$ [6.7, 6.8] eg2 $19 \sin 36$ or [11.1, 11.2] $\frac{11.5 \times [11.1, 11.2]}{2}$		

Question	Answer	Mark	Comments
17	68.3 – 0.05 or 68.25 or 68.3 + 0.05 or 68.35 or 8.7 – 0.05 or 8.65 or 8.7 + 0.05 or 8.75	M1	accept $68.34\dot{9}$ for 68.35 accept $8.74\dot{9}$ for 8.75 may be seen in an inequality eg $68.25 \leqslant p < 68.35$
	$\frac{[68.2, 68.3) - 2 \times (8.7, 8.8]}{2}$	M1	oe $\frac{68.25 - 2 \times 8.75}{2}$ or $\frac{68.25 - 17.5}{2}$ or $\frac{50.75}{2}$ is M2
	25.375 or $\frac{203}{8}$ or $25\frac{3}{8}$	A1	SC2 Answer 25.375 and 25.525
	Additional Guidance		
	1st M1 If given as an inequality condone incorrect notation eg $68.25 \leqslant p \leqslant 68.35$	M1	
	Ignore any subsequent rounding after 25.375 seen		
	Condone eg 68.250 for 68.25	M1	
	Answer 25.3 or 25.4 with no correct working	M0M0A0	
	Only working for upper bound eg $\frac{68.35 - 2 \times 8.65}{2}$ = 25.525	M1M0A0	

Question	Answer	Mark	Comments
18	(b : g =) 4 : 1 or (b : w =) 6 : 10 or states a number of blue discs that is four times the number of green discs or states a number of blue discs and a number of white discs that are in the ratio 3 : 5 (not 3 and 5) or $b = 4g$ or $\frac{b}{w} = \frac{3}{5}$	M1	oe ratio or equation eg (b : g =) 3 : 0.75 or 4 blue 1 green or 6 blue 10 white or $5b = 3w$ do not allow (b : w =) 3 : 5
	Three numbers of the form $12n$, $3n$ and $20n$ where $n > 0$ or unsimplified fraction equivalent to $\frac{32}{35}$	A1	any order may be seen in a ratio or as numbers of discs eg 12 : 3 : 20 or 100 15 60 or 3 0.75 5 or 4 : 1 : $\frac{20}{3}$ or $\frac{12+20}{12+3+20}$ or $\frac{3+5}{3+0.75+5}$ or $\frac{8}{8.75}$ or $\frac{b+\frac{5}{3}b}{b+\frac{5}{3}b+\frac{1}{4}b}$ or $\frac{\frac{8}{3}b}{\frac{35}{12}b}$
	$\frac{32}{35}$ or 0.91(4…) or 91.(4…)%	A1	oe fraction eg $\frac{64}{70}$

Additional Guidance is on the next page

18 cont	**Additional Guidance**	
	Ignore conversion of a correct fraction to a decimal or percentage	
	Ignore incorrect simplification of a correct fraction	
	Answer 32 : 35	M1A1A0
	Final A1 fraction answers must be $\frac{\text{integer}}{\text{integer}}$	
	1 : 4 only scores M1 if indicated as g : b	
	10 : 6 only scores M1 if indicated as w : b	
	1st M1 may be embedded eg1 b : g : w = 4 : 1 : 10 eg2 b : g : w = 6 : 3 : 10	 M1 M1
	Condone 4b : g as an indication of 4 blue and 1 green etc	

Question	Answer	Mark	Comments
19	tan 64 = $\frac{h}{4}$ or tan 26 = $\frac{4}{h}$ or $\frac{h}{\sin 64} = \frac{4}{\sin 26}$	M1	oe eg tan 64 = $\frac{h}{15-11}$ or tan (90 – 64) = $\frac{15-11}{h}$ or $h^2 + 4^2 = \left(\frac{4}{\cos 64}\right)^2$ any letter
	4 tan 64 or $\frac{4}{\tan 26}$ or $\frac{4}{\sin 26}$ × sin 64 or 8.2…	M1dep	oe eg $\sqrt{\left(\frac{4}{\cos 64}\right)^2 - 4^2}$ implies M2 may be seen on diagram
	$\frac{1}{2}$ × (15 + 11) × their 8.2… or $\frac{1}{2}$ × 4 × their 8.2.. + 11 × their 8.2..	M1dep	oe eg 15 × their 8.2… – $\frac{1}{2}$ × 4 × their 8.2… dep on M2
	[106.6, 106.62]	A1	accept 107 with working seen
	Additional Guidance		
	3rd M1 is for a total area and may be calculated as a trapezium or a rectangle + a triangle or a rectangle – a triangle or a triangle + a triangle		
	8.2… seen scores M2 even if not subsequently used		
	Further work after 106.6 eg 106.6 + 16.4		M1M1M0A0

Question	Answer	Mark	Comments
20	**Alternative method 1**		
	$\frac{n^2+n}{2}$ or $\frac{n^2+2n+n+2}{2}$ or $\frac{n^2+3n+2}{2}$	M1	may be seen in stages eg $n^2 + n$ followed by $\frac{n^2+n}{2}$
	$\frac{n^2+n}{2}$ and $\frac{n^2+2n+n+2}{2}$ or $\frac{n^2+n}{2}$ and $\frac{n^2+3n+2}{2}$	M1dep	may be seen in stages eg $n^2 + n$ followed by $\frac{n^2+n}{2}$ and $n^2 + 3n + 2$ followed by $\frac{n^2+3n+2}{2}$ implies M2
	$\frac{2n^2+4n+2}{2}$ or $n^2 + 2n + 1$ with M2 seen	A1	oe single fraction with terms collected eg $\frac{4n^2+8n+4}{4}$
	$n^2 + 2n + 1$ and $(n + 1)^2$ with M2A1 seen	A1	allow $(n + 1)(n + 1)$ for $(n + 1)^2$
	Alternative method 2		
	$\frac{n+1}{2}(n + n + 2)$	M1	oe eg $(n + 1)\left(\frac{n}{2} + \frac{n+2}{2}\right)$
	$\frac{n+1}{2}(2n + 2)$ or $\frac{n^2+n}{2} + \frac{n^2+n}{2} + \frac{2n+2}{2}$ with M1 seen	M1dep	
	$\frac{2n^2+4n+2}{2}$ or $n^2 + 2n + 1$ with M2 seen	A1	oe single fraction with terms collected eg $\frac{4n^2+8n+4}{4}$
	$n^2 + 2n + 1$ and $(n + 1)^2$ with M2A1seen	A1	allow $(n + 1)(n + 1)$ for $(n + 1)^2$

Mark scheme and Additional Guidance continue on the next two pages

Question	Answer	Mark	Comments
20 cont	**Alternative method 3**		
	$\frac{n+1}{2}(n + n + 2)$	M1	oe eg $(n + 1)\left(\frac{n}{2}+\frac{n+2}{2}\right)$
	$\frac{n+1}{2}(2n + 2)$ with M1 seen	M1dep	oe eg $\frac{(n+1)(2n+2)}{2}$
	$(n + 1)^2$ with M2 seen	A2	A1 $2(n + 1)\ \frac{n+1}{2}$ or $\frac{2(n+1)^2}{2}$ allow $(n + 1)(n + 1)$ for $(n + 1)^2$

Additional Guidance is on the next page

20 cont	**Additional Guidance**	
	Only substituting in values of n	M0M0A0A0
	Consistently using a different letter to n can score up to M1M1A1A1	
	Using two different letters consistently within the two fractions (eg n replaced by x in the first equation and n replaced by y in the second equation) can score a maximum of M1M1A0A0 unless recovered to the same letter	
	Multiplying fractions instead of adding can score a maximum of M2A0	
	For M marks condone eg $n2$ for $2n$ etc	
	$n^2 + n$ /2 and $n^2 + 3n + 2/2$ recovered to $\frac{2n^2+4n+2}{2}$ and/or $n^2 + 2n + 1$ and/or $(n + 1)^2$	M1M1A0A0
	$n^2 + n$ /2 and $n^2 + 3n + 2/2$ not recovered	M0M0A0A0
	$n^2 + n$ and $n^2 + 3n + 2$ recovered to $\frac{2n^2+4n+2}{2}$ and/or $n^2 + 2n + 1$ and/or $(n + 1)^2$	M1M1A0A0
	$n^2 + n$ and $n^2 + 3n + 2$ not recovered	M0M0A0A0
	Equating to n^2 in working can score a maximum of M1M1A0A0 (equating to eg x^2 can score up to M1M1A1A1)	
	$1n$ is allowed for n throughout	
	Alts 2 and 3 $\frac{n+1}{2}(2n + 2)$ with M1 seen scores M2 If they attempt to expand $(n + 1)(2n + 2)$ use Alt 2 If they attempt to expand $\frac{1}{2}(2n + 2)$ use Alt 3	

Question	Answer	Mark	Comments
21	$\pi r \times 2r$ or $\pi r \times 3r$ or $2\pi r^2$ or $3\pi r^2$ or $5\pi r^2$	M1	oe implied by a correct equation for first A1
	$2\pi r^2 + 3\pi r^2 = 57.8\pi$ or $5\pi r^2 = 57.8\pi$ or $2\pi r^2 = 57.8\pi \div 5 \times 2$ or $3\pi r^2 = 57.8\pi \div 5 \times 3$ or $\sqrt{11.56}$	A1	oe eg $\pi r \times 2r + \pi r \times 3r = 57.8\pi$ or $5r^2 = 57.8$ or $r^2 = 11.56$ or $2r^2 = 23.12$ or $3r^2 = 34.68$
	3.4 or $\frac{17}{5}$ or $3\frac{2}{5}$	A1	
	Additional Guidance		
	11.56 not in a square root or a correct equation		M0
	Adding the area of a circle (or 2 circles) can score a maximum of M1A0A0 eg $3\pi r^2 + \pi r^2 = 57.8\pi$ Adding further incorrect terms scores M0		M1A0A0
	T & I scores M1A1A1 if answer 3.4, otherwise scores 0		
	Allow $\pi r^2 5$ for $5\pi r^2$ etc throughout		
	Answer ± 3.4		M1A1A0
	$5\pi r^2 \times \pi r^2$ or $3\pi r^2 \times \pi rl$ etc		M0
	Allow π to be replaced by [3.14, 3.142]		
	Answer 3 is incorrect unless 3.4 seen in working lines		

Question	Answer	Mark	Comments
22	**Alternative method 1**		
	$(\sqrt{12} =)\ 2\sqrt{3}$	M1	
	$5\sqrt{3} - 2\sqrt{3} = 3\sqrt{3}$	A1	implies M1A1
	27 with M1A1 seen	A1	
	Alternative method 2		
	$5\sqrt{3}\ 5\sqrt{3} - 5\sqrt{3}\ \sqrt{12} - 5\sqrt{3}\ \sqrt{12} + \sqrt{12}\ \sqrt{12}$ or $25\sqrt{3}\ \sqrt{3} - 10\sqrt{3}\ \sqrt{12} + \sqrt{12}\ \sqrt{12}$ or $(5\sqrt{3}\ 5\sqrt{3} =)\ 75$ or $(5\sqrt{3}\ \sqrt{12} =)\ 30$ or $(10\sqrt{3}\ \sqrt{12} =)\ 60$ or $(\sqrt{12}\ \sqrt{12} =)\ 12$	M1	oe expansion eg1 $\sqrt{75}\ \sqrt{75} - \sqrt{75}\ \sqrt{12} - \sqrt{75}\ \sqrt{12} + \sqrt{12}\ \sqrt{12}$ eg2 $\sqrt{75}\ \sqrt{75} - \sqrt{900} - \sqrt{900} + \sqrt{12}\ \sqrt{12}$
	75 – 30 – 30 + 12 or 75 – 60 + 12	A1	implies M1A1
	27 with M1A1 seen	A1	
	Additional Guidance		
	27 with no working ($2\sqrt{3}$ not seen)		M0A0A0
	Alt 1 $5\sqrt{3} - \sqrt{12} = 3\sqrt{3}$ ($2\sqrt{3}$ not seen)		M0A0A0
	Alt 2 75 – 30 – 30 – 12		M1A0A0
	Alt 1 $5\sqrt{3} - 2\sqrt{3} = 3\sqrt{3}$ followed by $3\sqrt{3}^{\,2} = 27$ (condone missing brackets)		M1A1A1
	Only converting to decimals		M0A0A0

Question	Answer	Mark	Comments
23	64 : 125	B1	
	Additional Guidance		
24	$(x + 6)(x – 2)$ or $\frac{-4 \pm \sqrt{4^2 - 4 \times 1 \times -12}}{2 \times 1}$ or $–2 \pm \sqrt{16}$	M1	oe
	–6 and 2	A1	may be seen in inequalities or as intersections with x-axis on the graph must be selected if appearing in a list of values or a table
	$–6 < x < 2$ or $2 > x > –6$	A1ft	ft M1A0 and two values must be a single inequality
	Additional Guidance		
	To award A1ft the values must be used to give a continuous interval eg1 $(x + 6)(x – 2)$ followed by (x =) 6 and (x =) –2 Answer $–2 < x < 6$ eg2 $(x + 6)(x – 2)$ followed by (x =) 6 and (x =) –2 Answer $6 < x < –2$		M1A0A1ft M1A0A0ft
	$x < 2$ and $x > –6$		M1A1A0
	$–6 < x > 2$		M1A1A0
	$–6 \leqslant x < 2$		M1A1A0
	$–6 < x < 2$ in working with different answer on answer line		M1A1A0
	$–6 < x < 2$ in working with integers on answer line		M1A1A0

Question	Answer	Mark	Comments
25	8 + 19 or 27	M1	may be seen in the table
	$\frac{2}{5} \times 5 (\times 1)$ or 2	M1	oe eg $\frac{55-53}{5} \times 5$ or $\frac{50}{5\times10+10\times20+5\times26+15\times8} \times 2 \times 10$ or 0.1 × 20 may be seen on the histogram
	$\frac{8}{10} \times 10 \times 2$ or 16	M1	oe eg $\frac{63-55}{10} \times 10 \times 2$ or $\frac{50}{5\times10+10\times20+5\times26+15\times8} \times 8 \times 20$ or 0.1 × 160 may be seen on the histogram
	9	A1	
	Additional Guidance		
	18 (medium eggs) for Farm B with no incorrect working implies 2nd and 3rd M1		
	(19 + 8 – 2 – 16 = 19 + 8 – 18) 19 – 10 = 9		M3A1
	$\frac{27}{50} - \frac{2}{50} - \frac{16}{50} = \frac{9}{50}$		M3A0
	8 + 19 + 15 + 8 does not score the 1st M1		
	8 27 42 50 is M0 unless they select 27		

Question	Answer	Mark	Comments
26	**Alternative method 1**		
	(a =) –3	B1	
	(b =) 4	B1ft	ft 7 + their a correct or ft
	(c =) –11	B1ft	ft 10 + 7 × their a correct or ft
	Alternative method 2		
	$x^3 + 5x^2 + 2x^2 + 10x + ax^2 + 5ax + 2ax + 10a$ or $x^3 + 7x^2 + 10x + ax^2 + 7ax + 10a$ or $10a = -30$ or $a = -3$	M1	oe terms may be seen in a grid implied by $x^3 + 5x^2 + 2x^2 + 10x - 3x^2 - 15x - 6x - 30$ or $x^3 + 7x^2 + 10x - 3x^2 - 21x - 30$
	5 + 2 + their a = b or $b = 4$ or 10 + their $5a$ + their $2a$ = c or $c = -11$ or $x^3 + 4x^2 - 11x - 30$	M1dep	oe eg $5x^2 + 2x^2$ + their ax^2 = bx^2 or $10x$ + their $5ax$ + their $2ax$ = cx
	$a = -3$ and $b = 4$ and $c = -11$	A1	
	Additional Guidance		
	Apply the scheme that awards most marks		
	Allow $x10$ for $10x$ etc		
	$a = -3$ $b = 4$ $c = -11$ in working with one or both negative signs omitted on answer lines	B2	
	$a = -3$ $b = 4$ $c = -11$ in working with values in a different order on answer lines	B2	

Question	Answer	Mark	Comments
27	**Alternative method 1**		
	$y + 1 = \frac{2x}{5}$ or $5y = 2x - 5$	M1	x and y may be transposed oe 1st step eg $\frac{y}{2} = \frac{x}{5} - \frac{1}{2}$
	$5(y + 1) = 2x$ or $5y + 5 = 2x$	M1dep	x and y may be transposed oe 2nd step eg $\frac{y}{2} + \frac{1}{2} = \frac{x}{5}$ implies M2
	$\frac{5(y+1)}{2}$ or $\frac{5y+5}{2}$ or $\frac{5(3+1)}{2}$ or 10	A1	may use x instead of y oe expression or calculation eg $\frac{5y}{2} + \frac{5}{2}$ or $\frac{3+1}{\frac{2}{5}}$
	$\frac{2\times-0.5}{5} - 1$ or -1.2 or $-\frac{6}{5}$ or $-1\frac{1}{5}$	M1	oe
	8.8 or $\frac{44}{5}$ or $8\frac{4}{5}$	A1	

Mark scheme and Additional Guidance continue on the next page

Question	Answer	Mark	Comments
27 cont	**Alternative method 2**		
	$\frac{2x}{5} = 3 + 1$ or $\frac{2x}{5} = 4$	M1	oe
	$2x$ = their 4×5	M1dep	oe implies M2
	10	A1	
	$\frac{2 \times -0.5}{5} - 1$ or -1.2 or $-\frac{6}{5}$ or $-1\frac{1}{5}$	M1	oe
	8.8 or $\frac{44}{5}$ or $8\frac{4}{5}$	A1	
	Additional Guidance		
	The 4th mark may be seen first and may be the only mark awarded		
	f may be used for y		
	Missing brackets must be recovered		
	Answer 8.8		M2A1M1A1
	First three marks in Alt 1 Can be gained using a reverse function machine for a full calculation (applied to 3) which may be seen in stages eg $3 + 1 = 4$ and $4 \times 5 = 20$ and $20 \div 2$ Part marks are not possible for this approach		M1M1A1