



**General Certificate of Secondary Education  
June 2011**

**Methods in Mathematics (Pilot)                      93652H**  
**(Specification 9365)**

**Unit 2: Methods in Mathematics  
Written Paper (Higher)**

***Mark Scheme***

Mark schemes are prepared by the Principal Examiner 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 examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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)

Copyright © 2011 AQA and its licensors. All rights reserved.

### **Copyright**

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

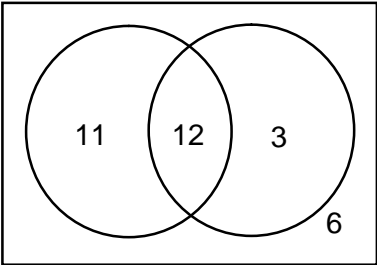
Set and published by the Assessment and Qualifications Alliance.

## 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.
- Q** Marks awarded for quality of written communication. (QWC)
- 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.
- ft** Follow through marks. Marks awarded following a mistake in an earlier step.
- SC** Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
- oe** Or equivalent. Accept answers that are equivalent.  
eg, accept 0.5 as well as  $\frac{1}{2}$

**M2 Higher Tier**

<b>Q</b>	<b>Answer</b>	<b>Mark</b>	<b>Comments</b>
<b>*1</b>	Sight of 1.035 or 103.5	B1	Sight of digits 4968 implies B1
	$480 \times 1.035$	M1	oe
	496.80	Q1	496.8 is Q0 SC1 648 (from 0.35)
<b>Alt *1</b>	$480 \times 3.5 \div 100$	M1	oe
	16.8	M1	
	496.80	Q1	496.8 is Q0 SC1 648 (from 0.35)
<b>2(a)</b>		B3	Part marks to a maximum of 2 for 6 in 'outside' B1 12 in overlap B1 26 total in both circles B1
<b>Alt 2(a)</b>	$x$ marked in intersection, $23 - x$ in History, $15 - x$ in French	M1	
	$x + 23 - x + 15 - x + 6 = 32$	M1	
	$x = 12$	A1	
<b>2(b)</b>	3	B1 ft	ft Their Venn diagram if intersection populated

Q	Answer	Mark	Comments
3	$w$ and $4w$ and attempt to add or dashes marked on diagram	M1	Any multiple of 22 seen implies M1
	$22w$	A1	
	(Width = ) $2.5, \frac{55}{22}$ or equivalent	A1 ft	ft If M awarded. 2.5 seen then 10 (3 marks). 10 from valid working without 2.5 seen (2 marks)
Alt 3	Values for length and width chosen in ratio 4:1 and perimeter of large rectangle correctly calculated ( $22 \times$ width)	M1	
	Another pair of values for length and width chosen in ratio 4:1 and perimeter of large rectangle correctly calculated ( $22 \times$ width) giving an answer closer to 2.5	M1	
	(Width = ) $2.5, \frac{55}{22}$ or equivalent	A1	10 from valid working without 2.5 seen is 2/3
4(a)	$\pi \times 13$ or $2 \times \pi \times 6.5$	M1	
	41, 40.8...	A1	$13\pi$
4(b)	$\pi \times 9^2$	M1	$\pi \times 4.5^2$ or $\pi \times 18^2$
	254.3 to 254.5 or $81\pi$	A1	254 with working
5	$x^2 - 4x + x - 4$	M1	Allow one sign or arithmetic error but must have 4 terms, 1 in $x^2$ , 2 in $x$ and a constant term Allow three correct terms
	$x^2 - 3x - 4$	A1	
6(a)	-21	B1	
6(b)	1.5	B1	oe
	Evidence of $y = x$ drawn or implied or $5x - 6 = x$ seen	B1	T & I with at least two attempts

Q	Answer	Mark	Comments
7(a)	Correct transformation	B2	B1 For reflection of $A$ in $x = 1$ B1 For reflection of $B$ in $y = 1$ (no line shown) B1 For $y = 1$ drawn
7(b)	Rotation	B1	Do not accept 'turn'
	(Anticlockwise) $90^\circ$	B1	Clockwise $270^\circ$ Do not accept $-90^\circ$ or $90^\circ$ c
	(Centre or about) $(2, -2)$	B1	If a combined transformation given then it is B0 even if correct.
8	Other two vertices plotted at $(1, 4)$ and $(5, 4)$ and all sides drawn	B3	Part marks to maximum of $2/3$ B1 Any kite with $AB$ as long diagonal B1 For two vertices plotted on $y = 4$ and not symmetrical. B2 For other two vertices plotted on $y = 4$ and symmetrical about $(3, 4)$ B2 For any kite with area $10 \text{ cm}^2$ (ie vertices plotted on $x = 1$ and $x = 5$ )
9	Triangle (C) drawn at $(8, 5)$ , $(8, 13)$ and $(16, 5)$	B2	B1 For at least 2 rays from $(0, 9)$ through corners of triangle B or any triangle of correct size or triangle with two of $(8, 5)$ , $(8, 13)$ , $(16, 5)$ as vertices SC1 Enlarging A by sf 2 to triangle at $(10, 1)$ , $(14, 1)$ and $(10, 5)$
	(Scale factor) 4	B1 ft	ft Their triangle
	(Centre) $(4, 5)$	B1	ft If rays drawn

Q	Answer	Mark	Comments
10(a)	5	B1	
10(b)	$7y + 2y = 4 + 8$	M1	Allow one rearrangement or arithmetic error
	$9y = 12$	A1	
	$1\frac{1}{3}$	A1 ft	ft On one error only Do not accept 1.3 unless correct answer seen. 1.33 is OK
10(c)	$7(w + 2) - 3(w - 4)$	M1	
	$4w + 26$	A1	
	Their ' $4w + 26$ ' = 21	M1	
	-1.25	A1 ft	oe ft On one error only if both Ms awarded
	Both Ms awarded, terms collected and their equation solved (correctly or incorrectly)	Q1	Strand (ii) T & I is Q0
11(a)	0.77069...	B1	
11(b)	0.771	B1	ft Their (a) if > 3 sf
12(a)	4, 6, 10, 16, 24	B2	B1 For 3 correct or 4, 4, 6, 10, 16
Alt 12(a)	Substitutes $n = 1, 2, 3, 4$ and 5 into the formula	M1	If evidence that squaring is doubling then M0
	4, 6, 10, 16, 24	A1	
12(b)	$25^2 - 25 + 4 (= 604)$ or $\frac{1}{2}(n^2 - n + 4)$ oe	M1	Writing out a list 2, 3, 5, 8, 12, 17, 23, etc is M0 unless it leads to the correct answer
	302	A1	

Q	Answer	Mark	Comments
13(a)	$18^2 - 13^2$	M1	$x^2 + 13^2 = 18^2$
	$\sqrt{155}$	M1 Dep	Must show or take a square root
	12.4, 12.45, 12.44...	A1	Accept 12 with working
13(b)	Sight of sine	M1	
	$12 \div \sin 42$	M1 Dep	
	17.9...	A1	Accept 18 with working
14	Internal angle of nonagon = 140 or external angle ( $XBC = 40$ )	B1	All angles can be marked on diagram
	internal angle hexagon = 120	B1	
	$XCB = \text{their } XCB (= 40)$	M1	$XCB = 180 - \text{their } XBC - \text{their } BXC$ Must be less than $180^\circ$
	$ECD = 180 - (120 + 40)$	M1	Must be less than $180^\circ$
	20	A1ft	ft On one error
15	$(x + 3)$	B1	
	$(x + 3)^2 - 14$	B1 Dep	
16	$(x \times x) = 9 \times 16$	M1	$\frac{x}{9} = \frac{16}{x}$ oe (from similar triangles)
	12	A1	
17	$\frac{\sin x}{11} = \frac{\sin 85}{18}$	M1	oe
	$\sin x = \frac{\sin 85 \times 11}{18}$ $= 0.60878\dots$	M1	
	37.5	A1	37 or 38 with working. If $\sin 85$ rounded to 0.99, answer is 37.22..., 0.996 gives 37.49... so A0 for any answer under 37.5 even if then rounded to 37.5



Q	Answer	Mark	Comments
<b>18</b>	$(2x - 3)(2x + 3)$	B1	
	$(2x \pm a)(x \pm b)$	M1	$ab = 15$
	$(2x + 3)(x - 5)$	A1	
	$\frac{2x - 3}{x - 5}$	A1 ft	ft If M1 awarded and a common factor cancelled A0 For any incorrect further work
<b>19</b>	62.5% or 0.625 seen	B1	37.5% or 0.375
	$0.625x = 0.6(x + 6)$	M1	oe
	$0.025x = 3.6$	A1	
	144	A1	SC2 240
<b>19 Alt 1</b>	Any multiple of 8 split in the ratio 5 : 3 <b>and</b> total for women plus 6 calculated as a percentage (or decimal) of total	M1	eg, $120 = 75 : 45$ , $51 \div 126$ (0.4047)
	Correct calculation of the percentage	A1	
	Second trial and all the above calculations carried out correctly	A1	
	144	A1	
<b>19 Alt 2</b>	$5x$ and $3x$	M1	
	$(3x + 6)/(8x + 6) = 2/5$	M1	oe
	$15x + 30 = 16x + 12$	A1	
	144	A1	
<b>19 Alt 3</b>	Women were $3/8$ of club	M1	
	If $x$ originally $3/8x + 6 = 2/5(x + 6)$	M1	oe
	$15x + 240 = 16x + 96$	A1	
	144	A1	

Q	Answer	Mark	Comments
<b>19</b> <b>Alt 4</b>	$m/w = 5/3$	M1	
	$m/(w + 6) = 3/2$	M1	oe
	$3m = 5w$ <b>and</b> $2m = 3w + 18$	A1	
	144	A1	
<b>19</b> <b>Alt 5</b>	Old ratio 5 : 3 = 15 : 9 compared to new ratio 15 : 10	M1	
	So 1 part is 6	M1	oe
	24 parts originally, so $24 \times 6$	A1	
	144	A1	
<b>19</b> <b>Alt 6</b>	$\frac{y}{x} = 0.375$ or $\frac{y+6}{x+6} = 0.4$	M1	
	$0.375x + 6 = 0.4x + 2.4$	M1	oe
	$0.025x = 3.6$	A1	
	144	A1	
<b>20</b>	$\pi \times 5^2 + \pi \times 5 \times l (= 220)$	M1	oe NB csa = 141.46...
	$l = (220 - 25\pi) \div 5\pi$	M1	
	9, 9.005...	A1	SC1 14.00...

Q	Answer	Mark	Comments
21(a)	$OM = \mathbf{a} + \frac{2}{3}(\mathbf{b} - \mathbf{a})$ or $OM = \mathbf{b} + \frac{1}{3}(\mathbf{a} - \mathbf{b})$	B1	
21(b)	$PR = 4\mathbf{b} - \mathbf{a}$	M1	
	$ON = \mathbf{a} + \frac{1}{3}(4\mathbf{b} - \mathbf{a})$	M1	oe
	$ON = \frac{2}{3}\mathbf{a} + \frac{4}{3}\mathbf{b}$	A1	
	Comment that $ON$ and $OM$ are parallel and share a common point with all working shown	Q1	$ON = 2OM$ implies parallel and common point Strand (iii)
21(b) Alt	$PR = 4\mathbf{b} - \mathbf{a}$	M1	
	$MN = \frac{2}{3}(\mathbf{a} - \mathbf{b}) + \frac{1}{3}(4\mathbf{b} - \mathbf{a})$	M1	oe
	$MN = \frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$	A1	
	Comment that $ON$ and $MN$ are parallel and share a common point with all working shown	Q1	$ON = MN$ implies parallel and common point. Strand (iii)