

---

GCSE

# Methods in Mathematics

93652F: Foundation Tier

Mark scheme

---

93652F

June 2016

---

Version: 1.0 Final

---

---

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](http://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.

<b>M</b>	Method marks are awarded for a correct method which could lead to a correct answer.
<b>A</b>	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>B</b>	Marks awarded independent of method.
<b>ft</b>	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
<b>SC</b>	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
<b>M dep</b>	A method mark dependent on a previous method mark being awarded.
<b>B dep</b>	A mark that can only be awarded if a previous independent mark has been awarded.
<b>oe</b>	Or equivalent. Accept answers that are equivalent. eg, accept 0.5 as well as $\frac{1}{2}$
<b>[a, b]</b>	Accept values between <i>a</i> and <i>b</i> inclusive.
<b>3.14...</b>	Allow answers which begin 3.14 eg 3.14, 3.142, 3.149.
<b>Use of brackets</b>	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.

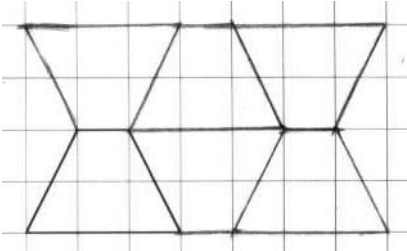
### **Work replaced**

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

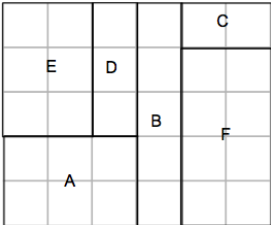
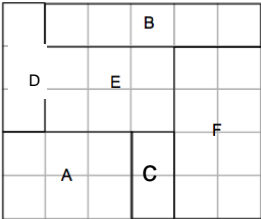
### **Premature approximation**

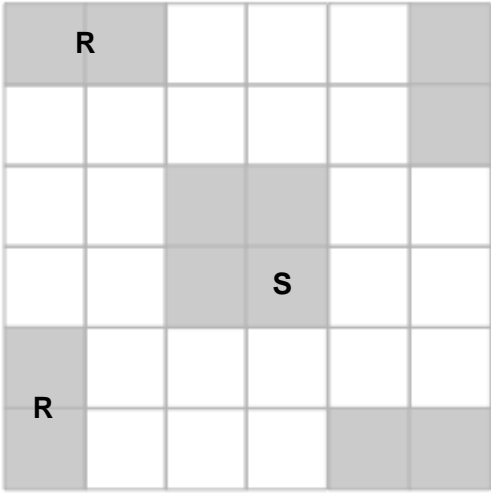
Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Q	Answer	Mark	Comments
1(a)	14	B1	
1(b)	12	B1	
1(c)	13	B1	
2	<b>Alternative method 1</b>		
	(1, 4) or (4, 5) plotted	M1	
	Both (1, 4) and (4, 5) plotted	M1dep	
	(7, 6)	A1	SC2 if coordinates reversed and answer of (6, 7) given but must be a full method and answer SC! for (2.5, 4.5) with no working
	<b>Alternative method 2</b>		
	$4 - 1$ or $5 - 4$	M1	
	$4 - 1$ and $5 - 4$ and one of $4 + \text{their } (4 - 1)$ or $5 + \text{their } (5 - 4)$	M1dep	
	(7, 6)	A1	SC2 if coordinates reversed and answer of (6, 7) give but must be a full method and answer SC! for (2.5, 4.5) with no working
3(a)	9762	B1	
3(b)	2796	B2	B1 for 2976, 2679
4(a)	<i>ED</i> or <i>DE</i>	B1	
4(b)	<i>AB</i> or <i>BA</i> or <i>EF</i> or <i>FE</i>	B1	

Q	Answer	Mark	Comments
5(a)	Any fact that is true for the trapezium It has one line of symmetry It has line symmetry It has no rotational symmetry It has rotational symmetry of order 1	B1	Do not accept 'It is symmetrical' The type of symmetry must be defined
5(b)	At least 5 more trapezia drawn. In two rows or two columns, e.g. 	B2	B1 for two trapezia anywhere in this orientation
6(a)	Straight (not necessarily ruled) line from one side of circle to other passing through centre	B1	Do not award if line extends > 1mm beyond circumference
6(b)	Segment clearly shown (ie shaded)	B1	Do not award if segment shaded > 1mm beyond circumference but allow chord to extend beyond circumference Allow shaded semi-circle
6(c)	Two radii drawn and sector (major or minor) shaded	B1	Allow radii to extend beyond circumference. SC1 if parts (b) and (c) reversed Allow shaded semi-circle unless semi-circle given as answer for 6(b)
7(a)	54	B1	
7(b)	45 or 95	M1	
	140	A1	SC1 for 145 from 150 rounded down

Q	Answer	Mark	Comments
8(a)	A and E	B1	
8(b)	B and F	B1	
8(c)	True	B1	
	False	B1	

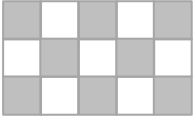
8(d)	 <p>E and D can be reversed or placed horizontally</p>	B2	<p>B1 if any two pieces correctly placed or if grid filled but repeats used</p> <p>If answer grid blank mark practice grids</p> <p>Pieces do not need to be labelled if clearly drawn</p>
	<p>or</p> 		

Q	Answer	Mark	Comments
9(a)	Any isosceles triangle	B1	
9(b)	$5 \times 5$ square	B1	
9(c)		B2	B1 for extra square (S) in centre completing $2 \times 2$ square B1 for two rectangles (R) in corners with no other additional squares added to either rectangle B1 Rotational symmetry of order 4 but more than 5 squares shaded
10	42	B1	
	Angles in a triangle add to $180^\circ$	Q1	oe strand (i)
11(a)	$6x$	B1	
11(b)	$x - 3$	B1	
11(c)	$\frac{x}{4}$	B1	
12(a)	5	B1	
12(b)	250 or 125 or 243 seen	B1	
	250 and 243 both given and indication that 250 or $2 \times 5^3$ is greater or $2 \times 5^2$ or 250 is bigger by 7	B1	Clear indication of selection e.g. could be circled



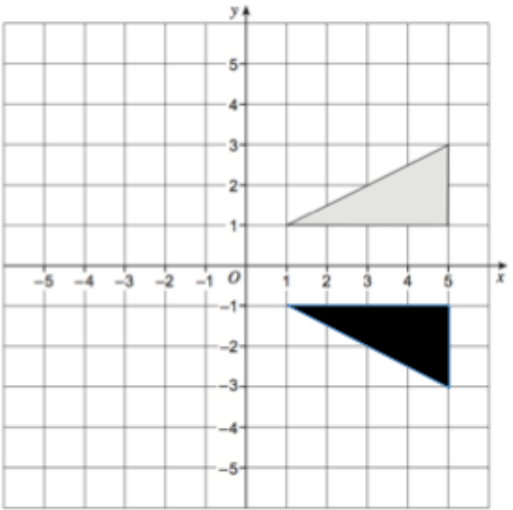
Q	Answer	Mark	Comments
13	<b>Alternative method 1</b>		
	0.45 or 0.55	M1	oe
	158.4 or $352 \times 0.45$ or $352 \times 0.55$	M1dep	oe
	193.6	A1	Ignore any units or extra zeros Ignore rounding (correct or incorrect) after correct answer seen but do not allow any contradictory further work
	<b>Alternative method 2</b>		
	10% = 35.2 or any equivalent percentage and value	M1	oe
	A build up to 45% or 55% of their values as long as a correct combination shown	M1dep	oe
	193.6	A1	Ignore any units or extra zeros Ignore rounding (correct or incorrect) after correct answer seen but do not allow any contradictory further work

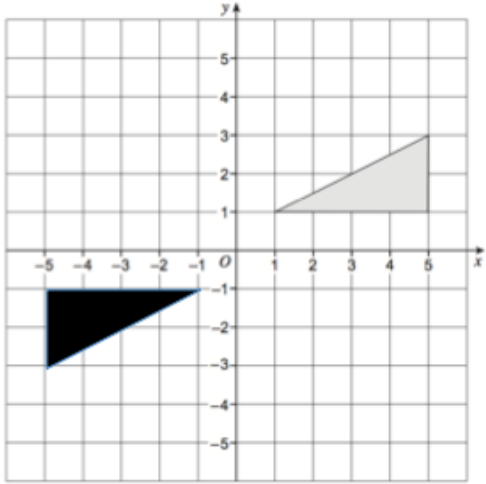
Q	Answer	Mark	Comments
<b>13</b>	<b>Additional Guidance</b>		
	35.2 140.8 $5\% = 35.2 \div 2 = 18.2$ $45\% = 140.8 + 18.2 = 159$ 193		M1  M1dep A0
	35.2 140.8 17.6 $35.2 + 140.8 + 17.6 = 193.6$ 158.4		M1  M1dep A0
	$325 \times 0.45$ 146.25 205.75	Misread	M1 M1dep A0
	$352 \times 0.45 = 158.4$ $352 - 158.4 = 194$		M1, M1dep A1
	$352 \times 0.55 = 193.6$ $352 - 193.6 = 158.4$		M1, M1dep A0

Q	Answer	Mark	Comments
14(a)		B1	
14(b)	Full explanation starting with any given pattern and adding on 3 the appropriate number of times or clear indication that the answer is 26	Q2	strand (ii) Q1 for partial explanation
	<b>Additional Guidance</b>		
	(5, 8, 11, 14), 17, 20, 23, 26 so answer is 26		Q2
	26		Q2
	(5, 8, 11, 14), 17, 20, 23, 26, 29 and 28 is not in the list		Q2
	(5, 8, 11, 14), 17, 20, 23, 26, 29		Q1
	(5, 8, 11, 14), 17, 20, 23, 26		Q1
	Does not double, goes up in threes		Q1
	Because he adds 3 grey tiles each time		Q1
	Pattern 2 isn't double pattern 2 so pattern 8 won't be double pattern 4		Q1
$3n + 2$		Q1	
In pattern 8 there would be 51 tiles in total. The pattern increases by 6 each time		Q0	
It does not double		Q0	
14(c)	32	B1ft	ft the value they give for the number of grey tiles in pattern 8 in (b) + 6
14(d)	$3n + 1$	B1	
15	Correct enlargement	B2	B1 Any enlargement (sf 2 for example) B1 any two adjacent sides correctly enlarged

Q	Answer	Mark	Comments
16(a)	6.38(...) or 6,38(...) or 6.4 or 6,4 or $\frac{1040}{163}$	B1	Accept 6.38 followed by any digits <b>NB</b> Allow B1 if correct answer seen, followed by incorrect rounding or change of form, ie fraction to decimal
16(b)	200	B1	
16(c)	18.0 or 18,0	B1	Do not accept 18 or 18.00 or 18,00
17(a)	$6 \times 4 \times 2$ or $2 \times 2 \times 4$ or 48 or 16	M1	
	$48 = 3 \times 16$	A1	oe
	<b>Additional Guidance</b>		
	6 ÷ 2 is not enough unless reference is made to the height and length of both cuboids being 2 and 4 respectively or reference to cross sectional area × length		
	$6 \div 2 = 3$	M0	
	$6 \div 2 = 3$ and height, length same	M1, A1	
	Diagram of large cuboid may divided into 3 approximately equal 'small' cuboids	M1	
	Diagram of large cuboid may divided into 3 approximately equal 'small' cuboids <b>and</b> indication that there are 3 of them (numbered for example)	M1,A1	

Q	Answer	Mark	Comments
<b>17b</b>	$816 \div \text{their } (2 \times 2 \times 4)$ $816 \div \text{their } (2 \times 4 \times 6)$ or $816 \div \text{their } (4 \times 4 \times 6)$ or $816 \div \text{their } 192 \text{ (from stack of 4)}$	M1	16, 32, 48, 64, 80 (at least 4 values) or 48, 96, 144, 192, 240, (at least 4 values) or 96, 192, 288, 384 (at least 4 values)
	51 or 17 or 8.5 or 8 layers or 4.25 (stack of 4)	A1ft	ft their value in (a) Continues series to at least 816
	$(51 - 3) \div 2$ or $8 \times 3$ or $8.5 \times 3$ or $4.25 \times 6$	M1dep	oe
	24	A1	

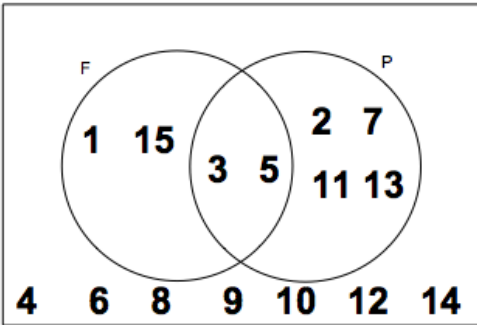
<b>18(a)</b>		B2	B1 reflection in $y$ -axis or any other reflection in line of form $y = a, a \leq 1$
--------------	---	----	---

Q	Answer	Mark	Comments
18(b)		B2	B1 any $180^\circ$ rotation B1 $\pm 90^\circ$ rotation about origin
19	$DBC$ and $DCB = 74$ or $ADB = 37$	M1	Must be clearly stated or shown on diagram
	$DBC$ and $DCB = 74$ and $ADB = 37$	M1dep	Must be clearly stated or shown on diagram
	States that sum of two opposite interior angles equals exterior angles or writes $37 + 37 = 74$ and writes 2 angles same (oe) or shows or states that $ABD = 106$ and writes 2 angles same (oe) or shows or states that $ADC = 69$ and writes 2 angles same (oe)	Q1	strand (ii)
	<b>Additional Guidance</b>		

Q	Answer	Mark	Comments
20	<b>Alternative method 1</b>		
	$4 \times 8$ or 32	B1	Look for values on diagram
	65 – their 32 or 33	M1	
	their $33 \times 2 \div$ their 12 or 5.5	M1dep	
	8 – their 5.5	M1dep	
	2.5	A1	
	<b>Alternative method 2</b>		
	$8 - d$	M1	oe Look for values or expressions on diagram
	$4d + 10 \times (8 - d)$ oe	M1	$\frac{1}{2} \times 12 \times (8 - d)$ oe
	$4d + 80 - 10d = 65$ oe	M1dep	oe $\frac{1}{2} \times 12 \times (8 - d) = 33$ oe
	$6d = 15$	M1dep	oe
	2.5	A1	

Q	Answer	Mark	Comments
---	--------	------	----------

Additional Guidance			
20	Line drawn vertically on diagram to create rectangle and triangle with 10 marked as base of triangle $4 \times 8 = 36$ $65 - 36 = 29$ $29 \times 2 \div 10 = 5.8$ $8 - 5.8$ 2.2		B1 M1 M1dep M1dep A0
	$4 \times 8 = 32$ $65 - 32 = 33$ $33 \times 2 \div 16 = 4.125$ $8 - 4.125$ 3.875		B1 M1 M0dep M0dep A0

21		B2	B1 Any two sections correct
----	---	----	-----------------------------



Q	Answer	Mark	Comments
22	Area circle = $\pi \times 10^2$ or $100\pi$ or [314, 314.2]	M1	
	Square root of their circle area or 17.7....	M1dep	
	17.7	A1	SC2 8.9 from using 5 as radius SC1 any value square rooted and rounded correctly to 1 dp
	<b>Additional Guidance</b>		
	$\pi \times 20$ $\sqrt{20\rho}$ 7.9		Must see square root SC1
23	List of at least 3 correct multiples of 21 and at least 3 correct multiples of 24 or $3 \times 7$ or $2 \times 2 \times 2 \times 3$	M1	Ignore any incorrect multiples Prime factors can be seen in a 'tree' oe eg $21 \div 7 = 3$
	168 or $2 \times 2 \times 2 \times 3 \times 7$ or $2^3 \times 3 \times 7$	A1	SC1 336 or 504

Q	Answer	Mark	Comments
24	Sets up a correct equation eg $6(x - 12) = 3(x + 4)$ $6x - 72 = 3x + 12$ $6x - 72 + 3x = 180$ $3(x + 4) + 3x = 180$ $6x - 72 + 3x + 12 + 3x + 3x = 360$	M1	Brackets do not need to be expanded for M1 but if they are allow one error
	Rearranges to get letter terms on one side and number terms on other or collects letter or number terms	M1dep	Allow one error if no previous error (sign, arithmetic, expansion or rearrangement)
	$2x = 56$ $9x = 252$ $6x = 168$ $15x = 420$	A1	
	28	A1ft	ft their equation if both Ms awarded and at most one error
	<b>Additional Guidance</b>		
	$6x - 72 = 3x + 12$ $9x = 84$ 9.333...		M1, M1dep, A0 A1 ft
	$3x + 12 + 3x = 180$ $9x = 192$ 21.33		M1, M0dep, A0 A0 ft
	$6(x - 12) + 3x = 180$ $9x = 108$ 12		M1 M1dep, A0 A1ft
$6x - 72 + 3x + 12 + 3x + 3x = 180$ $15x = 240$ 16		M0 M0dep, A0 A0ft	