AQA

GCSE
Mathematics

93702F Applications of Mathematics
Unit 2: Foundation Tier
Mark scheme

93702F

June 2015

Version V1 Final Mark Scheme

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.

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 within the scheme 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.
3.14 …	Allow answers which begin 3.14 eg 3.14, 3.142, 3.149.
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 candidate has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the candidate. In cases where there is no doubt that the answer has come from incorrect working then the candidate should be penalised.

Questions which ask candidates to show working
Instructions on marking will be given but usually marks are not awarded to candidates who show no working.

Questions which do not ask candidates to show working
As a general principle, a correct response is awarded full marks.

Misread or miscopy
Candidates often copy values from a question incorrectly. If the examiner thinks that the candidate 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.

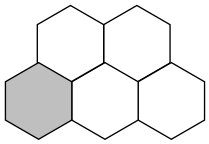
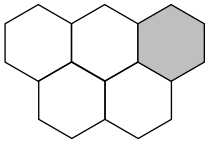
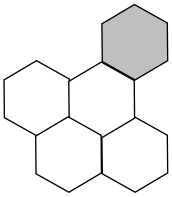
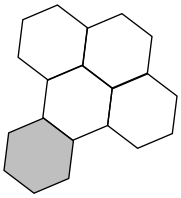
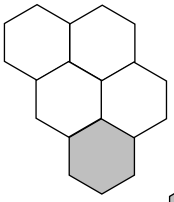
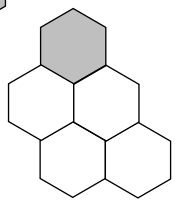
Choice
When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

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.

Q	Answer	Mark	Comments
1(a)	grams	B1	
1(b)	kilometres	B1	
1(c)	square metres	B1	

Q	Answer	Mark	Comments
2(a)	2	B1	
2(b)	 or  or  or  or  or 	B1	Allow if intention clear Must add exactly one hexagon

Q	Answer	Mark	Comments
2(c)	12 or 16.8(0) or 13.8(0) or (£)1.61 seen	B1	12 could be on diagram
	their 12 × 1.4 × 1.15 or their 16.8(0) × 1.15 or their 13.8(0) × 1.4	M1	
	19.32	A1ft	ft B0 M1 only
	Additional guidance		
	Some candidates round part way through the calculation Examples		
	12 × 1.4 = 16.8 = 17 17 × 1.15 = 19.55	B1M1A0	
	12 × 1.4 = 16.8 17 × 1.15 = 19.55	B1M1A0	

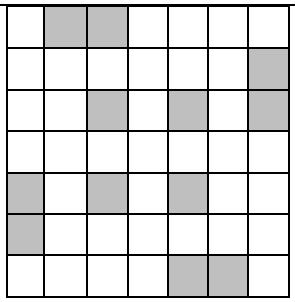
Q	Answer	Mark	Comments
3	16 × 0.45 or 7.2(0) or 16 × 45 or 720	M1	
	10 – their 7.2(0) or 2.8(0) or 1000 – their 720 or 280	M1	
	4 (coins) and £2, 50p, 20p, 10p seen	A2	A1 £2, 50p, 20p, 10p seen or more than 4 coins with total £2.80 with number of coins given A1ft M2 scored and smallest number of coins for their £2.80 with number of coins given
	Additional guidance		
	All coins must be real		
	To obtain A2 must score M2 **and** give the four correct coins **and** 4 (coins)		
	To obtain A1 must score M2 **and** give the four correct coins		
	To obtain A1ft must score M2 and give the smallest number of coins with total their £2.80 together with the number of coins Examples		
	16 × 0.45 = £7.20 £10 – £7.20 = £3.80 £2, £1, 50p, 20p, 5p and 5p		M1 M1 A0ft
	16 × 0.45 = £7.20 £10 – £7.20 = £3.80 £2, £1, 50p, 20p, 10p and 5 (coins)		M1 M1 A1ft

Q	Answer	Mark	Comments
4	✓ ✗ ✗ ✓	B3	B2 3 correct B1 2 correct
5(a)	$13\frac{1}{2}$ seen	B1	Attempt at area e.g. counting squares counting squares in 5's
	their $13\frac{1}{2} \times 5$ or their $13 \times 5 + 2.5$	M1	oe
	$67\frac{1}{2}$	A1ft	oe ft B0M1 SC2 840
	Additional guidance		
	For B1 allow dots or numbers seen in the squares a value of 13 or 14 if clearly **not** a perimeter do not allow dashes on the edges of the diagram		

Q	Answer	Mark	Comments
5(b)	Line joining midpoints of *AB* and *AD*	B2	B1 line joining midpoint of *AB* to *AD* or line joining midpoint of *AD* to *AB* or midpoints of *AB* and *AD* identified
	Additional guidance		
	Allow an un-ruled line if the intention clear a tolerance of ± 2 mm at the end of the line		
5(c)	cross 8 squares from *C* and 4 squares from *B* allow a tolerance of ± 2 mm	B2	B1 cross 8 squares from B and 4 squares from C or 12 ÷ 3 or 4 or 8 seen
	Additional guidance		
	Cross must be on the line *BC* ± 2 mm		

Q	Answer	Mark	Comments
6(a)	[104, 106]	B1	
6(b)	[72, 74]	B2	B1 160 (pounds) or B1ft correct answer from their 160 pounds Allow ± ½ small square SC1 70
	Additional Guidance		
7	**Alternative method 1**		
	18 × 12 or 216 or 18 × 12 – 15 or 201	M1	
	their 201 × 6.25	M1dep	their 201 is not either 216 or 231
	1256.25	A1	
	Alternative method 2		
	18 × 12 × 6.25 or 1350 or 15 × 6.25 or 93.75	M1	
	their 1350 – their 93.75	M1dep	must be two amounts of money
	1256.25	A1	
	Additional Guidance		
	For 18 × 12 + 15 or 231 allow M1 only		

Q	Answer	Mark	Comments
8(a)	45 minutes	B3	B2 Job A → 2 h or 120 min and Job B → 1 h 15 min or 75 min B2ft Job A → 2 h or 120 min and correctly works out in minutes 2 h – their Job B time or Job B → 1 h 15 min or 75 min and correctly works out in minutes their Job A time – 1 h 15 min B1 Job A → 2 h or 120 min or Job B → 1 h 15 min or 75 min B1ft their Job A time – their Job B time correctly worked out in minutes
	Additional Guidance		
	Decimal time For example Allow 2.00 for 2 hours Allow 1.15 or 1 h 15 for 1 h 15 min only if it is clearly used as 1 h 15 min in a subsequent calculation		
	Examples		
	3.00× – 1.15× = 1.85× = 145 minutes×	B0	
	2.00✓ – 1 h 15× = 0.85× = 85 minutes×	B1	
	3.00× – 1 h 15✓ = 1.45✓ = 145 minutes×	B1	
	3.00× – 1.15✓ = 1.45✓ = 105 minutes✓	B2	
	2.00✓ – 1.15✓ = 0.45✓ = 45 minutes✓	B3	
	2.00✓ – 1.15✓ = 0.45✓	B2	
	2.00✓ – 1.15× = 0.45 h×	B1	

Q	Answer	Mark	Comments
8(b)	**Alternative method 1**		
	36 ÷ 60 × their 45	M1	oe
	27	A1ft	ft their 8(a)
	Alternative method 2		
	their 2 × 36 – their 1.25 × 36	M1	oe
	27	A1ft	ft their 8(a)
	Additional Guidance		
	Follow through For **any** fraction of an hour in 8(a) could score up to M1A1ft For a whole number of hours in 8(a) could score up to M1 **only** **Decimal times** Allow decimal times for M1 Examples		
	2 × 36 – 1.15 × 36 = 30.6		M1A0
9		B2	B1 all correctly shaded on outside or all correctly shaded on inside or as B2 with or without the centre square shaded and up to 12 other squares shaded to give a pattern with rotational symmetry of order 4
	Additional guidance		
	Ignore the practise grid unless the answer grid is blank		

Q	Answer	Mark	Comments
10	Two 'vertical' lines from base of length 8 cm ± 0.2 cm	B1	
	Right angles (± 2°) drawn at ends of base	B1	
	Semicircle of diameter 6 cm ± 0.2 cm at 'top' of rectangle	B1	
	Additional guidance		
11(a)	$3\frac{1}{2}$ or 3.5	B1	
11(b)	60	B1	
11(c)	'After leaving Madrid' ticked and larger gradient	B1	Examples of equivalent reasons 1 steeper line 2 same time to travel a longer distance or B1ft 'After leaving Madrid' ticked and their 60 and 90
	Additional guidance		
	Only ft if using their 60 from part (b) in their reason		

Q	Answer	Mark	Comments
11(d)	**Alternative method 1**		
	8 km = 5 miles or 1 km = [0.62, 0.63] miles or 1 km = 0.6 miles or 1 mile = [1.6, 1.61] km	B1	May be implied in working oe
	104 ÷ 8 × 5 or 104 × [0.62, 0.63] or 104 × 0.6 or 104 ÷ [1.6, 1.61]	M1	Uses their conversion factor oe
	65 or [64.4, 65.52] or [64.5, 65]	A1	Use value from their M1 calculation
	Alternative method 2		
	8 km = 5 miles or 1 km = [0.62, 0.63] miles or 1 km = 0.6 miles or 1 mile = [1.6, 1.61] km	B1	May be implied in working oe
	60 ÷ 5 × 8 or 60 ÷ [0.62, 0.63] or 60 ÷ 0.6 or 60 × [1.6, 1.61]	M1	Uses their conversion factor oe
	96 or [95.2, 96.8] or [96, 96.6]	A1	Use value from their M1 calculation
	Additional guidance		
	For B1 and M1 → allow conversions to 1 decimal place For M1 allow incorrect conversion factors **only** if they have been stated in the working have **not** been stated but are in the following ranges 1 km = [0.5, 0.7] miles 1 mile = [1.5, 1.7] km but **not** 1.7 if it is clearly from 104 ÷ 60 = 1.73 rounded down For A1 → answers must be in the ranges given and be compatible with the conversion factors used Reversing the conversion factor, e.g. using 1 mile = 0.6 km etc, scores B0 but can score M1		

Q	Answer	Mark	Comments
12(a)	$20 \times 20 \times 20 \times 64 = 512\,000$ or $512\,000 \div (20 \times 20 \times 20) = 64$ or $512\,000 \div 64 = 20 \times 20 \times 20$ or $20^3 \times 64 = 512\,000$ or $512\,000 \div 20^3 = 64$ or $512\,000 \div 64 = 20^3$	Q2	Strand (ii) Correct completion of argument Q1 $20 \times 20 \times 20$ or 20^3 or $512\,000 \div 64$ or 8000 seen
	Additional guidance		
	To score Q2 there must be a clear connection between 8000 and $20 \times 20 \times 20$ or 20^3 Example $512\,000 \div 64 = 8000$ and $20 \times 20 \times 20 = 8000$ scores Q2		

12(b)	128 × 100 or 12 800	M1	oe	
	40	A1		
	Additional guidance			
	12 800 × 40 = 512 000			M1A0
	12 800 × 40 = 512 000 Answer 40			M1A1

Q	Answer	Mark	Comments
12(c)	128 ÷ 20 or 6.4 or 6 or 100 ÷ 20 or 5 or their 40 ÷ 20 or 2	M1	or 20 × 6 = 120 or 20 × 5 = 100 or 20 × 2 = 40
	their 6 × their 5 × their 2 or 6 and 5 and 2	M1	their 6 and their 5 and their 2 must be integers and rounded up or down their 2 is the answer to their 40 ÷ 20 rounded up or down
	60	A1ft	ft their 40
	Additional guidance		
	Check for correct integers on the diagram for M1 or M1M1		

13	210 ÷ 6 × 4 or 210 ÷ 3 or 70 and 210 – their 70	M1	oe
	140	A1	
	Additional guidance		
	Using $^{2}/_{3}$ (or $^{4}/_{6}$) as a decimal		
	210 × 0.66 = 138.6 or 210 × 0.67 = 140.7		M1A0
	210 × 0.6666 = 139.986 or 210 × 0.6667 = 140.007 with rounded answer 140		M1A0
	210 × 0.6666 with answer 140		M1A1
	210 × 0.6 = 126		M0A0

Q	Answer	Mark	Comments
14(a)	3×9 has a units digit of 7 or $3 \times 9 = 27$	B1	oe
	Additional guidance		
	Ignore further work if not contradictory Example		
	3 and 9 are both prime and $3 \times 9 = 27$		B1
	Allow equivalent answers Examples		
	$13 \times 19 = 247$		B1
	$27 \div 9 = 3$ or $247 \div 13 = 19$		B1
14(b)	89 and 73	B2	B1 two prime numbers that multiply to give an integer with units digit 7 e.g. 1 83 and 79 e.g. 2 31 and 37 e.g. 3 $17 \times 11 = 187$ e.g. 4 $43 \times 19 = 817$ or divides 6497 by a prime number other than 2 or 5
	Additional guidance		
	The answer to a multiplication or division need not be shown		
	Award B1 for one correct in a list of responses		
	If 14(b) is blank check 14(a) and award any available marks		

Q	Answer	Mark	Comments
15(a)	$5x = 2x + 12$	B1	

15(b)	4	B2ft	B1ft $3x = 12$ oe ft their equation from (a) for B2 or B1
	Additional guidance		
	If $5x = 2x + 6$ or $2x = 5x - 6$ in part (a) → 2 scores B2 and $3x = 6$ oe scores B1		
	If $5x = x + 12$ in part (a) → 3 scores B2 and $4x = 12$ oe scores B1		
	If 0 marks are scored in (a) The correct solution for **any** equation in (a) can score up to B2		
	If 1 mark is scored in (a) The correct solution for **any** equation other than $5x = 2x + 12$ in (a) can score B1 max		
	Award B1ft for the correct rearrangement of the equation separating x terms and numbers on opposite sides of the equation, e.g. $5x - x = 12$ from $5x = x + 12$		
	Answers only Answer 4 only **always** scores B2 Answer 2 only or answer 3 only scores B2 **only** if it is compatible with their answer to 15(a)		

Q	Answer	Mark	Comments
15(c)	**Alternative method 1**		
	54	B1ft	ft $9x + 18$ evaluated correctly for their value of x in (b) Only ft their value of x in (b)
	their 54 and 50 and Yes	Q1ft	only ft their value of x in (b) Strand (iii) Correct evaluation of $9x + 18$ with correct ft decision made SC1 their 48 and 50 and correct decision
	Alternative method 2		
	54	B1ft	ft $9x + 18$ evaluated correctly for their value of x in (b) only ft their value of x in (b)
	their 10.8 and Yes or their 54 ÷ 5 = 10 and Yes **AND** their 5.4 and Yes or their 54 ÷ 10 = 5 and Yes	Q1ft	only ft their value of x in (b) Strand (iii) Correct evaluation of $9x + 18$ and correct evaluation of their 54 ÷ 5 or their 54 ÷ 10 with correct ft decision made SC1 their 9.6 and correct decision or their 48 ÷ 5 = 9 and correct decision or their 4.8 and correct decision or their 48 ÷ 10 = 4 and correct decision
	Additional guidance		
	Alternative method 1 → must see 50 as well as their 54 and correct ft decision for Q1ft		
	Decision may be implied → e.g. 54 > 50 does **not** imply yes		
	If the numbers of apples in bags C and D are equal allow either $12x + 6$ or $6x + 30$ for $9x + 18$		
	their 48 → the correct evaluation of $9x + 12$ for their x		

Q	Answer	Mark	Comments
16(a)	[228, 232]	B1	
16(b)	36 + 39 or 75	M1	
	their [9.8, 10.2] × 5 or [49, 51]	M1	
	[24, 26]	A1	SC1 16
	Additional guidance		
	2nd M1 their [9.8, 10.2] × 5 or [49, 51] can be *CD* → [5.8, 6.2] × 5 or [29, 31] *BC* or *AD* → [6.4, 6.8] × 5 or [32, 34] *AB* → [8.8, 9.2] × 5 or [44, 46] *BD* → [9.6, 10] × 5 or [48, 50] If a length is measured incorrectly and the incorrect length is stated and linked then their [9.8, 10.2] can be the given incorrect length The link could be on the diagram. Example		
	AC = 10.5 or *AC* drawn with 10.5 next to it on diagram 10.5 × 5 = 52.5 and 36 + 39 = 75 75 – 52.5 = 22.5		M1M1A0
17(a)	A → 3 and B → 2 and C → 4 and D → 1	B2	B1 Any two or three correct
17(b)	(Graph) 3	B1	Allow A and 3

Q	Answer	Mark	Comments
18(a)	Straight line joining (0, 40) and (100, 70) Allow ± ½ small square at (0, 40) and at (100, 70)	B2	B1 straight line with positive gradient passing through (0, 40) or straight line with positive gradient passing through (100, 70) or straight line with gradient 0.3 or coordinates of any two points on line identified on graph or in working
	Additional guidance		
	To check gradient use their endpoints. Allow tolerance [0.28, 0.32]. B2 → their line must span 0 cards to 100 cards		
18(b)	**Alternative method 1**		
	56 or their [54, 56]	M1	ft their graph for [54, 56] from 50 cards Allow ± ½ small square
	[110, 112]	A1ft	ft 56 + their [54, 56]
	Alternative method 2		
	56 or 40 + 0.3 × 50 or 55	M1	oe, e.g. 40 + 3 × 5
	111	A1	
	Additional guidance		
	Alternative method 1 their 55 can be from a horizontal line e.g. charge = 40, a line with negative gradient or a curve		

Q	Answer		Mark	Comments
18(c)	**Alternative method 1**			
	50 + 0.6 × 150 or 50 + 6 × 15 or 90	(130 – 50) ÷ 0.6	M1	oe, e.g. 110 + 0.6 × 50 or 110 + 6 × 5
	(150 cards cost) (£)140 and No	(Only) 133 (.3 …) (cards) (can be bought for £130) and No	A1	
	Alternative method 2			
	110 + 80 – 50 (from 100 cards → (£)110 and 50 cards = (£)80)		M1	oe, e.g. 2 × 95 – 50 (from 75 cards → £95) or 3 × 80 – 2 × 50 (from 50 cards → £80)
	(150 cards cost) (£)140 and No		A1	
	Alternative method 3			
	(100 (cards) → (£)110) 110 (cards) → (£)116 120 (cards) → (£)122 130 (cards) → (£)128 (140 (cards) → (£)134) (150 (cards) → (£)140)		M1	oe, e.g. 130 (cards) → (£)128 implies all previous values
	(150 cards cost) (£)140 and No or (140 cards cost) (£)134 and No		A1	or 130 cards → (£)128 and No → £2 is not enough (to buy 20 more cards) oe or 130 cards → (£)128 and No → £2 can only buy 3 more cards oe
	Additional guidance			
	Decision (No) must be seen for A1			

Q	Answer	Mark	Comments
19(a)	30 ÷ 24 or 6 ÷ 24 or 15 (min) or 0.25 or 60 ÷ 24 × 30	M1	oe
	1.25 (h) or 75 (min)	A1	oe
	1 h 15 min	B1ft	ft their time SC2 1 h 25 min
	Additional guidance		
	Do not award B1ft if their time is a whole number of hours if their time is in minutes < 60 min Examples		
	24 ÷ 30 = 0.8 = 80 min = 1 h 20 min		M0A0B1ft
	24 ÷ 30 = 0.8 = 1 h 20 min		M0A0B0
	24 ÷ 30 = 0.8 (0.8 × 60 =) 48 min		M0A0B1ft

Q	Answer	Mark	Comments
19(b)	$16^2 + 30^2$ or 256 + 900 or 1156	M1	
	$\sqrt{16^2 + 30^2}$	M1dep	
	34	A1	SC1 [25.3, 25.4]
	Additional guidance		
	Example 1		
	32 + 60 = 92 $\sqrt{92}$ = 9.59		M0M0A0
	Example 2		
	16^2 = 32 and 30^2 = 60 32 + 60 = 92 $\sqrt{92}$ = 9.59		M1M1A0