OCR
Oxford Cambridge and RSA

GCSE

Methods in Mathematics (Pilot)

Unit **B392/02:** Methods in Mathematics 2 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for November 2016

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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.

Annotations used in the detailed Mark Scheme.

Annotation	Meaning
✔	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

These should be used whenever appropriate during your marking.

The **M**, **A, B**, etc annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks.
It is vital that you annotate these scripts to show how the marks have been awarded.
It is not mandatory to use annotations for any other marking, though you may wish to use them in some circumstances.

Subject-Specific Marking Instructions

1.   **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.

2.   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.

3.   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.

4.   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.

5.   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 and applies as a default.
      - **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**.

6. In questions with no final answer line, make no deductions for wrong work after an acceptable answer (ie **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.

7. In questions with a final answer line following working space,

   (i) if the correct answer is seen in the body of working and the answer given on the answer line is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.

   (ii) if the correct answer is seen in the body of working but the answer line is blank, allow full marks. Place the annotation ✓ next to the correct answer.

   (iii) if the correct answer is seen in the body of working but a completely different answer is seen on the answer line, then accuracy marks for the answer are lost. Method marks could still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.

8. In questions with a final answer line:

   (i) If one answer is provided on the answer line, mark the method that leads to that answer.

   (ii) If more than one answer is provided on the answer line and there is a single method provided, award method marks only.

   (iii) If more than one answer is provided on the answer line and there is more than one method provided, award zero marks for the question unless the candidate has clearly indicated which method is to be marked.

9. In questions with no final answer line:

   (i) If a single response is provided, mark as usual.

   (ii) If more than one response is provided, award zero marks for the question unless the candidate has clearly indicated which response is to be marked.

10. 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.

11. 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.

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

13. 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.

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)	(i)	85	1		
		(ii)	$15.\dot{6}$	2	**M1** for $47 \div 3$ soi by $15\frac{2}{3}$ or $15.6[6]$ or 15.7	Accept 15.666.... (at least 3dp)
	(b)	(i)	A pair of different numbers that multiply to make 1	1		NOT 1 x 1 or -1 x -1
		(ii)	$-\dfrac{1}{8}$ oe	1		
	(c)		$\dfrac{9}{16}$	2	**M1** for $\dfrac{3}{4} \times \dfrac{3}{4}$ oe	

2*			Clear, complete proof that angles of a quadrilateral add up to 360⁰	2	**1** for some progress towards a proof but not completely watertight
			eg Quadrilateral divided into two triangles One triangle is 180⁰ 2 x 180 = 360		eg correct diagram with two triangles or one triangle = 180 or 2 x 180 = 360

Question			Answer	Marks	Part Marks and Guidance	
3	(a)		1.3 **or** $1\dfrac{3}{10}$ **or** $\dfrac{13}{10}$	3	**M1** for $10x - 5 = 8$ or $2x - 1 = \dfrac{8}{5}$ **M1** ft for x terms on one side and numbers on the other **OR** **M1** correct ft from $ax = b$ to $x = \dfrac{b}{a}$	ft from *their* ax + b = c
	(b)		$x > -5$	2	**M1** for $3x > -15$	**SC1** for $x = -5$ or $x \geq -5$ or $x < -5$
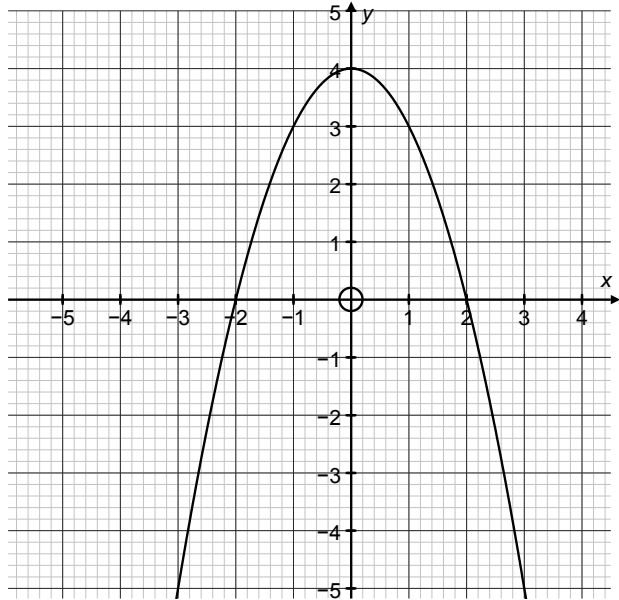
Question			Answer	Marks	Part Marks and Guidance	
4			(6, 5)	5	**B1** for y coord = 5 **M1** for right angled triangle in correct position **M2** ft for $\sqrt{5^2 - 3^2}$ **OR** **M1** for Pythagoras statement with 5 and *their* 3	eg (x, 5) where x is positive Allow for 4 coming from recognition of 3, 4, 5 triangle Could be eg $\sqrt{5^2 + 3^2}$
5	(a)		37	4	**M3** for splitting shape and finding correct areas soi by **M2** for splitting shape and finding at least one correct area **M1** for one correct step	eg 40 & 3 or 25 & 12 or 29, 9 & 3 eg 40 or 3 or 25 or 9 or 12 eg splitting shape, completion of 8x5 rectangle or a correct area
	(b)		123.7	4	**M3** for complete method or for finding correct angle in appropriate right angled triangle **OR** **M2** for tan = 2/3 or 3/2 **OR** **M1** for drawing right angled triangle with sides 2 & 3 in correct place on a diagram	90 + tan^{-1} (2/3) or 33.7 or 180 – tan^{-1}(3/2) or 56.3

Question			Answer	Marks	Part Marks and Guidance	
6	(a)		$\dfrac{3}{8}$	1		
	(b)		580	2	**M1** for $\dfrac{348}{3} \times 5$ or 116 or 1740	
	(c)		87	FT3	**M2** for 435 **OR** **M1** for $\dfrac{their\,b}{4} \times 3$ or 145	Ft their (b) as long as final answer is a whole number – max marks if not whole no is M2

6	(d)*		Clear, correct comparison of amount of honey for same cost or cost for same amount of honey leading to a conclusion that the smaller jar is better value.
			
			eg 250g jar = 180 ÷ 250 = 0.72 per gram
			         400g jar = 320 ÷ 400 = 0.80 per gram
			         So 250g jar is better value
				3	**2** for correct working to get cost of both for same amount or correct working to get amount of both for same cost but answers could be incorrect or conclusion could be missing, incorrect or unclear.
					
					1 finding correct cost for another amount (or correct amount for another cost) but not going on to do the other jar.
					
					NB 1p is 1.38….g or 1.25g
					         50g is 36p or 40p
					         20p buys 27.7777... g or 25g	

Question			Answer	Marks	Part Marks and Guidance	
7	(a)		30	2	**M1** for 5 x 6 or differences 4, 6, 8	May be on diagram
	(b)		$n(n+1)$ oe	2	**M1** for any quadratic expression or n and $n + 1$ seen	

Question			Answer	Marks	Part Marks and Guidance
7	(c)*		Clear and complete explanation of why 1089 cannot be the area of a rectangle in the sequence. eg Areas are product of two consecutive numbers so one is odd and one is even and odd x even = even but 1089 is odd or 32 x 33 = 1056 33 x 34 = 1122 These are the areas of two consecutive rectangles in the sequence but 1089 is between these numbers so there is no rectangle with this area. or $n(n+1) = 1089$ $n^2 + n - 1089 = 0$ Solves to get $\dfrac{-1 \pm \sqrt{4357}}{2}$ and says n is not an integer	3	**2** for complete, correct explanation but without a final conclusion eg odd x even = even or n = 32 <u>and</u> n = 33 substituted into n(n+1) and evaluated **1** for some correct work which could lead to an explanation eg $n(n+1) = 1089$ or odd x even or answer should be even or n = 32 or n = 33 or at least two values substituted into n(n+1) and evaluated

Question			Answer	Marks	Part Marks and Guidance	
8	(a)		-5, 3, 3, 0	2	**B1 for** 2 values correct	
	(b)			2	**B1** for at least four of *their* points correctly plotted **AND** **B1** for a correct smooth curve	Within half a small square Within half a small square Curve must have one max turning point - **B0** for multiple or "hairy" curves
	(c)		-1.7, 1.7 (± 0.1)	FT2	**B1** for each value If 0 scored then **M1** for evidence of reading from *y*=1	
9	(a)		156	3	**M2** for 540 − 90 − 90 − 48 (=312) or 90 + ½(180 − 48) **OR** **M1** for angle sum = 540° or ½(180 − 48)	
	(b)		8.75	3	**M2** for $\dfrac{15}{12} \times 7$ **OR** **M1** for PR:RT = 7:5 or SF = 7/12	(accept 12/7 or PR:PT = 7:12)

Question			Answer	Marks	Part Marks and Guidance	
10	**(a)**		$x = 1, \ y = {}^{-}2.5$ or $-2\dfrac{1}{2}$ or $-\dfrac{5}{2}$	3	**M1** for correctly eliminating one variable or for substituting first variable found **B1** for each correct value	
	(b)		$28x^2 - x - 15$	3	**M2** for three of the following terms : $28x^2 + 20x - 21x - 15$ **OR** **M1** for two terms	$-x$ may count as two terms
11			8.03	4	**M3** for $\sqrt{1.8^2 + 4.5^2 + 6.4^2}\,(= 8.02807...)$ (may be done in stages) **OR** **M2** for $1.8^2 + 4.5^2 + 6.4^2$ or for finding AC $= \sqrt{23.49}\,(= 4.8466...)$ or $DB = \sqrt{61.21} = 7.8236...$ **OR** **M1** for any correct Pythagoras statement	If M3 not scored then allow **B1** for correctly rounding from their value seen to more than 4sf

Question			Answer	Marks	Part Marks and Guidance	

12	(a)		Showing $2d^2 - 6d + 3 = 0$ (complete explanation)
			eg de = 3
			       e = 6 − 2d
			       area is d(6 − 2d) = 3
			       6d − 2d² = 3
			       6d − 2d² − 3 = 0
				3	**M2** for $d(6 - 2d) = 3$ or
					
					$2d + \dfrac{3}{d} = 6$
					
					OR
					M1 for $de = 3$ or $e = 6 - 2d$	

	(b)		0.63, 2.37	3	**M2** for $\dfrac{6 \pm \sqrt{12}}{4}$ or better or $\left(d - \dfrac{3}{2}\right)^2 - 0.75 = 0$ **OR** **M1** for correct substitution into quadratic formula or $\left(d - \dfrac{3}{2}\right)^2$ **A1** for both roots After 0 marks scored **SC1** for their answer(s) correctly rounded to 2dp	Condone answer with more than 2dp which rounds to 0.63 and 2.37 Condone one error in substitution
13	(a)		32.25	3	**M2** for 1.3225 **OR** **M1** for 1.15²	
	(b)		90000	FT2	ft 119025 ÷ (0.01 *their* (a) + 1) **M1** for 119025÷1.15²	May be scored in (a)
14	(a)		$[x =] \dfrac{3y + 1}{2 - y}$ **oe**	4	**M1** for multiplying both sides by (x + 3) **AND** **M1** for getting all *x* on one side and all *y* on other side **AND** **M1** for factorising to isolate *x*	Condone yx+3 = 2x-1 for M1 FT

Question			Answer	Marks	Part Marks and Guidance	
	(b)		$$\dfrac{1}{2x-1}$$	3	**M2** for factorising denominator **OR** **M1** for incorrect factorisation of denominator which gives two correct terms when multiplied out	$$\dfrac{x+3}{(x+3)(2x-1)}$$
15			115.8 to 116	7	**M1** for $\dfrac{5\pi\times5.8^2}{6}$ oe **A1** for 88.069 … soi by 88 or 88.1 **M1** for $\dfrac{1}{2}\times5.8^2\times\sin60$ oe **A1** for 14.5665 .. soi by 14.6 **M1** for $\dfrac{1}{2}\pi\times their2.9^2$ oe **A1** for 13.21 … soi by 13 or 13.2 After 0 marks awarded then **B1** for AB = 5.8cm soi	**M1** for $\pi\times5.8^2$ oe **A1** for 105.68 … soi by 106 or 105.7 **M1** for $\dfrac{1}{2}\pi\times their2.9^2$ oe **A1** for 13.21 .. soi by 13.2 or 13 **M1** for $\left(\dfrac{\pi\times5.8^2}{6}-\dfrac{1}{2}\times5.8^2\times\sin60\right)$ oe **A1** for 3.047 … soi by 3.05 or 3 Final answer 116 or more dp is OK (all M and A marks can be gained for working done "all in one" as opposed to separated into bits. Condone correct answers given in terms of π)