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General Certificate Secondary of Education
January 2013

Methods in Mathematics (Pilot) 9365

Unit 2 Higher Tier 93652H

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 meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting 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 the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting 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.

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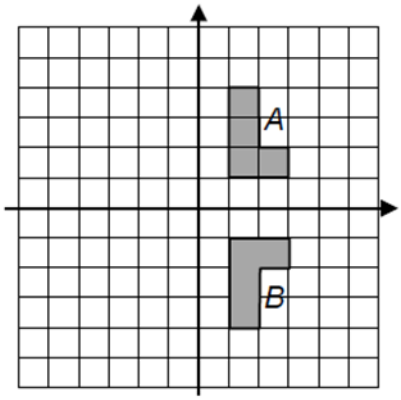
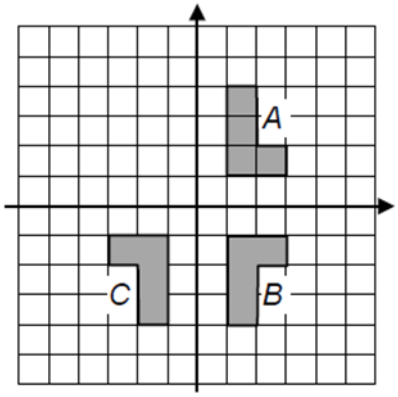
Glossary for Mark Schemes

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.

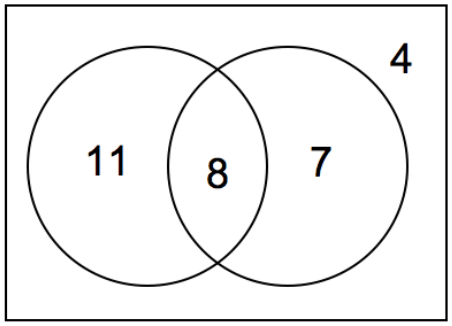
M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
Q	Marks awarded for quality of written 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 $\frac{1}{2}$
[*a*, *b*]	Accept values between *a* and *b* inclusive.
25.3 …	Allow answers which begin 25.3 e.g. 25.3, 25.31, 25.378.
Use of brackets	It is not necessary to see the bracketed work to award the marks.

M2 Higher Tier

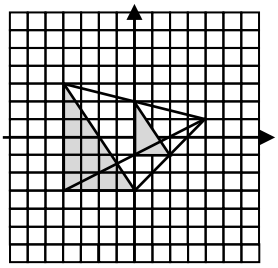
Q	Answer	Mark	Comments
1(a)	$5x - 45$	B1	
1(b)	$x(x + 8)$	B1	$(x + 0)(x + 8)$ $(x + 8)x$ $(x + 8)\ (x + 0)$ $(x + 4)^2 - 16$ $x(8 + x)$ $(8 + x)x$ $x(x + 8$ [allow missing last bracket]
1(c)	$6 \times 9 \div 2$	M1	oe 6×4.5 or 9×3 or any indication that RHS is multiplied by 6 eg 54 seen or $\frac{9}{2}$ $(\times 6)$
	27	A1	
***2**	65	B1	
	Corresponding	Q1	Strand (i) If other explanations involving angles on a straight line, interior, opposite, alternate angles etc. must be complete. eg 65 marked opposite 65 given and 'Alternate, opposite' is Q1.
3(a)		B1	
3(b)		B1ft	Correct position or ft their (b) reflected in y-axis Image in all 4 quadrants correctly reflected and shapes not labelled B1 B0 If no labels and images in 4th and 3rd quadrants only accept as B and C B2 A reflected in y axis and then x axis i.e. images in 2nd and 3rd quadrants with C in correct position B0 B1

Q	Answer	Mark	Comments
3(c)	Origin or (0, 0) or O	B1ft	Multiple transformations, even if correct answer also seen is B0B0
	180° or half-turn (direction need not be stated or can be ignored)	B1ft	Correct answer or ft their C. eg if C is 1 unit to the left then the rotation will be 180° about (–0.5, 0). Must be a rotation as this is stated in the question. If a correct combined rotation is given eg 90° clockwise followed by 90° clockwise must have appropriate directions is B1 but 90° followed by 90° would be B0.
4	1.68 × 320 or 217.6	M1	oe
	537.6	A1	
	900 ÷ 8 × 5	M1	oe
	562.5	A1	
	Correct method and conclusion based on their values calculated	Q1	Strand (iii)
5(a)	32	B1	
	65	B1	
5(b)	1^{st} and 4^{th} terms that fit their rule eg 1 (2) (4) 8 Double 0 (2) (4) 6 Goes up in 2s or $2n - 2$ (oe) √2, 2, 4, 16, square previous term 2, 2, 4, 6, Fibonacci 1, 2, 4, 7 Goes up 1 more each time	B2	B1 for a valid rule but wrong values
6	483 and 987	B3	B2 for 3 or more digits correct B1 for 2 digits correct Allow commas, dashes, slashes etc between digit. B2 for total reverse eg 384 and 789

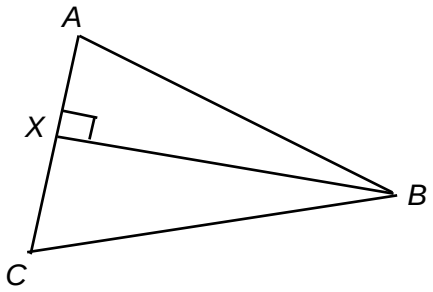
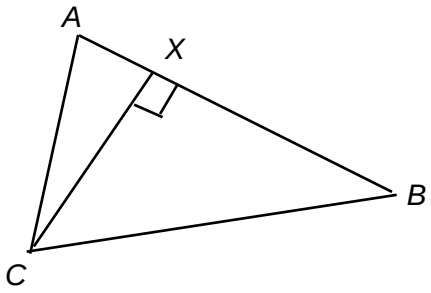
Q	Answer	Mark	Comments
7	0.5 × 4 × 6 (= 12)	M1	
	Their 12 × 16	M1Dep	6 × 4 × 16 ÷ 2 is M2
	192	A1	
	cm^3	B1	
8	$2w + 6 + 4w – 4$	M1	Allow one sign, rearrangement or arithmetic error, ie three terms must be correct. eg $2w + 5 + 4w – 4$ $2w + 6 + 4w – 1$ $2w + 4 + 4w – 4$ $2w + 6 + 4w + 4$
	$6w + 2$	A1	$2(3w + 1)$. Do not allow incorrect further work eg $3w + 1$
9	180 – (360 ÷ 8)	M1	Check diagram for external angle marked as 45. If so M1
	135	A1	Check diagram for internal angle marked as 135. If so M1, A1
	67.5	A1	
9 Alt	6 × 180 (= 1080)	M1	
	1080 ÷ 8 = 135	A1	
	67.5	A1	

Q	Answer	Mark	Comments
10	19 + 15 (= 34)	M1	
	30 – 4 (= 26)	M1	
	Their 34 – their 26	M1	
	8	A1	**NB** 8 on answer line is 4 marks
10 Alt	Venn diagram filled in with 4 'outside'	B1	
	Total in one circle = 19 and total in other circle = 15	B1	
	8 in intersection Correct Venn Diagram is 3 marks. Diagram need not be labelled.  	B1	Dashes or 'lists' eg 1, 2, 3, 4 or tallies
	8	B1ft	**NB** 8 on answer line is 4 marks ft from the intersection of their Venn Diagram if populated.
11a	$25^2 + 43^2$	M1	$43^2 - 25^2$
	√their 2474	M1Dep	
	49.7 …	A1	Accept 50 with working Ignore incorrect working after correct answer seen
11(a) Alt	Either angle correctly calculated to 30 or 60 or better and used with an appropriate trig ratio and side	M2	Angles are 30.17… and 59.826 eg 43 ÷ cos 30 or 43 ÷ sin 60 or 25 ÷ cos 60 or 25 ÷ sin 30 **NB** if cosine rule used then $25^2 + 43^2 - 2 \times 25 \times 43 \times \cos 90$ must lead to √2474 for M2 otherwise it is M0
	[49.69, 49.75]	A1	A0 if outside range due to premature rounding.

Q	Answer	Mark	Comments
11(b)	Sight of tan	M1	
	tan x = 15 ÷ 33	M1Dep	oe
	24.4..	A1	Accept 24 with working Ignore incorrect rounding after correct answer seen
11(b) Alt	Hypotenuse correctly calculated as [36, 36.3] and then either side used with the hypotenuse and an appropriate trig ratio or cosine rule	M2	eg $\cos^{-1}(33 \div 36)$ $\sin^{-1}(15 \div 36)$ or $\cos y = (33^2 + 36^2 - 15^2) \div (2 \times 33 \times 36)$
	[24.35, 24.45]	A1	A0 if outside range due to premature rounding.
12(a)	$5x - 3x$ or $6 + 8$	M1	
	$2x = 14$	A1	
	7	A1ft	ft on one error only
12(b)	Substituting their 7 into $5x - 8$ or $3x + 6$ expressions to get side (=27)	M1	ft on their x and a complete method. If they 'start again' and calculate or state a different value for x than that in (a) do not allow this M.
	270 ÷ their 27	M1	If following through on a value from (a) or a 'start again' value, then x can be substituted into either $5x - 8$ or $3x + 6$ to get the side. If this value is then divided into 270 award M1 unless the side calculated is negative ($x < 1.6$ substituted into $5x - 8$ then award M0
	10	A1	ft their answer. If a decimal must be to 2dp or better.
12(b) Alt	$5xy - 8y = 270$ **and** $3xy + 6y = 270$ leading to a 'balanced pair' eg $15xy - 24y = 810$ **and** $15xy + 30y = 1350$	M1	
	A correct equation from eliminating the balanced variable. eg $54y = 540$	M1	
	10	A1	

Q	Answer	Mark	Comments
13	5 × 9 (= 45)	M1	
	= 6 × w = their 45	M1	
	7.5	A1	
14	225	B1	
	224.5 or 224.49^{r}	B1ft	B1 for the minimum value of their 225 Eg 229 giving 228.5, 226 giving 225.5. Must be a sensible lower bound for 230
15		B2	B1 for any correctly sized triangle anywhere. B1 for 2 vertices correct. B1 for at least two rays from corners through (4, 1)
16(a)	42	B1	
16(b)	48	B1	
17	CN = 5 or CB = 10	M1	Check diagram
	(AC =) 30 – 13 – 5 – 5 (= 7)	A1	15 – (11.5)
	3.5	A1	
18	$\frac{-(3)\pm\sqrt{(3)^2-4(2)(-7)}}{2(2)}$	M1, A1	Allow one error for M1 from the following. Wrong sign for b, $-4ac$ negative. Denominator of 2. Do not allow M1 for not dividing all top by 2 or $2a$. A1 if all correct.
	1.27 and –2.77	A1ft	ft on wrong sign for b only –1.27, 2.77
18 Alt	$2(x + 0.75)^2 - 8.122$	M1	$(x + 0.75)^2 - 4.0625$
	$= \pm\sqrt{(4.0625)} - 0.75$	A1	Must have ±
	1.27 and –2.77	A1	

Q	Answer	Mark	Comments
***19**	Cuboid 1 1 × 2 × 2	M1	
	Cuboid 2 2 × 2 × 3	M1	
	Cuboid 3 3 × 2 × 4	M1	Continues for at least 2 more products seen.
	Cuboid 16 16 × 2 × 17	A1	
	Finds a formula and substitutes n = 16 and makes a valid conclusion, eg no 544 (> 500)	Q1	Strand (ii). **NB** SC2 544 and valid conclusion with no working.
***19 Alt1**	First four cuboids have 4, 12, 24, 40 cubes	M1	
	Recognises the rule +8, +12, +16 and shows +20 or 60	M1	
	Continues the list to the 16th cuboid, showing values with at most one error 60, 84, 112, 144, 180, 220, 264, 312, 364, 420, 480, 544	M1	
	544 for 16th value	A1	
	Makes a valid conclusion based on their 16th term first 2 Ms awarded, eg no 544 (> 500)	Q1	Strand (ii).
***19 Alt 2**	4 12 24 40 8 12 16 4 4	M1	Numbers of cubes identified and second difference calculated
	$2n^2$	M1	
	2 4 6 (+ $2n$)	M1	Difference between $2n^2$ and original series calculated
	$2n^2 + 2n$	A1	$2(16)^2 + 2 \times 16$
	Finds a quadratic formula starting with $2n^2$ and substitutes n = 16 and makes a valid conclusion, eg no 544 (> 500)	Q1	Strand (ii).

Q	Answer	Mark	Comments
***19 Alt 3**	Width = n	M1	
	Height = $n + 1$	M1	
	Depth 2 so volume = $2 \times n \times (n + 1)$	M1	
	$2n^2 + 2n$	A1	$2(16)^2 + 2 \times 16$
	Finds a quadratic formula and substitutes $n = 16$ and makes a valid conclusion, eg no 544 (> 500)	Q1	Strand (ii).
20	$(x^2 =)\ 6^2 + 8^2 - 2 \times 6 \times 8 \times \cos 72$	M1	$4 \times \cos 72$
	70.33…	A1	1.236 or 1.24 is A0
	[8.385, 8.4]…	A1	
20 Alt 1	$XB = 7.608\ldots$ **and** $AX = 2.472\ldots$ **and** $XC = 3.5278$	M1	
	$\sqrt{(7.608^2 + 3.5278^2)}$	M1	
	[8.385, 8.4]	A1	
20 Alt 2	$CX = 5.706\ldots$ **and** $AX = 1.854\ldots$ **and** $XB = 6.145$	M1	
	$\sqrt{(5.706^2 + 6.145^2)}$	M1	
	[8.385, 8.4]	A1	

Q	Answer	Mark	Comments
21	(Linear sf =) 1.5	B1	681 or 1021.5 implies B1
	454×1.5^3	M1	
	1532 (…)	A1	Accept 1530 or 1500 with working
21 Alt1	Radius of larger cylinder = [5.7, 5.71]	B1	
	$\pi \times \text{radius}^2 \times 15$	M1	
	[1531.5, 1532.5]	A1	
22	$180 - (2 \times 35)$	B1	*RQP* = 110 marked on diagram
	110	B1	