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General Certificate Secondary of Education
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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.

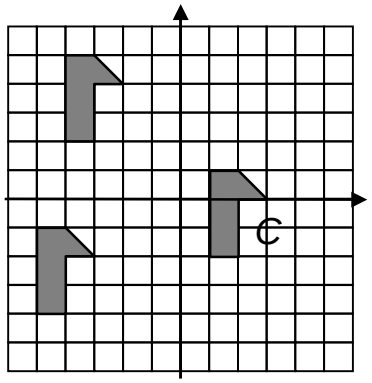
M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
Q	Marks awarded for quality of written 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 $\frac{1}{2}$

M2 Higher Tier

Q	Answer	Mark	Comments
1(a)	$4x - 12$	B1	
1(b)	$y(y - 7)$	B1	
1(c)	$3p + 6 = 18$	M1	Must see an attempt at expansion. Allow arithmetic error but not $3p + 2$ or Must see attempt at division by 3 Allow arithmetic errors for $18 \div 3$ or flow chart $\times 3 + 6$ gets M1 but $+2 \times 3$ must see an attempt at inverse flow chart
	$3p = 12$	A1	$p + 2 = 6$.
	4	A1 ft	ft on one sign, arithmetic or rearrangement error SC1 For $p = \frac{16}{3}$ from $3p + 2$ oe Allow embedded answer if clear
2	Sum (need not be evaluated) of any two primes between 11 and 59 inclusive, eg 17 + 19	M1	List of at least 5 primes, which must include at least 2 correct 2-digit primes, with at most 1 error for every 5 primes eg 1, 2, 3, 5, 7, 9, 11, 13 is B0 2, 3, 5, 7, 9, 11, 13 is B1
	Finds a mid-point for chosen pair of primes eg, adds and divides by 2 or draws a number line, or similar and attempts to find mid-point	M1 Dep	
	Any of (11, 23), (11, 47), (17, 29), (17, 41), (19, 43), (23, 59), (29, 53), (31, 43), (41, 53), (47, 59)	A1	SC1 Correct prime answer for any two-digit prime up to 60 and any odd two-digit non-prime up to 60 SC2 Correct prime answer for any single digit prime and any two-digit prime up to 60

Q	Answer	Mark	Comments
***3(a)**	68	B1	
	Alternate	Q1	Strand (i) Q0 for Z angle but ignore if alternate also stated Accept 'alternative' or 'alternating' but not 'alternative segment' If other explanations involving angles on a straight line, interior, opposite, corresponding angles etc must be complete and use correct terminology
3(b)	360 ÷ 5 **NB** It must be clear that they are calculating the exterior angle This may be informed by the diagram.	M1	540 ÷ 5 oe eg 3 × 180 ÷ 5 **NB** It must be clear that they are calculating the interior angle. This may be informed by the diagram
	72	A1	108
	Their 72 + 90 (their 72 must be < 90)	M1	360 – (their 108 + 90) (their 108 must be > 90)
	162	A1 ft	ft with 90 from square or 'exterior' of square only
4(a)	Sight of 10	M1	Alt 30 × 30 ÷ 9
	100	A1	
***4(b)**	450 ÷ 30 (= 15) or 300 ÷ 30 (= 10) Allow mix of units	M1	oe Area patio ÷ area larger square Allow mix of units
	450 ÷ 30 (= 15) **and** 300 ÷ 30 (= 10) 4.50 ÷ 0.3 (= 15) **and** 3 ÷ 0.3 (= 10)	M1 Dep	450 × 300 ÷ 900 or 4.5 × 3 ÷ 0.09
	150 square	A1	
	Attempts to find total number of large squares in the patio by dividing both sides by 30 or 0.3 and multiplying values, giving this as the number of small squares and multiplying by 4 to get number of rectangles 150 and 600 is 4 marks with working, 3 marks if no working	Q1	Strand (iii) Attempts to divide area of patio by area of larger square giving this as the number of small squares and multiplying by 4 to get number of rectangles 150 and 600 is 4 marks with working. 3 marks if no working SC1 Rectangular = 4 × squares if no other marks awarded

Q	Answer	Mark	Comments
5(a)	(76 – 68) (= 8)	M1	
	60 + 4 × 8 or 68 + 3 × 8 or 76 + 2 × 8	M1	60, 68, 76, 84, 92, (100, ….)
	92	A1	SC2 100
5(b)	$8n$ $8 \times n$ $n(8)$	B1	Do not accept $n8$ but any other algebra is OK, eg $n \times 8$
	$8n$ + 52 or equivalent eg 60 + 8 × (n – 1)	B1 Dep	Do accept $n8$ + 52 for B0, B1 $8n$ + 60 or equivalent after 100 in (a) is 2 marks
6(a)	60 × 20 × 25 (= 30 000)	M1	oe
	630 000 ÷ their 30 000	M1 Dep	
	21	A1	
6(b)	27 ÷ 3 × 25	M1	oe 25, 50, 75, 100, 125, 150, …. or correct attempt to build up the heights as far as 150 but if it goes beyond 225 then M0
	225	A1	SC1 675
	2.25	B1ft	Their height if a value stated (in cm) and converted to m **NB** If initial calculation uses 0.25 this is B1. SC2 6.75 from 27 × 25

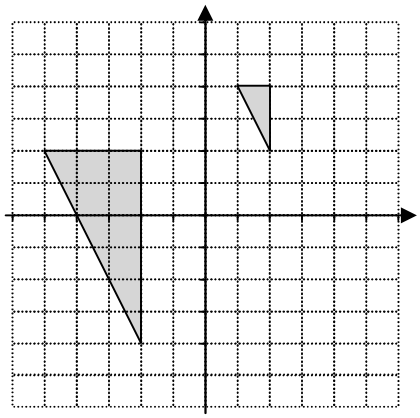
Q	Answer	Mark	Comments
7(a)		B2	B1 For translation of $\begin{pmatrix}5\\a\end{pmatrix}$ or translation $\begin{pmatrix}b\\-4\end{pmatrix}$
7(b)	$\begin{pmatrix}-1\\-6\end{pmatrix}$	B2	B1 For –1 in first line B1 For –6 in second line B1 For $\begin{pmatrix}1\\6\end{pmatrix}$ B1 For $\begin{pmatrix}-6\\-1\end{pmatrix}$ B1 For (–1, –6) seen if no vector filled in
8	36420 – 32518 (= 3902)	M1	
	Their 3902 ÷ 32 518 (× 100)	M1 Dep	
	12% from 11.99…	A1	11.9… is 2/3
8 Alt 1	36 420 ÷ 32 518 (×100)	M1	
	1.119… or 111.9…	A1	112
	12%	A1	
8 Alt 2	10% + 1% (+ 1%) = 3251.8 + 325.18 (+ 325.18)	M1	M1 For attempt to find a whole number percentage greater than 10% with at least 10% correct 32518 + 3251.8 + 325.18 + (325.18)
	3576.98, 3902.16	M1 Dep	36094.98, 36420.16
	12%	A1	
9	$3(x + 1) + 2(x + 4)$	M1	
	$5x + 11$	A1	
	Their $5x + 11 = 12$	M1	$3(x + 1) + 2(x + 4) = 12$ is M2
	0.2	A1 ft	oe ft on one error but both Ms awarded

Q	Answer	Mark	Comments
10(a)	32^2 (1024) and 26^2 (676)	M1	$x^2 + 26^2 = 32^2$ or 1024 – 676
	$\sqrt{32^2 - 26^2}$	M1 Dep	Square root must be seen or implied
	[18.6, 19] $2\sqrt{87}$	A1	Accept 19 with working
Alt 10(a)	$\cos^{-1}(26 \div 32) = 35.65\ldots$ **and** either $x = 26\tan(35.65)$ or $x = 32\sin(35.65)$	M2	Must be a complete alternative method for M2
	[18.6, 19] $2\sqrt{87}$	A1	Accept 19 with working
10(b)	Sight of cos	M1	
	$\cos y = 11 \div 17$	M1 Dep	
	[49.5, 50]	A1	Accept 50 with working
Alt 10(b)	$\sqrt{(17^2 - 11^2)} = 12.96$ **and** either $\sin^{-1}(12.96 \div 17)$ or $\tan^{-1}(12.96 \div 11)$	M2	Must be a complete alternative method for M2
	[49.5, 50]	A1	Accept 50 with working

Q	Answer	Mark	Comments
11	Sight of 0.6	B1	
	$2\ (00) \times 0.6^9$	M1	
	[2, 2.02]	A1	2.0155392 SC2 [3.35, 3.36] SC2 [1.2, 1.21] 2 must be supported by working.
Alt 11	(This is for the build up method) 200, 120, 72, 43.2 seen	M1	or same digits
	All values up to 8 bounces within the range of the table below	A1	
	[2, 2.1]	A1 ft	SC2 [3.3, 3.4] SC2 [1.2, 1.26] ft on one error

Time	Minimum value	Maximum value
0	200	200
1	120	120
2	72	72
3	43	43.2
4	25	26
5	15	15.6
6	9	9.4
7	5	5.7
8	3	3.5
9	2	2.1
10	1.2	1.26

Q	Answer	Mark	Comments
12	$(x \pm a)(x \pm b)$	M1	$ab = \pm 10$
	$(x - 5)(x - 2)$	A1	
	$(x =)\ 5, 2$	A1 ft	ft Their brackets if M1 awarded
12 Alt 1	$(x - 3\frac{1}{2})^2 - (3\frac{1}{2})^2 + 10$	M1	
	$x - 3\frac{1}{2} = \pm 1\frac{1}{2}$	A1	$\pm$ must be seen
	$(x =)\ 5, 2$	A1	
12 Alt 2	$\frac{7 \pm \sqrt{(-7)^2 - 4 \times 1 \times 10}}{2}$	M1	Accept -7^2 in square root
	$\frac{7 \pm \sqrt{9}}{2}$	A1	$\pm$ must be seen
	$(x =)\ 5, 2$	A1	
13	3:15 or chooses a multiple of 18 greater than 18 and divides into ratio 1 : 5 or 7:11	M1	eg 36 $\Rightarrow$ 6 : 30 or 14 : 22 **NB** Look on diagram for values
	Difference of their first or second values	M1	eg 7 – 3, 15 – 11, 14 – 6 or 30 – 22
	3 : 4 : 11	A1	oe 6 : 8 : 22 **NB** 3 : 7 : 11 implies M1 3 : 4 : any value or any value : 4: 11 implies M2 (or equivalents including decimals). Check if any 'pair of ratios' is correct. If so then award M1
Alt 13	$\frac{1}{6}, \frac{5}{6}$ and $\frac{7}{18}, \frac{11}{18}$	M1	oe
	$\frac{7}{18} - \frac{1}{6}\ \left(= \frac{4}{18}\right)$	M1	oe
	3 : 4 : 11	A1	oe 6 : 8 : 22 $\quad \frac{1}{6} : \frac{2}{9} : \frac{11}{18}$

Q	Answer	Mark	Comments
14	$8^2 + 9^2 - 2 \times 8 \times 9 \times \cos 54$	M1	
	60.358 …	A1	
	[7.769 …, 8]	A1	8 with working
15(a)	Correct transformation 	B2	B1 Any enlargement sf $\frac{1}{3}$ B1 For any 2 vertices in correct position B1 For at least 2 rays drawn from (4, 5) to *P*, *Q*, or *R*
15(b)	(22, ….)	B1	
	(...., 14)	B1	
16	32 – 15 (= 17)	M1	Check diagram
	y coordinate = 19	A1	
	36 – 17 – 10 (= 9)	M1	oe eg 26 – 17
	x coordinate = 23	A1	(19, 23) is A1 max
Alt 16	Graph drawn with *A* at (15, 10) and *B* at (32, 36)	M1	
	Any rectangles drawn from A and B matching the diagram.	M1	
	x coordinate = 23	A1	
	y coordinate = 19	A1	
17	$2 \times PF = 24$	M1	oe
	$x = 7$	A1	
	$6 \times y =$ (their $x + 2$) $\times 5$	M1 Dep	
	$y = 7.5$	A1 ft	ft Their *x* SC1 No valid working but 8×3 or 24 seen

Q	Answer	Mark	Comments
18	$(x + 2)$	M1	
	$(x + 2)^2 - 4\,(-8)$	A1	$(x + 2)^2 - 12$ or $(x + 2)^2 = 12$
	$(x + 2) = \pm\sqrt{12}$	M1	Allow M1 for moving their constant term over equal sign and square rooting, but must have $\pm$
	$(x =) -2 \pm \sqrt{12}$ **and** $\sqrt{12} = \sqrt{(4 \times 3)}$ or state $\sqrt{12} = 2\sqrt{3}$	A1	Must show that $\sqrt{12} = 2\sqrt{3}$ for A1
18 Alt 1	$(-2 + 2\sqrt{3})^2 + 4(-2 + 2\sqrt{3}) - 8$	M1	
	$4 + -8\sqrt{3} + 12 - 8 + 8\sqrt{3} - 8 = 0$	A1	All terms must be correctly evaluated to at least those shown and some indication that they cancel Stating = 0 is not enough
	$(-2 - 2\sqrt{3})^2 + 4(-2 - 2\sqrt{3}) - 8$	M1	
	$4 + 8\sqrt{3} + 12 - 8 - 8\sqrt{3} - 8 = 0$	A1	All terms must be correctly evaluated to at least those shown and some indication that they cancel Stating = 0 is not enough
18 Alt 2	$\frac{-4 \pm \sqrt{(4)^2 - 4 \times 1 \times (-8)}}{2 \times 1}$	M1	If quadratic formula used, maximum 3 marks
	$\frac{-4 \pm \sqrt{48}}{2}$	A1	Must have $\pm$
	$-2 \pm \frac{\sqrt{16 \times 3}}{2}$	A1	Must show the division of both terms and that $\sqrt{48} = 4\sqrt{3}$
***19**	(vol cyl =) $\pi \times r^2 \times 6r$	M1	(vol cyl =) $18.849\ldots r^3$
	(vol spheres =) $3 \times \frac{4}{3} \times \pi r^3$	M1	(vol spheres =) $3 \times 4.188\ldots \times r^3$
	$6\pi r^3$ and $4\pi r^3$	A1	$18.849\ldots r^3$ **and** $12.566\ldots r^3$
	Both volumes correctly worked and $4 = \frac{2}{3} \times 6$ or equivalent seen	Q1	Strand (ii) - Numerical values must be stated to 1 dp accuracy at least and score Q0 even if shown to be in ratio $0.6666\ldots$