AQA

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MATHEMATICS
8300/2H

Higher Tier Paper 2 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 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.

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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 $a \leq$ 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	A and B	B1	
	Additional Guidance		
2	(1, 5)	B1	
	Additional Guidance		
3	1 3 9 27 81	B1	
	Additional Guidance		
4	130°	B1	
	Additional Guidance		
5	Pi or π	B1	accept a value in range [3.14, 3.142]
	Additional Guidance		
	Accept incorrect spelling if intention is clear eg accept pie		
	Answer $(C =) \pi d$		B0
	Answer $(C =) \pi d$ $(k =) \pi$		B1

Question	Answer	Mark	Comments
6(a)	2.5 × 12 or 30 and 7.5 × 7 or 52.5 and 12.5 (× 1) or 95	M1	allow one incorrect midpoint or [2, 3] × 12 and [7, 8] × 7 and [12, 13] (× 1) ignore $t \geqslant 15$ row
	$\frac{\text{their } 30 + \text{their } 52.5 + \text{their } 12.5}{12 + 7 + 1}$ or 95 ÷ 20	M1dep	$t \geqslant 15$ product must be 0 if seen condone bracket error seen eg 30 + 52.5 + 12.5 ÷ 20
	4.75	A1	accept 4.8 or 5 if full working shown using **correct** midpoints
	Additional Guidance		
	Two correct from 30, 52.5 and 12.5 implies the first mark and could be used to score up to M2		M1
	Midpoints used in the ranges [2, 3], [7, 8] and [12, 13] must be seen eg 2.5 × 12 and 7 × 7 and 12 (× 1) or 3 × 12 and 7 × 7 and 13 (× 1) NB These could be used to score up to M2		M1
	Correct products seen in the table but a different method shown in the working lines eg 20 ÷ 4 = 5		M0

6(b)	Lower than part (a)	B1	
	Additional Guidance		

Question	Answer	Mark	Comments
7	**Alternative method 1**		
	$35x + 6x = ax$ or $35 + 6 = a$ or $41x = ax$	M1	
	$a = 41$	A1	
	$40 + 3b = 13$	M1	oe
	$b = –9$	A1	SC3 $a = 41$, $b = –27$ or $a = 41$, $b = \frac{5}{3}$
	Alternative method 2		
	$35x + 40 + 6x + 3b$ or $41x + 40 + 3b$	M1	
	$35x + 6x = ax$ or $35 + 6 = a$ **and** $40 + 3b = 13$	M1dep	oe eg $41x = ax$ and $3b = –27$
	$a = 41$	A1	implies first M1 only
	$b = –9$	A1	SC3 $a = 41$, $b = –27$ or $a = 41$, $b = \frac{5}{3}$
	Additional Guidance		
	$a = 41$ and $b = –9$		M1A1M1A1
	$a = 41$ or $b = –9$		M1A1
	$35x$, 40, $6x$ and $3b$ seen without addition signs shown or implied		M0
	$35x + 40 + 6x +$ ***b*** leading to an answer of $a = 41$ and $b = –27$		SC3
	$35x +$ **8** $+ 6x + 3b$ leading to an answer of $a = 41$ and $b = \frac{5}{3}$		SC3
	$35x +$ **8** $+ 6x +$ ***b*** leading to an answer of $a = 41$ and $b = 5$		M1A1
	$a = 41x$		M0
	For $\frac{5}{3}$ accept 1.66… or 1.67		
	Condone multiplication signs eg $35 \times x$ for $35x$		

Question	Answer	Mark	Comments
8	12×6 or 72	M1	oe area of rectangle
	$\pi \times 6^2$ or 36π or [113, 113.112]	M1	oe may be implied eg $\pi \times 6^2 \div 4$ or 9π or [28.2, 28.3]
	$\pi \times 6^2 \div 2$ or 18π or [56.4, 56.6]	M1dep	oe dep on 2nd M1
	[15.4, 15.5] or $72 - 18\pi$	A1	
	Additional Guidance		
	$72 - 18\pi = 54\pi$		M1M1M1A0
	$\pi \times 6^2 \div 2$ scores 2nd and 3rd M1		
	$12 \times 6 = 72$ $72 \div 2 = 36$ (unless identified as half of rectangle)		(1st) M0
	$\pi \times 6^2$ scores 2nd M1 even if subsequently used incorrectly eg $\pi \times 6^2 = 36\pi$ $36\pi \times 2 = 72\pi$		(2nd) M1
	Ignore units throughout		

Question	Answer	Mark	Comments
9	**Alternative method 1** comparing with 7.5 minutes		
	180 ÷ 135 or 180 ÷ 14 or 79.8 ÷ 14 or 79.8 ÷ 135	M1	oe or reciprocals
	$\frac{14 \times 135}{180}$ or 10.5 or $\frac{79.8 \times 180}{135}$ or 106.4	M1dep	oe or reciprocals
	$\frac{79.8 \times 180}{14 \times 135}$ or 7.6	M1dep	oe eg 79.8 ÷ 10.5 or 106.4 ÷ 14
	No and 7.6 (and 7.5)	A1	oe eg No and 7 minutes 36 seconds (and 7 minutes 30 seconds)
	Alternative method 2 comparing with 79.8 litres		
	135 ÷ 180 or 14 ÷ 180 or 7.5 × 14 or 7.5 ÷ 180	M1	oe or reciprocals
	$\frac{14 \times 135}{180}$ or 10.5 or $\frac{7.5 \times 135}{180}$ or 5.625	M1dep	oe or reciprocals
	$\frac{7.5 \times 135 \times 14}{180}$ or 78.75	M1dep	oe eg 10.5 × 7.5 or 5.625 × 14
	No and 78.75	A1	

Alternative methods and Additional Guidance continued on the next two pages

Question	Answer	Mark	Comments
9 cont	**Alternative method 3** comparing with 14 litres per minute		
	180 ÷ 135 or 180 ÷ 7.5 or 79.8 ÷ 135 or 79.8 ÷ 7.5	M1	oe or reciprocals
	$\frac{7.5 \times 135}{180}$ or 5.625 or $\frac{79.8 \times 180}{135}$ or 106.4	M1dep	oe or reciprocals
	$\frac{79.8 \times 180}{7.5 \times 135}$ or [14.18, 14.19]	M1dep	oe
	No and [14.18, 14.19]	A1	
	Alternative method 4 comparing new rate of flow with rate required		
	135 ÷ 180 or 14 ÷ 180	M1	oe or reciprocals
	$\frac{14 \times 135}{180}$ or 10.5	M1dep	oe
	79.8 ÷ 7.5 or 10.64	M1	oe
	No and 10.5 and 10.64	A1	
	Alternative method 5 comparing with 135 degrees		
	180 ÷ 14 or 180 ÷ 7.5 or 79.8 ÷ 14 or 79.8 ÷ 7.5	M1	oe or reciprocals
	180 ÷ 14 **and** 79.8 ÷ 7.5 or 180 ÷ 7.5 **and** 79.8 ÷ 14	M1dep	oe or matching reciprocals
	$\frac{79.8 \times 180}{7.5 \times 14}$ or 136.8	M1dep	dep on M2
	No and 136.8	A1	

Additional Guidance continued on the next page

Question	Answer	Mark	Comments

	Additional Guidance	
9 cont	No may be implied eg It takes more	
	7.3(0) used for 7.5 may score up to M3	
	$7\frac{1}{2}$ minutes converted to 7.3(0) or 7 minutes 50 seconds	A0
	Ignore incorrect conversion of 7.6 to minutes and seconds if 7.6 seen	
	Use the scheme that awards the most marks and ignore choice	

Question	Answer	Mark	Comments
10	$4x + 5 = 6x - 10$ or $4x + 5 = 10(x - 4)$ or $6x - 10 = 10(x - 4)$	M1	oe eg $4x + 5 + 6x - 10 = 2 \times 10(x - 4)$ condone $10x - 4$ for $10(x - 4)$
	$4x - 6x = -10 - 5$ or $-2x = -15$ or $4x - 10x = -40 - 5$ or $-6x = -45$ or $6x - 10x = -40 + 10$ or $-4x = -30$	M1dep	oe collection of terms eg $4x + 6x - 20x = -80 - 5 + 10$ or $-10x = -75$ condone $10x - 4$ for $10(x - 4)$ eg $4x - 10x = -4 - 5$ or $6x - 10x = -4 + 10$
	$(x =)$ 7.5	A1	oe may be implied by (side length =) 35 or (perimeter =) 105
	(6 × their 7.5 – 10) × 3 or (4 × their 7.5 + 5) × 3 or 10 × (their 7.5 – 4) × 3 or 35 × 3 or 6 × their 7.5 – 10 + 4 × their 7.5 + 5 + 10 × (their 7.5 – 4) or 20 × their 7.5 – 45 or 105	M1dep	oe dep on M1M1 condone $10x - 4$ for $10(x - 4)$ must show working if M1M1A0
	105 and Yes	A1	oe eg 1.05 and Yes
	Additional Guidance		
	$4x + 5 = 6x - 10 = 10(x - 4)$		M1
	Condone $10x - 4$ for $10(x - 4)$ for up to M3		

Question	Answer	Mark	Comments
11	3.041…	M1	condone 3.042
	3.14 – 3.041… = 0.09… or 3.041… + 0.1 = 3.141… or 3.041… and 3.14 – 0.1 = 3.04	A1	oe condone 3.042 for 3.041…
	Additional Guidance		
	Must see calculation for the A mark		
	Do not allow use of a more precise value of π for the A mark		

Question	Answer	Mark	Comments
12	2.85×10^6	B2	B1 correct value not in standard form eg 2 850 000 or 28.5×10^5 or 2.9×10^6
	Additional Guidance		
	Condone different spacing or commas eg 2850000 or 28,50,000		B1
	$2.85.10^6$		B1
	2.85×10^6 in working with 2.9×10^6 on answer line		B2
	2.85×10^6 in working with 3×10^6 on answer line		B2
	2.9×10^6 in working with 3×10^6 on answer line		B1
	3×10^6 only		B0
	2.85×10^6 in working with 2 850 000 on answer line		B1
	2 850 000 in working with 2 900 000 on answer line		B1
	2 900 000 only		B0
	2 850 000 in working with 2.8×10^6 on answer line		B1
	2.8×10^6 only		B0

Question	Answer	Mark	Comments
13	Evaluates method	B1	eg1 his method does not work because 1.2 m does not divide exactly by 50 cm eg2 there are not a whole number of 50 cm in 1.2 m eg3 50 cm will not fit in 0.2 m eg4 1.2 ÷ 0.5 = 2.4 which is not a whole number eg5 120 ÷ 50 = 2.4 and cannot have 2.4 boxes eg6 can only fit 2 layers of boxes
	Evaluates claim	B1	eg1 he can only fit 40 eg2 he will not fit (as many as) 48
	Additional Guidance		
	Volume divided volume doesn't always work		(1st) B0
	He is wrong as he can put 42 boxes		(2nd) B0
	Only 2 layers will fit so he can't fit 48 boxes		B1B1
	Can't have 0.4 of a box so he can only fit 45 boxes		B1B0
	5 × 4 × 2 = 40		B0B1

Question	Answer	Mark	Comments
14	$3n$	B1	
	Additional Guidance		
15	**Alternative method 1**		
	45 ÷ (22 + 3) or 45 ÷ 25 or 1.8	M1	oe eg $\frac{45}{25}$
	22 × their 1.8 or 39.6 or 3 × their 1.8 or 5.4	M1dep	
	their 39.6 × 8.96 + their 5.4 × 7.31 or [354, 355] + [39, 40]	M1dep	
	394.29 or 394.3	A1	
	Alternative method 2		
	45 ÷ (22 + 3) or 45 ÷ 25 or 1.8	M1	oe eg $\frac{45}{25}$
	their 1.8 × 8.96 or [16.1, 16.13] or their 1.8 × 7.31 or [13.1, 13.2]	M1dep	
	their [16.1, 16.13] × 22 + their [13.1, 13.2] × 3 or [354, 355] + [39, 40]	M1dep	
	394.29 or 394.3	A1	

Alternative method and Additional Guidance continued on the next page

Question	Answer	Mark	Comments
15 cont	**Alternative method 3**		
	45 ÷ (22 + 3) or 45 ÷ 25 or 1.8	M1	oe eg $\frac{45}{25}$
	22 × 8.96 or [197, 197.12] or 3 × 7.31 or [21.9, 22]	M1	
	their [197, 197.12] × their 1.8 + their [21.9, 22] × their 1.8 or [354, 355] + [39, 40]	M1dep	oe dep on M1M1
	394.29 or 394.3	A1	
	Additional Guidance		
	Allow up to M2 even if not subsequently used		
	Ignore units throughout		
16(a)	106	B1	
	Additional Guidance		

Question	Answer	Mark	Comments
16(b)	50 – 42 or 8 or $\frac{42}{50}$ or $\frac{21}{25}$ or 0.84 or 84%	M1	oe
	$\frac{8}{50}$ or $\frac{4}{25}$ or 0.16 or 16%	A1	oe
	Additional Guidance		
	Ignore incorrect conversion if correct answer seen		
	$\frac{8}{42}$		M1A0
17	could be even or odd	B1	
	Additional Guidance		

Question	Answer	Mark	Comments
18(a)	$\frac{10}{10+7+3}$ or $\frac{10}{20}$ or $\frac{5}{10}$ or $\frac{1}{2}$ or 0.5	M1	oe eg 50%
	$\frac{1}{8}$ or 0.125 or 12.5%	A1	oe eg $\frac{1000}{8000}$ or $\frac{125}{1000}$
	Additional Guidance		
	Ignore incorrect conversion if correct answer seen		
	Answer $\frac{1}{2}$	M1	
	10 out of 20	M0	
	10 : 20	M0	
	Answer 1 out of 8	M1A0	
	Answer 1 : 8 is A0 but M1 is possible		
	$\frac{10}{20}$ $\frac{7}{20}$ $\frac{3}{20}$	M1	

Question	Answer	Mark	Comments
18(b)	$\frac{10}{19}$ or $\frac{3}{19}$	M1	oe allow [0.52, 0.53] or [0.15, 0.16]
	$\frac{10}{19} \times \frac{3}{18}$ (× 2) or $\frac{3}{19} \times \frac{10}{18}$ (× 2) or $\frac{5}{57}$ (× 2) or [0.087, 0.088] (× 2)	M1dep	oe eg $1 \times \frac{10}{19} \times \frac{3}{18}$ or $\frac{30}{342}$ allow [0.52, 0.53] × [0.16, 0.17] or [0.15, 0.16] × [0.55, 0.56]
	$\frac{10}{57}$ or 0.175… or 17.5…%	A1	oe eg $\frac{60}{342}$ SC2 $\frac{7}{38}$ or 0.184… oe
	Additional Guidance		
	$\frac{7}{20} \times \frac{10}{19} \times \frac{3}{18}$	M1M0A0	
	$\frac{7}{20} \times \frac{3}{19} \times \frac{10}{18}$	M1M0A0	
	If more than one product is seen, the correct one(s) must be selected for 2nd M1 $\frac{10}{19} \times \frac{6}{18} + \frac{3}{19} \times \frac{10}{18}$	M1M0A0	
	Both correct products selected but multiplied together scores M1 only $\frac{10}{19} \times \frac{3}{18} \times \frac{3}{19} \times \frac{10}{18}$	M1M0A0	
	Ignore incorrect conversion if correct answer seen		
	5 out of 57 cannot score 2nd M1 but implies 1st M1		
	5 : 57 cannot score 2nd M1 but 1st M1 is possible		
	Answer 10 out of 57	M1M1A0	
	Answer 10 : 57 is A0 but M2 or M1M0 is possible		

Question	Answer	Mark	Comments
19	4×10 or 40 and 2×3 or 6 or $\frac{2}{4}$ and $\frac{3}{10}$ or 0.5 and 0.3	M1	oe eg 50% and 30%
	$\frac{2 \times 3}{4 \times 10}$ or $\frac{\text{their } 6}{\text{their } 40}$ or 0.15	M1dep	oe eg $\frac{3}{20}$ or $\frac{2}{4} \times \frac{3}{10}$ or 0.5×0.3
	15	A1	
	Additional Guidance		
	2 : 4 and 3 : 10		M0

Question	Answer	Mark	Comments
20	$\frac{6n^2}{n} + 2n^3$ or $6n + 2n^3$ or $6n^3 - 6n$	M1	expands one bracket correctly allow $3 \times 2n$ for $\frac{6n^2}{n}$
	$\frac{6n^2}{n} + 2n^3 + 6n^3 - 6n$ or $6n + 2n^3 + 6n^3 - 6n$	M1dep	fully correct expansion allow $3 \times 2n$ for $\frac{6n^2}{n}$
	$8n^3$ and $(2n)^3$	A1	must have seen M1M1 oe eg $8n^3$ and $2n \times 2n \times 2n$ or $8n^3$ and $\sqrt[3]{8n^3} = 2n$ condone $8n^3$ and 2^3n^3
	Additional Guidance		
	Do not allow $\frac{2n^2 \times 3}{n}$ for $\frac{6n^2}{n}$		

Question	Answer	Mark	Comments
21(a)	**Alternative method 1**		
	$y = \frac{k}{\sqrt{x}}$	M1	oe equation implied by $4 = \frac{k}{\sqrt{9}}$ oe
	$(k =)\ 4 \times \sqrt{9}$ or $(k =)\ 12$	M1dep	oe
	$y = \frac{12}{\sqrt{x}}$	A1	oe equation
	Alternative method 2		
	$ky = \frac{1}{\sqrt{x}}$	M1	oe equation implied by $4k = \frac{1}{\sqrt{9}}$ oe
	$(k =)\ \frac{1}{\sqrt{9}} \div 4$ or $(k =)\ \frac{1}{12}$	M1dep	oe
	$\frac{1}{12}y = \frac{1}{\sqrt{x}}$	A1	oe equation
	Additional Guidance		
	Alt 1 $(k =)\ 12$ or $(k\ \alpha)\ 12$ with no incorrect working		M1M1
	Condone use of α for up to M1M1A0 eg (Alt 1) $y\ \alpha\ \frac{k}{\sqrt{x}}$ $k\ \alpha\ 12$ $y\ \alpha\ \frac{12}{\sqrt{x}}$		 M1 M1dep A0
	$y = \frac{12}{\sqrt{x}}$ oe		M1M1A1

Question	Answer	Mark	Comments
21(b)	$\frac{12}{\sqrt{25}}$ or $\frac{\text{their } k}{\sqrt{25}}$	M1	oe their k from (a)
	2.4 or $\frac{12}{5}$ or $2\frac{2}{5}$	A1ft	ft $\frac{\text{their } k}{5}$
	Additional Guidance		
	y α 2.4		M1A0
	$y = \frac{\frac{4}{3}}{\sqrt{x}}$ in (a) $\frac{\frac{4}{3}}{\sqrt{25}}$ $\frac{4}{15}$ (allow [0.266, 0.267])		M1 A1ft

Question	Answer	Mark	Comments
22	$3(x-2)$ or $x^3(x^2-4)$ or $x^2(x^3-4x)$ or $x(x^4-4x^2)$ or $(x^4+2x^3)(x-2)$ or $x^3(x+2)(x-2)$ or $x^2(x^2+2x)(x-2)$ or $x(x^3+2x^2)(x-2)$	M1	numerator or denominator factorised oe eg $x^2(x+2)(x^2-2x)$
	$3(x-2)$ and $x^3(x+2)(x-2)$ or $3(x-2)$ and $(x^4+2x^3)(x-2)$ or $3(x-2)$ and $x^2(x^2+2x)(x-2)$ or $3(x-2)$ and $x(x^3+2x^2)(x-2)$	A1	numerator and denominator factorised each with factor $(x-2)$
	$\frac{x^3(x+2)}{3}$ or $\frac{x^2(x^2+2x)}{3}$ or $\frac{x(x^3+2x^2)}{3}$ or $\frac{x^4+2x^3}{3}$	A1	oe fully simplified expression eg $\frac{1}{3}x^3(x+2)$ or $\frac{x^4}{3}+\frac{2x^3}{3}$
	Additional Guidance		
	$\frac{x^3(x+2)}{3}$ followed by further incorrect work		M1A1A0
	$\frac{x^3\times(x+2)}{3}$ or $\frac{1}{3}\times x^3(x+2)$		M1A1A0
	$3\times(x-2)$ and $x^3\times(x+2)\times(x-2)$		M1A1
	$3\times(x-2)$ or $x^3\times(x^2-4)$		M1
	$1(3x-6)$ or $-1(6-3x)$		M0
	$-3(2-x)$		M1
	$-3(2-x)$ and $-x^3(x+2)(2-x)$		M1A1

Question	Answer	Mark	Comments
23	$-\frac{1}{3}$ **a**	B1	
	Additional Guidance		
24	Plots at least three of (0, 6) (–1, –1) (–2, –2) (–3, –3) (–4, –10)	M1	points may be implied by a curve passing through the points tolerance ±2 mm
	Plots (0, 6) (–1, –1) (–2, –2) (–3, –3) (–4, –10) and joins with a smooth curve	A1	points may be implied by a curve passing through the points tolerance ±2 mm
	Additional Guidance		
	Draws $y = f(x - 2)$ or $y = f(x) + 2$ or $y = f(x) - 2$		M0A0

Question	Answer	Mark	Comments
25	$\tan 49 = \frac{AC}{16}$	M1	oe eg $\tan(90 - 49) = \frac{16}{AC}$ or $AC^2 + 16^2 = \left(\frac{16}{\cos 49}\right)^2$
	tan 49 × 16 or [18.4, 18.41]	M1dep	oe eg $\frac{16}{\tan(90 - 49)}$ or $\sqrt{\left(\frac{16}{\cos 49}\right)^2 - 16^2}$
	$\frac{\sin x}{\text{their } [18.4, 18.41]} = \frac{\sin 35}{20}$ or $\frac{\text{their } [18.4, 18.41]}{\sin x} = \frac{20}{\sin 35}$	M1dep	oe eg $\frac{\sin x}{16 \tan 49} = \frac{\sin 35}{20}$ dep on 1st M1
	$\sin x = \frac{\sin 35}{20}$ × their [18.4, 18.41]	M1dep	oe eg $\sin x = \frac{16 \tan 49 \sin 35}{20}$ or $\sin^{-1}\left(\frac{\sin 35}{20} \times \text{their } [18.4, 18.41]\right)$ or $\sin^{-1}$ [0.527, 0.528] dep on 1st and 3rd M1
	[31.8, 31.9]	A1	allow 32 with full method seen
	Additional Guidance		
	Answer [31.8, 31.9] possibly from scale drawing		5 marks
	Answer 32 possibly from scale drawing		Zero

Question	Answer	Mark	Comments
26	$\frac{x^2-2}{x^2-2+2}$ or $\frac{x^2-2}{x^2}$	M1	
	$\frac{x^2}{x^2}-\frac{2}{x^2}$ or $1-\frac{2}{x^2}$	A1	implied by correct final answer must be two terms oe eg $x^2x^{-2}-2x^{-2}$
	$1-2x^{-2}$ or $a = 1$ and $b = -2$ and $n = -2$	A1	
	Additional Guidance		

Question	Answer	Mark	Comments
27	$\frac{1}{64} = k^3$ or $\sqrt[3]{\frac{1}{64}}$	M1	oe equation in k
	$(k =) \frac{1}{4}$ or $(k =) 0.25$	A1	must see working for M1 implied by $y = \left(\frac{1}{4}\right)^x$ $\left(\frac{1}{4}\right)^3 = \frac{1}{64}$ is M1A1
	$\left(\frac{1}{4}\right)^{\frac{1}{2}} = \frac{1}{2}$ or $0.25^{\frac{1}{2}} = 0.5$	A1	must see working for M1A1 allow $\sqrt{\frac{1}{4}} = \frac{1}{2}$ or $\sqrt{0.25} = 0.5$
	Additional Guidance		

Question	Answer	Mark	Comments
28(a)	0.25 or $\frac{1}{4}$ or $\frac{2}{8}$	B1	
	m/s^2 or ms^{-2} or m/s/s or $\frac{m}{s^2}$	B1	oe eg metres per second per second SC2 acceleration and unit not in m/s^2 eg 25 cm/s^2 or 3240 km/h^2
	Additional Guidance		
	$\frac{2}{14-6}$ with no further simplification		(1st) B0
28(b)	**Alternative method 1**		
	$\frac{1}{2} \times 6 \times (v-2)$ or $\frac{1}{2} \times (14-6) \times (v+v-2)$ or $(14-6) \times (v-2)$ or $\frac{1}{2} \times (14-6) \times 2$ or 8	M1	oe partial area any letter
	$\frac{1}{2} \times 6 \times (v-2)$ $+ \frac{1}{2} \times (14-6) \times (v+v-2)$ or $3(v-2) + 8(v-2) + 8$ or $11v - 14$	M1dep	oe full area in one variable eg $14 \times v - \frac{1}{2} \times 6 \times (v-2)$ $- \frac{1}{2} \times 2 \times (6+14)$ implies M2
	$\frac{1}{2} \times 6 \times (v-2)$ $+ \frac{1}{2} \times (14-6) \times (v+v-2) = 80$ or $94 \div 11$	A1	oe full area in one variable equated to 80
	8.5(4…) or 8.55 or $\frac{94}{11}$ or $8\frac{6}{11}$	A1	

Alternative method and Additional Guidance continued on the next page

Question	Answer	Mark	Comments
28(b) cont	**Alternative method 2**		
	$\frac{1}{2} \times 6 \times x$ or $\frac{1}{2} \times (14 - 6) \times (x + x + 2)$ or $(14 - 6) \times x$ or $\frac{1}{2} \times (14 - 6) \times 2$ or 8	M1	oe partial area x is the speed at 6 seconds any letter
	$\frac{1}{2} \times 6 \times x$ $+ \frac{1}{2} \times (14 - 6) \times (x + x + 2)$ or $3x + 8x + 8$ or $11x + 8$	M1dep	oe full area in one variable eg $14 \times (x + 2) - \frac{1}{2} \times 6 \times x$ $- \frac{1}{2} \times 2 \times (6 + 14)$ implies M2
	$\frac{1}{2} \times 6 \times x$ $+ \frac{1}{2} \times (14 - 6) \times (x + x + 2) = 80$ or $72 \div 11$ or 6.5(4…) or 6.55 or $\frac{72}{11}$ or $6\frac{6}{11}$	A1	oe full area in one variable equated to 80
	8.5(4…) or 8.55 or $\frac{94}{11}$ or $8\frac{6}{11}$	A1	
	Additional Guidance		
	First M1 Do not allow 8 from 14 – 6		
	Ignore units throughout		