GCSE

Methods in Mathematics (Pilot)

Unit **B392/02:** Higher Tier

General Certificate of Secondary Education

Mark Scheme for June 2014

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

1. Annotations

Annotation	Meaning
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
✓	Correct
✗	Incorrect
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working (after correct answer obtained), provided method has been completed
M0	Method mark awarded 0
M1	Method mark awarded 1
M2	Method mark awarded 2
A1	Accuracy mark awarded 1
B1	Independent mark awarded 1
B2	Independent mark awarded 2
MR	Misread
SC	Special case
∧	Omission sign

Subject-Specific Marking Instructions

12. **M** marks are for <u>using a correct method</u> and are not lost for purely numerical errors.
    A marks are for an <u>accurate</u> answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
    B marks are <u>independent</u> of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
    SC marks are for <u>special cases</u> that are worthy of some credit.

13. Unless the answer and marks columns of the mark scheme specify **M** and **A** marks etc, or the mark scheme is 'banded', then if the correct answer is clearly given and is <u>not from wrong working</u> **full marks** should be awarded.

    Do <u>not</u> award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen <u>and</u> the correct answer clearly follows from it.

14. Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct.

   Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, eg FT 180 × (*their* '37' + 16), or FT 300 − √(*their* '$5^2 + 7^2$'). Answers to part questions which are being followed through are indicated by eg FT 3 × *their* (a).

   For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.
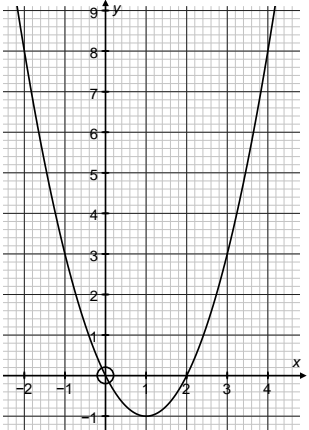
15. Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.

16. The following abbreviations are commonly found in GCSE Mathematics mark schemes.

   - **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point eg 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
   - **isw** means **ignore subsequent working** (after correct answer obtained).
   - **nfww** means **not from wrong working**.
   - **oe** means **or equivalent**.
   - **rot** means **rounded or truncated**.
   - **seen** means that you should award the mark if that number/expression is seen anywhere in the answer space, including the answer line, even if it is not in the method leading to the final answer.
   - **soi** means **seen or implied**.

17. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise, indicated for example by the instruction 'mark final answer'.

18. As a general principle, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered, mark the poorer (poorest).

19. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **M** marks are not deducted for misreads.

20. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.

21. If the correct answer is seen in the body and the answer given in the answer space is a clear transcription error allow full marks unless the mark scheme says 'mark final answer' or 'cao'. Place the annotation ✓ next to the correct answer.

    If the answer space is blank but the correct answer is seen in the body allow full marks. Place the annotation ✓ next to the correct answer.

22. Ranges of answers given in the mark scheme are always inclusive.

23. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.

24. Anything in the mark scheme which is in square brackets […] is not required for the mark to be earned, but if present it must be correct.

Question			Answer	Marks	Part Marks and Guidance	
1	(a)		150, 210	3	**M1** for 360 ÷ 12 **B1** for each correct value	
	(b)		18	2	**M1** for 27 ÷ 3 **OR** **SC1** for answer of £45	
	(c)		$\frac{1}{8}$ or 0.125	1		
	(d)		$7\frac{1}{2}$ **cao**	2	**M1** for 7.5 or incompletely cancelled equivalent or correct top-heavy fraction	eg 15/2, 105/14 seen
2	(a)		$\frac{1}{9}$ **oe** fraction	2	**M1** for 10x = 1.111111....**oe** or 9x = 1 **oe**	Not just x = 0.111111…
	(b)		15	1		
	(c)		34.36	2	**M1** for 0.8 x 42.95 **oe** **OR** **SC1** for 34.35 or 34.37	Allow equivalent, complete, correct, method(s)
	(d)		225	3	**M2** for 261 ÷ 1.16 **OR** **M1** for 116 or 1.16 seen	
3	(a)		24	2	**M1** for 360 as sum of exterior angles or 360 ÷ 15 or 180 − (13 x 180 ÷ 15)	**M1** can be implied by value of answer 156 or 204 or 336 13 x 180 = 2340
	(b)		156	1	or **FT** 180 − *their*(a)	
4	(a)		[x =] −2	2	**M1** for 3x = 10 - 16 or -3x = 16 - 10 **OR** **SC1** for FT from 3x = n or -3x = n	Decimal answers to 1dp rot
	(b)		[x =] 19	2	**M1** for x + 2 = 7 x 3 oe or $\frac{1}{3}x = 7 - \frac{2}{3}$	Condone use of decimals to 2dp or better for M1 eg 0.33[….] for 1/3

Question			Answer	Marks	Part Marks and Guidance	
5			44.89 to 45.0241	4	**M3** for AB = √45 or AB^2 = 36 + 9 or area = 36 + 9 **OR** **M2** for $AB = \sqrt{6^2 + 3^2}$ or AB^2 = 6^2 + 3^2 or area = 6^2 + 3^2 **OR** **M1** for right angled triangle drawn with AB as hypotenuse and sides 6 and 3	**Alternative method:** Surround square with larger square with horizontal and vertical sides. **M3** for $9 \times 9 - 4 \times \frac{1}{2} \times 3 \times 6$ **OR** **M2** for 9×9 **and** $\frac{1}{2} \times 3 \times 6$ **OR** **M1** for 9×9 **or** $\frac{1}{2} \times 3 \times 6$ Do not condone 9 obtained incorrectly from 6 + 3
6	(a)		17	2	**M1** for 1, 5, 9, 13, or for fifth pattern drawn or for error in counting but +4 used	
	(b)		$4n - 3$ **oe**	2	**M1** for $4n$ correctly obtained	Condone use of n4, nx4, etc or consistent different letter Allow correct expressions that have not been simplified
	(c)*		Clear and complete explanation of why there cannot be a pattern with an even number of squares	2	Looking for 3 aspects For 2 marks explanation could be <u>starting with 1 or odd</u> and <u>adding 4 or even</u> on each time <u>will always give an odd number</u> **or** <u>4n is even</u> and <u>subtracting 3</u> makes it <u>odd</u> **1** mark for 2 aspects A partially correct explanation eg "adding on 4 keeps it odd" Or "4n is even" or 3 or more examples in the sequence shown to be odd 2 marks and 1 mark can be gained from a different expression seen in part (b).	

Question			Answer	Marks	Part Marks and Guidance	
7			$28.25 - 28.6$ or 29 or $7.5\pi + 5$	5	**M1** for $\dfrac{10\pi}{2}$ **AND** **M1** for $\dfrac{5\pi}{2}$ **AND** **A1** for 15.7…. and 7.8[5…] or 5π and 2.5π **AND** **M1** for *their* semicircle + *their* semicircle + 5 After 0 scored **SC1** for 10π seen	Condone +10 or +5 respectively included for either or both of the first two method marks. Not 15.7… from wrong work soi by 7.85 7.5 π or 23.5..... implies M1,M1,A1
8			Two numbers, each >1000, product 3.2×10^8 **isw**	2	**B1** for two numbers each >1000 with product 3.2×10^n	Numbers need not be in standard form.
9	(a)		3, 0, −1, 0	2	**B1 for** 2 values correct	
	(b)			2	**B1** for at least four of *their* points correctly plotted **and** **B1** for correct smooth <u>curve</u>	Within half a small square Within half a small square horizontally of 5 points Curve must have one minimum turning point. Condone minor imperfections but not a "pointed" turning point. Ignore anything outside range of -2 < x < +3
	(c)		−0.4, 2.4 (± 0.1)	2	**B1**, **B1** (or **FT** *their* graph) If 0 scored, **M1** for evidence of at least one reading from *y* = 1	Could be straight line Condone correct answers without a curve (-0.4 and 2.4 only)

Question			Answer	Marks	Part Marks and Guidance	
10	(a)		(1.5, −0.5)	2	**M1** for one correct co-ordinate as answer or correct method seen to obtain a co-ordinate **OR** **SC1** for answers transposed	
	(b)	(i)	Ruled perpendicular bisector of AB that passes through (1, 0) and (2, -1)	2	**M1** for a correct freehand line **or** correct intersecting arcs on each side of AB **or** at least 3 points on the perp. bisector **or** correct line that does not reach AB	Condone dashed or dotted lines for 2 marks Correct by eye
		(ii)	$x + y = 1$ **oe**	FT 2	**M1** for gradient = −1 **OR** **SC1** for $1 - x$ or $-x + 1$	Strict FT but only with negative gradient Missing y =
11	(a)		$4x^2 + 8x + 3$ as final answer	3	**M2** for three of the following terms seen: $4x^2$, 6x, 2x, 3 **OR** **M1** for two terms seen	8x could imply 2 terms. Do not award marks for terms obtained by simply re-writing the question
	(b)		(3x − 2)(3x + 2) **cao**	2	**M1** for factors, in double brackets, which multiply to give $9x^2 \pm 4$ (+ any term in x)	$(3x \pm 2)^2$ or $(3x \pm 4)(3x \pm 1)$ or $(9x \pm 4)(x \pm 1)$ or $(9x \pm 1)(x \pm 4)$ or $(9x \pm 2)(x \pm 2)$ seen

Question			Answer	Marks	Part Marks and Guidance	
	(c)		6.36 nfww	5	***Getting equation:*** **M2** for $x^2 - 4x - 15 = 0$ **OR** **M1** for $x(x - 4) = 15$ ***Solving equation:*** **M2** for $\dfrac{4 \pm \sqrt{76}}{2}$ or $(x-2)^2 = 19$ **OR** **M1** for correct substitution into quadratic formula or $(x-2)^2$ seen	6.358[9...] or $\sqrt{19} + 2$ implies **M2, M2** Condone missing brackets Allow solution by trial and improvement **M4** for at least three trials, including one between 6.355 and 6.365 **OR** **M3** for at least three trials, including one between 6.3 and 6.4. **OR** **M2** for at least two trials including one between 6 and 7 **OR** **M1** for one trial Allow method marks for solving *their* quadratic equation
12	**(a)**		4.9	2	**M1** for $2\pi\sqrt{\dfrac{5.9}{9.8}}$ **or** 0.7759...	4.8752...rot implies M1 Allow M1 for numerical π in working − eg (2 x 3.14 =) 6.28
	(b)		$[L =]\dfrac{T^2 g}{4\pi^2}$ or $g\left(\dfrac{T}{2\pi}\right)^2$ **oe**	3	**M1** for squaring both sides **AND** **M1** for dividing both sides by $(2\pi)^{[2]}$ **SC2** for $\dfrac{T^2 g}{4\pi}$ **or** $\dfrac{T^2 g}{2.\pi^2}$	Condone one error in any M1 Alternate method: **M1** for dividing both sides by 2π **AND** **M1** for squaring both sides

Question			Answer	Marks	Part Marks and Guidance	
13	**(a)**		7	**3**	**M2** for $\sqrt{2^2 + 3^2 + 6^2}$ (may be done in stages) **OR** **M1** for $2^2 + 3^2 + 6^2$ or for finding diagonal of any face or for $\sqrt{2^2 + 3^2}$ or $\sqrt{2^2 + 6^2}$ or $\sqrt{3^2 + 6^2}$	Rounding at intermediate stage leading to inaccurate answer scores maximum of M2 (even if later rounded to 7)
	(b)		BC and AC lengths with AC = 2BC or AB and BC with AB = √(5 x BC²) rot or AB and AC with AB = √(1.25 x AC²) rot	**2**	**M1** for three sides given with one incorrect or for use of trig with angle 63[.434..] and a stated side	

Question	Answer	Marks	Part Marks and Guidance
14*	Finding that shaded area is $\frac{1}{8}$ of the larger hexagon with correct clear working Some examples of correct responses (all depend on statement that the area scale factor = 4 or $\frac{1}{4}$) then Method 1 Area between hexagons is $\frac{3}{4}$ of the area of the larger hexagon. Shaded area is $\frac{1}{6}$ of this. $\frac{1}{6}$ of $\frac{3}{4} = \frac{1}{8}$ Method 2 Shaded area is part of a slice of the larger hexagon. The slice is $\frac{1}{6}$ of the area of the larger hexagon. The shaded area is $\frac{3}{4}$ of this. $\frac{3}{4}$ of $\frac{1}{6} = \frac{1}{8}$ Method 3 Shaded area is part of a slice of the larger hexagon. The slice is $\frac{1}{6}$ of the area of the larger hexagon and forms a kite. The smaller kite is $\frac{1}{4}$ of $\frac{1}{6}$ of the area of the larger hexagon then $\frac{3}{4}$ of $\frac{1}{6} = \frac{1}{8}$	**5**	In all cases consider any work on diagram An answer of $\frac{1}{8}$ **oe** (eg $\frac{3}{24}$) has been obtained using a complete set of statements (possibly on diagram or numerical) that are fully correct, justified and clearly communicated. **4** Answer of $\frac{1}{8}$ **oe** with mostly clear working (possibly one error) or all working correct and clear but final answer missing or incorrect. **3** Answer of $\frac{1}{8}$ **oe** (condone eg $\frac{1.5}{12}$) with incomplete or no working or correct and mostly clear working with final answer missing or incorrect **2** Getting as far as outside $= \frac{3}{4}$ of the area of the larger hexagon or shaded area is $\frac{3}{4}$ of the area of the larger kite/slice or both area scale factor = 4 oe and $\frac{1}{6}$ seen **1** One correct statement eg area scale factor = 4 oe or $\frac{1}{6}$ seen

Question			Answer	Marks	Part Marks and Guidance	
15	(a)		3.2 **oe**	3	**M1** for $p = \dfrac{k}{v}$ or $pv = k$ or $p = \dfrac{1}{av}$ **AND** **B1** for k = 8 or a = 0.125 soi **OR** **SC1** for 1.25 in answer	Alt Method **M2** for 4 ÷ 2.5 x 2 **OR** **M1** for 4 ÷ 2.5 soi by 1.6
	(b)		16	2	**M1** for $0.5 = \dfrac{their(k)}{v}$ **oe**	For M1 must see *their* k in (a) Alt Method **M1** for 2 ÷ 0.5 soi by 4
16	(a)		17.32[050..]	4	**M3** for $2 \times \dfrac{5}{\tan 30}$ or $10 \tan 60$ **OR** **M2** for $\dfrac{5}{\tan 30}$ **OR** **M1** for suitable right angled triangle or correct trig statement	soi by 17.3205..... or 10√3 = 8.66…. or 5√3 Starting from 17.3 gives 0 Alt Method **M3** for using isosceles triangle inside the circle (5,5,120°) and using trig. to find the base then x 2 **M2** for using isosceles triangle inside the circle (5,5,120°) and using trig. to find the base **M1** for using isosceles triangle inside the circle (5,5,120°)

Question			Answer	Marks	Part Marks and Guidance	
	(b)		Answer in range 1295 – 1300 (inclusive) or 750√3	4	**B1** for length = 10 cm **AND** **M2** for area of triangle = ½ x (*their* a)² x sin60 or ½ x 17.3 x *their*15 or ½ x 17.3 x 5 x 3 **OR** **M1** for using eg trig to find height of triangle	Implied by *their* area x 10 soi by 129.[......] or 75√3 Correct height = 15

APPENDIX 1

Exemplar responses for questions 6c

Response	Mark awarded
There will never be an even amount of squares in the middle and each time you add four extra squares that one extra square will make the even number an odd number.	2
Because of the centre square previous sequence + 4. The sequence started with an odd number.	1 omits final aspect
The pattern starts with an odd number. When an odd number is added onto an odd number it will always be odd.	0 incorrect
Because the pattern started as an uneven number and the same amount is being added each time.	0
Odd plus even equals odd	1 too general

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