



GCSE

Mathematics

93652F Methods in Mathematics

Unit 2: Foundation Tier

Mark scheme

93652F

June 2015

Version 1.0 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.

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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 <i>a</i> and <i>b</i> 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

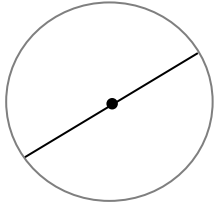

Erased or crossed out work that is still legible should be marked.

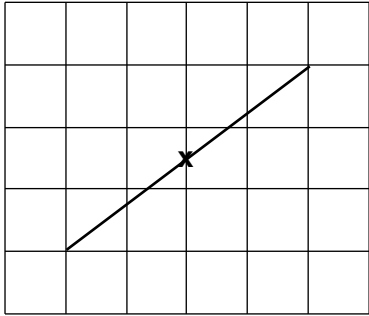
Work replaced

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

Premature approximation

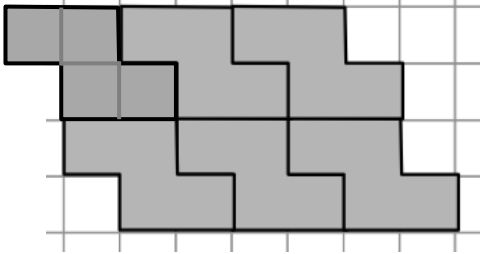
Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Q	Answer	Mark	Comments
1(a)		B1	Any line passing through centre and touching circumference at each end. If not ruled must be within $\pm 1\text{mm}$ tolerance. Allow ONE end of line to extend beyond by 1 mm
1(b)		B1	Must be drawn on the circle. Accept arc being drawn as part of sector if arc clearly identified e.g. labelled or drawn thicker than radii and sector not shaded.
2	An obtuse value for x and an acute value for y that have a total of 180°	B2	B1 for an obtuse value for x and an acute value for y that do not have a total of 180° B1 if x is acute and y is obtuse and total is 180° Any answer including one or both angles as 90° B0
3(a)	4 squares shaded	B1	Allow any indication of 4 squares eg ticks
3(b)	$\frac{1}{3}$	B1	
3(c)	1 : 2	B1ft	Correct answer or ft their fraction from (b)
4(a)	17	B1	
4(b)	72	B1	
4(c)	$3 \times (4 + 2 - 6)$	B1	

Q	Answer	Mark	Comments
5(a)	16.45 or $\frac{329}{20}$ or $\frac{9}{20}$	B1	oe
5(b)	$6\sqrt{10}$ or 18.9736.....	B1	If decimal answer given, must be at least 4 digits after the decimal point.
5(c)	18.974	B1ft	ft their answer to (b) if given to at least 4dp or given as a root that has more than 4 dp when written as a decimal
	Additional Guidance		
	(b) $\sqrt{360} = 2\sqrt{95}$ (c) 19.494 (b) $\sqrt{360} = 19.973$ (c) 19.973 (b) $\sqrt{360} = 19.74841766$ (c) 19.748	B0, B1ft B0, B0ft B0, B1ft	
6	3 and 11	B2	B1 any pair of number that add to 14 B1 any pair of number with a difference of 8
7(a)		B1	± 1mm
7(b)	Any correct perpendicular line	B1	Line does not have to intersect line on diagram.

Q	Answer	Mark	Comments
8(a)	12	B1	
8(b)	36	B1	
8(c)	27	B1	
8(d)	17	B1	
9(a)	$7\frac{1}{2}$	B1	oe Allow 4 on answer line if 7.5 seen to the right of 11. If answer line is blank, allow 7.5 to the right of 11.
9(b)	Goes down by 3.5, $3\frac{1}{2}$	B1	oe
	Additional Guidance		
	Any indication that the student realises it decreases by 3.5 eg – 2 then – 1.5	B1	
	$-4 + \frac{1}{2}$	B1	
	–3 and a half	B1	
	$-3.5n + 28.5$	B1	
	$x = -3.5$	B1	
$n - 3.5$	B0		
$-3 + \frac{1}{2}$	B0		

Q	Answer	Mark	Comments
9(c)	-3	B1	Accept 9 th term
9(d)	Yes ticked and an indication that $3 \times 81 = 243$ (243 could be seen in sequence) and $3 \times 243 = 729$	Q1	Strand (ii) oe $729 = 3^6$
	Additional guidance		
	$9 \times 81 = 729$ Multiples of 3 and/or 9 $729 \div 3 = 243$	Q1 Q0 Q0	Unless 243 is seen in sequence
10(a)	D	B1	
10(b)	B and E	B2	B1 for 1 correct
10(c)	C	B1	
10(d)	No ticked and reference to all perimeters being 10 apart from A which is 8	B1	oe Ignore incorrect units
	Additional Guidance		
	Recognising B, C, D and E are all the same and A is different (no perimeters given)	B1	
	A only has 8	B1	Implies others are different
	A correct and one other correct	B1	Could be B is 2 more than A
	A and B are different	B1	
	8 and 10 stated	B1	
A has a perimeter of 8	B0		
They all have different perimeters	B0		

Q	Answer	Mark	Comments	
10(e)		B1	<p>Enough of shape E (at least 5) drawn to show tessellation.</p> <p>e.g. 2 horizontal rows or 2 diagonal rows or any single shape enclosed and tessellation could be continued.</p>	
11	$3 \times 8 \times 5$ or $5 \times 5 \times 5$	M1	3×8 and 5×5	
	120 and 125	A1	24 and 25	
	Correct conclusion based on their volumes if M1 awarded and one of the volumes is correct If correct Cube	Q1	Strand (iii) Must be a value for both volumes	
	Additional Guidance			
	Volume cuboid = $3 \times 8 \times 5 = 130$ Volume cube = $5^3 = 125$ So cuboid is bigger	M1, A0, Q1		
	Volume cuboid = $3 \times 8 \times 5 = 124$ Volume cube = $5^3 = 125$ So cuboid is bigger	M1, A0, Q0		
	Volume cuboid = $3 \times 8 \times 5 = 124$ Volume cube = $5^3 = 125$ So cuboid is bigger	M1, A0, Q0		
Volume cuboid = 130 Volume cube = 150 So cube is bigger	M0, A0, Q0			

Q	Answer	Mark	Comments
12	<p>A</p> <p>B</p> <p>C</p> <p>D</p>	B2	<p>In A and B 1 and 2 are fixed. 3 and 4 can be symmetrical about the dashed line.</p> <p>In C 1, 2, and 3 are fixed. 4 can be symmetrical about the dashed line.</p> <p>In D there is only one answer.</p> <p>Maximum of B1 if no line of symmetry shown.</p> <p>B1 if incorrect number of squares shaded and one line of symmetry present and drawn on.</p>

Q	Answer	Mark	Comments
13		B2	B1 any face correct
14(a)	(4, 9)	B1	
14(b)	(4, a) where $a > 5$ and $a \neq 9$	B1	
15	3×12 or 36 or $2 \times 12 + 8$ or 32 seen	M1	
	36, 30 and 32	A1	
	Triangle B and all 3 of 36 and 30 and 32 seen	Q1ft	Strand (ii) ft only if two perimeters are correct and 3 values seen
	Additional Guidance		
	$3 \times 12 = 36$, $5 + 12 + 13 = 30$, $12 + 8 = 20$. Triangle C $3 \times 12 = 24$, $5 + 12 + 13 = 30$, $12 + 8 + 12 = 32$. Triangle A 36 , $5 + 12 + 13 = 30$, $12 + 8 + 8 = 28$, Triangle C Any use of area	M1, A0, Q1ft M1, A0, Q1ft M1, A0, Q1ft M0, A0, Q0	

Q	Answer	Mark	Comments
16(a)	4×3.25 or 13 or 2×3.25 or 6.5	M1	$8x^2$
	84.5	A1	oe
16(b)	$2 \times 4x + 2 \times 2x$	M1	oe allow invisible brackets $2 \times 4x + 2x$
	$12x$	A1	SC1 $6x$
	Additional guidance		
	$12x$ seen as part of an equation eg $12x = 84.5$	M1 A0	
17	$180 - 120$ or 60	M1	
	$360 - (130 + 90 + \text{their } 60)$	M1	Allow invisible brackets.
	80	A1	
18	$2 \times \pi \times 15$	M1	oe
	[94, 94.3] or 30π	A1	Correct answer only full marks
	Additional Guidance		
	Wrong formula is M0, A0. Be careful of $\pi \times 15^2 = 30\pi$ which is M0, A0		
	$2 \times \pi \times 15$ 30π $30\pi \div 2 = 15\pi = [47, 47.15]$	Correct formula followed by incorrect work	M1 A0
	$\frac{1}{2} \times 2 \times \pi \times 15$ 15π	Incorrect formula	M0 A0

Q	Answer	Mark	Comments
19	9×6 or 9×11 or $\frac{9}{2} \times 11$ or $\frac{1}{2} \times 9 \times 5$ or $\frac{1}{2} \times \frac{9}{2} \times 5$ or $\frac{1}{2} \times \frac{9}{2} \times (11 + 6)$	M1	54 or 99 or 49.5 or 22.5 or 11.25 or 38.25
	$9 \times 6 + \frac{1}{2} \times 9 \times 5$ or $9 \times 11 - 2 \times \frac{1}{2} \times \frac{9}{2} \times 5$ or $2 \times \frac{1}{2} \times \frac{9}{2} \times (11 + 6)$	M1dep	54 + 22.5 or 99 – 22.5 or 2 × 38.25
	76.5	A1	Allow 76 or 77 after 76.5 seen
20(a)	125	B1	
	Corresponding	B1	Allow B1 for fully complete method eg alternate angle and straight line.
20(b)	75	B1	
21(a)	Fully correct enlargement	B2	B1 for 2 correct sides B1 for a fully correct enlargement scale factor 2, 3 or 5
	Additional guidance		
	If shape is continued off the grid, and two correct sides seen on the grid	B1	

Q	Answer	Mark	Comments
21b	Reflection, Reflected, Reflect	B1	Allow poor spelling if meaning clear
	$x = -1$ written or drawn and labelled as $x = -1$	B1	Must have $x =$
	Additional Guidance		
	Ignore any linking words such as 'in', 'on', 'about', 'over', 'by'		
	Mirror about $x = -1$	B0, B1	
	Relefted in $y = -1$	B1, B0	
	Reflex in $x - 1$	B1, B0	
	Flipped over $x - 1 = 0$	B0, B0	
22	Any correct parallelogram, eg base 10, height 2	B2	B1 Any other parallelogram B1 for a rectangle of area 20 cm^2
23	$405 \div 27$ or 15	M1	oe
	3 and 5	A1	Correct answer only full marks
	Additional Guidance		
	Trial and improvement must be completely correct to score		
	No working 1, 15		M1 (by implication) A0
	No working 2, 13		M1 (by implication) A0

Q	Answer	Mark	Comments
24	$\pi \times 20^2$ seen	M1	
	$\pi \times 20^2 \times 45$ or [55 800, 56556] or 18000	M1dep	oe
	18000 π or 18000 $\times \pi$ or π 18000	A1	Allow [55 800, 56556] seen after 18000 π but not any other further numerical work.
	Be careful as 1800 π can come from circumference and curved surface area $2\pi rh$		
	$\pi \times 20^2 = 40\pi$ $40\pi \times 45$ 1800 π		M1 M1dep A0
	$2 \times \pi \times 20$ $40\pi \times 45$ 1800 π		M0 M0dep A0

Q	Answer	Mark	Comments
25	$10(x + 7) + 3x$ or $13 \times x + 7 \times 10$	M1	oe Excess in black rods = 7×10 or 70
	Their $10(x + 7) + 3x = 343$	M1dep	$343 - \text{their } 70$ or 273
	$13x = 273$	A1	$273 \div 13$
	21	Q1ft	Strand (ii) ft their equation or $343 - \text{their } 70$ if both Ms awarded and no further errors or correct answer. SC2 38.5 from $5(x + 7) + 3x$
	Trial and improvement must be fully correct to score		
	$10(x + 7) + 3x$ $13x + 7 = 343$ $13x = 336$ $x = 25.8$	M1 M1dep A0 Q1ft	
	Extra black = $7 \times 10 = 70$ $343 - 70 = 263$ $263 \div 13$ 20.2	M1 M1dep A0 Q1ft	
26(a)	24	B1	
26(b)	$\left(\frac{3}{8} = \right) \frac{9}{24}$ or $\left(\frac{5}{12} = \right) \frac{10}{24}$ or any correct fraction with denominator a common multiple of 8 and 12	M1	$\frac{5}{12} \pm \frac{3}{8}$ 0.375 and either 0.4166... or 0.417
	$\frac{1}{24}$ or $\frac{19}{24}$ or $\frac{9.5}{24}$	A1	oe $\frac{5}{12} - \frac{3}{8} \div 2$ or $\frac{5}{12} + \frac{3}{8} \div 2$
	$\frac{19}{48}$	B1ft	ft their fraction if cancelled correctly and denominator was a multiple of 24

Q	Answer	Mark	Comments
	$80^2 + 39^2$ or $6400 + 1521$ or 7921	M1	$80^2 - 39^2$ or $6400 - 1521$ or 4879
	$\sqrt{80^2 + 39^2}$ or $\sqrt{their\ 7921}$	M1dep	7921 must be from $80^2 + 39^2$
	89	A1	
Additional Guidance			
	$80^2 + 39^2 = 238$ $\sqrt{238} = 15.4$		M1 M1dep A0
Use of alternative methods must be a full method for M2			
27	$\tan x = 0.4875$ $x = 26^\circ$ $(x =) 80 \div \cos 26$ 89	$39 \div \sin 26$	M2 A1
	$\tan x = 2.05$ $x = 64.01^\circ$ $(x =) 80 \div \sin 64$ 89	$39 \div \cos 64$	M2 A1
	$(x^2 =) 39^2 + 80^2 - 2 \times 39 \times 80 \times \cos 90$ $(x^2 =) 39^2 + 80^2$ $\sqrt{80^2 + 39^2}$ 89	Must know $\cos 90 = 0$ If $\cos 90$ left in expression M0 until $39^2 + 80^2$ seen with no other values	M2 A1