OCR
RECOGNISING ACHIEVEMENT

GCSE

Methods in Mathematics (Pilot)

General Certificate of Secondary Education

Unit **B392/02:** Higher Tier

Mark Scheme for November 2013

Oxford Cambridge and RSA Examinations

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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

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

Subject-Specific Marking Instructions

1. **M** marks are for using a correct method and are not lost for purely numerical errors.
   A marks are for an accurate answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
   B marks are independent of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
   SC marks are for special cases 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 not from wrong working **full marks** should be awarded.

   Do not award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen and 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).
   - **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. 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'.

7. 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).

8. 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.

9. 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.

10. 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.

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

12. 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.

13. 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.

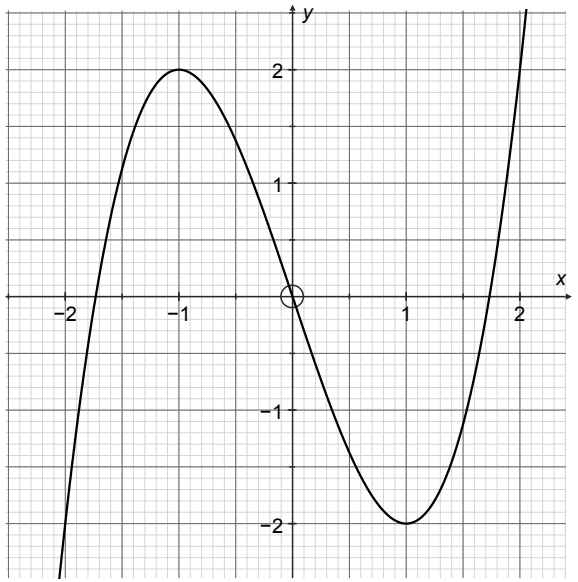
Question			Answer	Marks	Part Marks and Guidance	
1	(a)		3 **:** 4	**2**	**M1** for correct partial cancelling or 1 **:** 1.33(3…) **oe** or 0.75 **:** 1 **oe** **OR** **SC1** for 4 **:** 3	eg 9 **:** 12 etc.
	(b)	(i)	2 : 1 : 3	**2**	**M1** for 4 : 2 : 6 **oe**	Condone fractions, decimals and included consistent units for **M1**
		(ii)	$\frac{1}{6}$	**2**	**M1** for equivalent fraction (not cancelled)	Accept eg $\frac{2}{4+2+6}$
		(iii)	33.33[.....]% or $33\frac{1}{3}\%$ **oe**	**2**	**M1** for $\frac{1}{3}$ **oe** seen or 100 ÷ 12 x 4 soi by 33%	
2	(a)		10, 17	**2**	**B1** for each term	
	(b)*		Correct alternative formula giving 1st term = 2 and 2nd term = 5 with clear, correct working showing how both these terms have been calculated and 3rd and 4th terms obtained correctly using *their* formula (not 10, 17).	**4**	eg one possible correct different formula is $3n - 1$; the minimum working required for first term is $3 \times 1 - 1 = 2$ and for second term is 3 x 2 – 1 = 5 both seen with 8 and 11 **OR** **3** for a correct formula, different from $n^2 + 1$, with four terms given but working is unclear or incomplete for first two terms eg $3n - 1$ with 2, 5, 8, 11 or for correct alternate formula and complete required method with one arithmetic error or use of letter other than *n.* **OR** **2** for correct formula, different from $n^2 + 1$, with at least two correct terms given. Condone use of letter other than *n*. **OR** **1** for correct formula, different from $n^2 + 1$, possibly without any terms **or** multiple of 3 used or incorrect formula with $u_1 = 2$ or $u_2 = 5$ and two other terms correctly obtained from *their* formula.	

Question			Answer	Marks	Part Marks and Guidance	
3	(a)		3.6	3	**M2** for $\sqrt{(3.9^2 - 1.5^2)}$ **OR** **M1** for $3.9^2 - 1.5^2$ or $a^2 + 1.5^2 = 3.9^2$ **OR** **SC1** for any Pythagoras statement	eg $3.9^2 + 1.5^2$ (probably **soi** by 17.46 or 4.1785...or 4.18)
	(b)		21.6	3	**FT** from *their* **(a)** for full marks **OR** **M2** *their* **(a)** $\times$ 0.5 $\times$ 1.5 $\times$ 8 **OR** **M1** *their* **(a)** $\times$ 0.5 $\times$ 1.5 or *their* area of end section $\times$ 8	**FT** from 4.2 gives 25.07.. to 25.2 NB only accept '2D' x 8

Question			Answer	Marks	Part Marks and Guidance	
4*			$p + q = 270$ [°] with complete, correct reasoning.	4	Must see **all** of .... • [Interior] angles [of pentagon] add up to 540° **oe** • ∠EFB = 138° clearly identified (condone F =) • Interior (or allied) angles **or** alt angles **and** angles on straight line (allow clear use of 180 to indicate straight line) • $p + q = 540 – 90 – 42 – 138 = 270$ **oe** correct method = 270 NB use of ∠CBF + ∠EFB = 180° with interior angles implies 2nd and 3rd aspects **OR** **3** for $p + q = 270$ with **three** out of four aspects covered **or** completely correct reasoning (all four aspects) but with one error leading to wrong $p + q$. **OR** **2** for any **two** out of the four aspects. Allow $p + q = 270$ (eg p = 132 **and** q = 138) with 90, 138 and 42 as evidence for angles add up to 540. **OR** **1** for **one** aspect or relevant angle (eg ∠ABF = 138) or 270 without working. For all of the above, aspects may be seen on the diagram. Do not condone supplementary as a reason	
5	(a)	(i)	2.488[32]	1		
		(ii)	7.5×10^{12}	2	**M1** for 0.75 times a power of 10 or 7.5 times a power of 10 or 7 500 000 000 000	

Question			Answer	Marks	Part Marks and Guidance	
	(b)		Three correct calculations	3	**B2** for two correct calculations **OR** **B1** for one correct calculation	Some examples 25÷8, 50÷16, 75÷24, 100÷32, 125÷40, 150÷48, 3125÷1000, 312500÷10000, etc.
6	(a)		30.4	3	**M2** for **figs** 3043…. or 0.304 or 130.4 or 1 – (60 ÷ 46) or 14 ÷ 0.46 **oe** **OR** **M1** for 14 ÷ 46 or 60 ÷ 46 or 130.43478..	
	(b)		68 × 0.77 68 × 1.05 68 × 1.23	1 1 1		Do not give a mark for any statement on the left which is joined to more than one statement on the right
	(c)		$\frac{3}{16}$	3	**M2** for equivalent fraction to $\frac{3}{16}$ or $\frac{1}{2}\left(\frac{1}{8}+\frac{1}{4}\right)$ or $\frac{1}{8}+\frac{1}{2}\left(\frac{1}{4}-\frac{1}{8}\right)$ or $\frac{1.5}{8}$ or 0.1875 **OR** **M1** for changing to same denominator or $\left(\frac{1}{4}\pm\frac{1}{8}\right)$ or (0.125 ± 0.25)/2 or $\frac{1}{16}$ **oe**	NOT $\frac{12.5}{100}$ and $\frac{25}{100}$

Question			Answer	Marks	Part Marks and Guidance	
7	(a)		[x =] 3	3	**M1** for $2x - 1 = 5$ or $6x - 3$ [= 15] **AND** **M1** for collecting *their x* and *their* number terms on opposite sides of equation eg $2x = 6$ or $6x = 18$ **M1** for correct **FT** from $kx = n$	Condone correct embedded answer $6x - 1 = 15$ then $6x = 16$ then $x = 2\frac{2}{3}$ scores **M0**, **M1**, **M1** (condone 2.66[....] or 8/3 but not 16/6)
	(b)		$x > 1.2$ **oe** final answer	2	**M1** for $5x > 6$ or $-5x < -6$ **OR** **SC1 for** (x=)1.2 **or** x<1.2 **oe** or x>2.4 **oe**	Condone 6/5 for 2 marks
	(c)		$\frac{1}{3}$ oe, 1	4	**M2** for correct factors $(3x - 1)(x - 1)$ **OR** **M1** for factors which multiply to give two correct terms in $3x^2 - 4x + 1$ **AND** **B1** for each correct value (NB nfww)	Allow 0.33[333] Can be solved by completing square or use of formula **M2** for $\frac{-(-4) \pm \sqrt{4}}{6}$ **or** **M1** for $\frac{-(-4) \pm \sqrt{(-4)^2 - 4 \times 3(\times 1)}}{6}$ condone one error **OR** **M2** for $\left(x - \frac{2}{3}\right)^2 - \frac{1}{9} = 0$ **oe** **or** **M1** for $\left(x - \frac{2}{3}\right)^2$

Question			Answer	Marks	Part Marks and Guidance	
8	(a)		1.125, −2, −1.125, 2	2	**B1** for at least two correct	
	(b)			2	**B1** for at least 8 points correctly plotted from *their* table **AND** **B1** for smooth curve, not ruled, through origin and **all** *their* points.	**Inside** the correct two horizontal lines and within ½ small square of the correct x co-ordinate. Within half a small square Curve must be cubic shape with turning points in both 2nd and 4th quadrants. **B0** for multiple or "hairy" curves.
9			122 to 122.6	4	**M3** for 60.80 to 61.39 or 57.2 to 58.4 **OR** **M2** for $\tan\theta = \frac{6.2}{3.4}$ **oe** or 28.6 to 29.2 **OR** **M1** for splitting along AC and using trig.	Evidence of **M3** could be ..... use of radians ≈ 1.069.. leading to ≈ 2.138... use of grads. ≈ 68.066.. leading to ≈ 136.133.... AC = 7.07[....]

Question			Answer	Marks	Part Marks and Guidance	
10			5.6…..	**4**	**M1** for $\frac{2\pi r}{4}$ **oe** for curved bit (need not be in terms of π) **AND** **M1** for 2*r* for straight bits **soi** **AND** **M1** for 20÷3.570…**oe**. **OR** (if 0 scored) **SC1** for answer of 12.73....	NB $\frac{2\pi r}{4}$ = 20 is incorrect; M0 Allow trial and improvement; first two method marks as in previous column. Final method mark for at least one trial below 5.6 **and** at least one trial above 5.6 $\frac{20}{2+½\pi}$ or $\frac{40}{4+\pi}$ or $\frac{80}{8+2\pi}$
11	(a)		$x^2 - 4x + 3$ as final answer	**3**	**M2** for three of the following terms : $x^2 - x - 3x + 3$ **OR** **M1** for two terms	
	(b)		$[a =]\frac{M^2 - c}{b}$ **oe**	**3**	**M2** for $M^2 - c = ab$ **OR** **M1** for $M^2 = ab + c$	
	(c)		$\frac{2}{x+1}$	**3**	**M1** for factorising numerator **AND** **M1** for factorising denominator	$\frac{2(x-1)}{(x+1)(x-1)}$

Question			Answer	Marks	Part Marks and Guidance	
12	(a)		$(2\cos 250°,\ \ 2\sin 250°)$ or $(-2\cos 70°,\ \ -2\sin 70°)$ **oe**	**2**	**B1** for each co-ordinate **OR** **SC1** for co-ords transposed or for (–0.68,–1.88) after correct co-ords, using trig, seen.	Must be exact – do not allow (–0.684..., –1.879...)
	(b)		Circle, centre the origin Radius 3	**2**	**B1** for full circle with centre at the origin **B1** for at least a quadrant with radius 3	Allow inaccuracy in drawing as long as intention is clear (eg just missing 3 on any axis or small gaps in circle). Condone freehand
	(c)	(i)	$y = 1 - x$ **soi** $x^2 + x^2 - 2x + 1 = 4$ or $2x^2 - 2x + 1 = 4$ or $2x^2 - 2x + 1 - 4 = 0$	**B1** **B1**	eg $x^2 + (1-x)^2 = 4$	

Question			Answer	Marks	Part Marks and Guidance	
		(ii)	$^{-}0.82$, 1.82	**3**	**M2** for $\frac{2 \pm \sqrt{28}}{4}$ or $(x-0.5)^2 - 1.75 = 0$ **OR** **M1** for correct substitution into quadratic formula $\frac{-(-2) \pm \sqrt{(-2)^2 - 4 \times 2 \times -3}}{2 \times 2}$ or $(x-0.5)^2$ **seen** **B1** for one correct root or two unrounded correct roots (NB nfww)	Condone one error $^{-}0.82287\ldots$, 1.82287…
13			DE is common AD = $\frac{1}{2}$ AB = EF midpoint theorem AE = $\frac{1}{2}$ AC = DF midpoint theorem Triangles are congruent SSS	**3**	**M2** for all three line statements with reasons **OR** **M1** for three line statements with no reason or for two line statements with reasons **AND** **A1**(dep on **M1**) for SSS	An alternative approach is to use the midpoint theorem to find parallel lines and equal angles leading to AAS. Marks as on left. The three statements are as follows. 1. EF parallel to AD midpoint theorem and ∠ADE=∠DEF alternate angles 2. DF parallel to AE midpoint theorem and ∠AED=∠EDF alternate angles 3. DE is common Triangles are congruent AAS

Question			Answer	Marks	Part Marks and Guidance	
14	(a)		5.1[4…]	3	**M2** for $\sqrt{(3.2^2+6.7^2-2x3.2x6.7xcos48)}$ **soi** by 26.437….. **OR** **M1** for $3.2^2+6.7^2-2x3.2x6.7xcos48$	At least one dp in final answer 2x3.2x6.7xcos48 must be correctly evaluated ie **NOT** $(3.2^2+6.7^2-2x3.2x6.7)xcos48$ implied by eg 12.25 or 0.818... Radians = 9.08732... Grads. = 4.88588.... when considering **M** marks
	(b)		62[.2]	3	**M2** for $\frac{6.7\sin 82}{7.5}$ **soi** by 0.8846… **OR** **M1** for $\frac{\sin S}{6.7}=\frac{\sin 82}{7.5}$ **oe**	Radians = 0.2836... Grads. = 65.64.... for M marks
15			9.5[2]	3	**M1** Vol sf = 0.5 **AND** **M1** Length sf = 0.79[37…] **OR** **M1** volume of cone = $\frac{1}{3}\pi\times 3^2\times 12$ (=36π) **AND** **M1** for using radius = $\frac{1}{4}h$ eg $\frac{1}{3}\times\pi\times(\frac{1}{4}h)^2\times h=18\pi$ **oe**	113.097... or $(\frac{1}{3}\pi\times 3^2\times 12)\div 2$ (=18π) = 56.548.... **BUT** not from $\frac{4}{3}\pi\times 3^3$ or πrl = πx3x12

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553