



**General Certificate of Secondary Education
June 2011**

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

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

Mark Scheme

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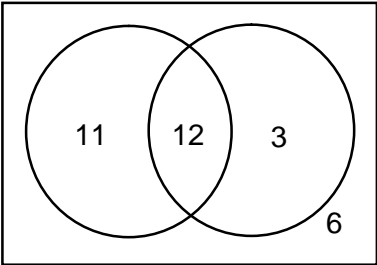
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Glossary for Mark Schemes

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.

- 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

Q	Answer	Mark	Comments
*1	Sight of 1.035 or 103.5	B1	Sight of digits 4968 implies B1
	480×1.035	M1	oe
	496.80	Q1	496.8 is Q0 SC1 648 (from 0.35)
Alt *1	$480 \times 3.5 \div 100$	M1	oe
	16.8	M1	
	496.80	Q1	496.8 is Q0 SC1 648 (from 0.35)
2(a)		B3	Part marks to a maximum of 2 for 6 in 'outside' B1 12 in overlap B1 26 total in both circles B1
Alt 2(a)	x marked in intersection, $23 - x$ in History, $15 - x$ in French	M1	
	$x + 23 - x + 15 - x + 6 = 32$	M1	
	$x = 12$	A1	
2(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	13π
4(b)	$\pi \times 9^2$	M1	$\pi \times 4.5^2$ or $\pi \times 18^2$
	254.3 to 254.5 or 81π	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°	B1	Clockwise 270° Do not accept -90° or 90° 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 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°
	$ECD = 180 - (120 + 40)$	M1	Must be less than 180°
	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
18	$(2x - 3)(2x + 3)$	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
19	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
19 Alt 1	Any multiple of 8 split in the ratio 5 : 3 and 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	
19 Alt 2	$5x$ and $3x$	M1	
	$(3x + 6)/(8x + 6) = 2/5$	M1	oe
	$15x + 30 = 16x + 12$	A1	
	144	A1	
19 Alt 3	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
19 Alt 4	$m/w = 5/3$	M1	
	$m/(w + 6) = 3/2$	M1	oe
	$3m = 5w$ and $2m = 3w + 18$	A1	
	144	A1	
19 Alt 5	Old ratio 5 : 3 = 15 : 9 compared to new ratio 15 : 10	M1	
	So 1 part is 6	M1	oe
	24 parts originally, so 24×6	A1	
	144	A1	
19 Alt 6	$\frac{y}{x} = 0.375$ 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	
20	$\pi \times 5^2 + \pi \times 5 \times l (= 220)$	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)