

Mathematics C (Graduated Assessment)

General Certificate of Secondary Education

Unit **B282**: Terminal Paper (Higher Tier)

Mark Scheme for January 2012

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, OCR Nationals, 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.

© OCR 2012

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

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

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

- i. **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.
- ii. 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.

- iii. 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 $180 \times (\textit{their} \text{'37'} + 16)$, or FT $300 - \sqrt{(\textit{their} \text{'5}^2 + 7^2)}$. Answers to part questions which are being followed through are indicated by eg FT 3 \times *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.

- iv. 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.
- v. 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).
 - **nfw** 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**.
- vi. 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'.
- vii. 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).
- viii. 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.

- ix. 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.
- x. 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'. 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.
- If the correct answer is seen in the working but a completely different answer is seen in the answer space, then accuracy marks for the answer are lost. Method marks would still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.
- xi. Ranges of answers given in the mark scheme are always inclusive.
- xii. 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.
- xiii. 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.

♠ = common with B281

Question			Answer	Marks	Part marks and guidance	
1	(a)		Straight Line through $(-3, -13)$ and $(3, 11)$	3	M2 for correct straight line in one quadrant or M2 for 3 correct points at least one negative x value Or M1 for 1 correct pair of coordinates found or plotted.	Straight intended Points within 2mm square
	(b)		1.5 oe	1	Or FT <i>their</i> line ± 0.1	Condone answer (1.5, 5)
2	(a)		$\frac{2}{15}$ oe	2	M1 for use of equivalent fractions with $\frac{12}{15}$ or $\frac{10}{15}$ oe	nfww so $\frac{4}{15} - \frac{2}{15}$ scores 0
	(b)		$\frac{4}{9}$ oe	2	M1 for $\frac{1}{3} \times \frac{4}{3}$ or $\frac{4}{12} [\div] \frac{9}{12}$	
3	(a)	♠	5 9 13	2	M1 for 2 terms correct in correct position or M1 for 1, 5, 9	eg 0 for 5, 21, 85
	(b)	♠	No with valid reason	1	For example: <ul style="list-style-type: none"> • numbers in sequence are all odd • 4 goes into 32 but doesn't into the sequence numbers • 33 is in the sequence • 31 is not divisible by 4 • $4 \times 8 + 1 = 33$ 	See exemplars
4	(a)	♠	M Triangle $(-1, 2)$ $(-1, 4)$ $(-2, 2)$	2	M1 for correct reflection in $y = 0$ or in $x = a, a \neq 0$	On overlay, 2 marks for blue, 1 mark for green or for a translation of blue parallel to the x-axis Condone label missing

Question			Answer	Marks	Part marks and guidance	
	(b)	♠	N Triangle (1, 0) (3, 0) (1, -1)	2	<p>M1 for rotation 90° anticlockwise about (0, 1) [at (-1, 2) (-1, 3) (-3, 2)] or rotation 90° clockwise wrong centre</p> <p>MR 'M' rotated, not 'L' : Allow M1 for a fully correct rotation of 'M'</p>	On overlay, 2 marks for blue, 1 mark for green or for a translation of blue Condone label missing
	(c)	♠	Reflection	1	May be earned independent of <i>their</i> 'M' and N	
5	(a)	♠	$2x + 3 + x + 5 + 2x + 3 + x + 5 [= 43]$ oe	1		
	(b)	♠	<p>$x = 4.5$</p> <p>length 12 width 9.5 oe</p>	2 1 1	<p>M1 for $6x = 27$ or $[x =] \frac{27}{6}$ or $27 \div 6$ and</p> <p>A1 for $\frac{9}{2}$ or 4.5 or $4\frac{1}{2}$ or $4\frac{3}{6}$ isw</p> <p>or FT <i>their</i> 'x' $\times 2 + 3$ or FT <i>their</i> 'x' $+ 5$ FT only if x is non integer Condone length and width reversed</p>	<p>A0 for just $\frac{27}{6}$</p> <p>eg after $4\frac{3}{6}$, $x = 4.3$, length = 11.6, width = 9.3 earns the last 2 marks but in such cases do not award isw as well</p>
6	(a)	(i)	$\frac{1}{4}$	2	M1 for $\frac{50}{200}$ oe	
		(ii)	Explanation eg 'Frequency for 5 is high' or 'Frequency for 2 is low'	1		See Exemplars
	(b)		$\frac{1}{24}$ oe	2	<p>M1 for <i>their</i> (a)(i) $\times \frac{1}{6}$</p> <p>A1 $\frac{1}{24}$ oe FT <i>their</i> (a)(i)</p>	

Question		Answer	Marks	Part marks and guidance	
7		$x > 6$	4	<p>M1 for first step correctly eliminating fraction or division by 2 $5x + 4 > 2x + 22$ or $2.5x + 2 > x + 11$ M1 for $3x + 4 > 22$ correctly collecting x terms FT M1 for $3x > 18$ correctly collecting numbers FT A1 for $x > 6$ or M1 correct division FT from $kx > m$ (accept simplified improper fraction isw)</p> <p>or B3 for $x = 6$ or $x < 6$ or SC2 for 6 embedded in inequality or SC1 for 6 embedded in equation</p>	<p>Condone for first three method marks the use of = instead of ></p> <p>Condone use of \geq throughout</p> <p>Non-linear statements do not score</p>
8	♠	<p>$a = 70$</p> <p>alternate angles</p> <p>isosceles triangle</p>	<p>1</p> <p>1</p> <p>1</p>	<p>Condone z angles</p> <p>Or [sum of the] angles of a triangle is 180° (and 180 may be omitted if 70 correct)</p>	<p>Condone wrong/no angles mentioned Condone alternative, alternating etc 0 for alternate segment 0 for just opposite</p> <p>1 for 'triangle adds to 180' 0 for sides of triangle add to 180 0 for angles add to 180 0 for a list of angle facts</p>

Question		Answer	Marks	Part marks and guidance	
9	(a)	Superior	1	Accept 1.2×10^{13}	
	(b)	2.08×10^{12} or 2.1×10^{12}	2	M1 for 16×10^{11} or 0.48×10^{12} or figs 208 or $1.6 + 0.48$ or $16 + 4.8$ or 1 600 000 000 000 and 480 000 000 000 seen	
	(c)	1000	1	Accept 1×10^3 or 10^3 or 1029 or 1030 oe	
10	(a)	$y = \frac{2+6x}{x+5}$	4	M1 for expansion $xy - 6x = 2 - 5y$ M1 for rearranging so terms in y (only) together FT <i>their</i> 1 st step eg $xy + 5y = 2 + 6x$ M1 for factorising FT <i>their</i> 2 nd step eg $y(x + 5)$ A1 for $y = \frac{2+6x}{x+5}$ or FT dependent on 3 rd M1	
	(b)	$(2x + 1)(x - 5)$ -0.5 and 5	M2 A1FT	M1 for factors, using integers excluding 0, giving two terms correct when expanded or $(2x \pm 1)(x \pm 5)$ FT their factors (providing M1 scored and not $(x + m)(x + n)$) If M0, B1 for -0.5 and 5	
				Accept $(2x - 10)(x + 0.5)$ for M2 Eg $(2x - 1)(x + 5)$ then 0.5, -5 scores M1A1	

Question			Answer	Marks	Part marks and guidance	
11			AG = AE and AB = AD because 'sides of square'	1	Alternative: 1 for AG = AE and AB = AD and $\angle GAD = \angle EAB$ without adequate reasons or 1 for both reasons without facts	Accept 'two sides and an angle are the same' or SSA
			$\angle GAD = \angle EAB$ because 'both 90 + $\angle EAD$ '	1		
			[Congruent] SAS	1		
12	(a)		-0.34	1		
	(b)		Cosine graph sketched through (0, 1) (90, -1) (180, 1)	2	Ignore $x > 180$ M1 for amplitude or period correct without translation	For M1 curve to start at (0, 1) or (0, 2) or (0, $\frac{1}{2}$)
13	(a)	♠	26455 to 26456	3	M2 for 1.27×20831 Or M1 for 1.27 or 0.27×20831 oe or $5624(.37)$ If M0 allow SC2 for figs 2645537	eg M1 for $2083.1 + 2083.1 + 1458.17$
	(b)		22398 to 22399	3	M2 for $\frac{20831}{0.93}$ Or M1 for 0.93 or $x - 7\%x = 20831$ implied	
	(c)	♠	24500 or 24501 and 25499 or 25500	1 1	<i>Their</i> lower boundary <i>Their</i> upper boundary Accept answers in either order	But 0 for eg 23500 and 24500

Question			Answer	Marks	Part marks and guidance										
14	(a)	♣	418 to 419	3	<p>M1 for $\pi \times 60$ or 188... or equiv for semicircle [$(\pi \times 60)/2$ or 94...]</p> <p>M1 for <i>their</i> '188' + 230</p>	<p>Allow even if later doubled or halved</p> <p>For any number + 230 (oe) eg M0M1 for 120 + 230 or 350 Area + 230 M0M1 418 + 120 M1M1 188 then 377 + 230 M1M1 But 377 + 230 with no working M0M1</p>									
	(b)	♣	<p>Groups, eg</p> <table style="margin-left: 20px;"> <tr><td>20 – 29</td><td>4</td></tr> <tr><td>30 – 39</td><td>4</td></tr> <tr><td>40 – 49</td><td>10</td></tr> <tr><td>50 – 59</td><td>6</td></tr> <tr><td>60 – 69</td><td>6</td></tr> </table> <p>Points plotted at correct heights FT <i>their</i> frequencies if shown</p> <p>Plots at midpoints and points joined with ruled lines</p>	20 – 29	4	30 – 39	4	40 – 49	10	50 – 59	6	60 – 69	6	<p>1</p> <p>For 20 – 24, 25 – 29 etc frequencies are 0,4,2,2,4,6,2,4,2,4 for 25 – 34, 35 – 44 etc: 6,6,8,6,4</p> <p>Allow for groups seen in stem and leaf form or tallied with or without totals</p> <p>1</p> <p>Condone one error</p> <p>1</p> <p>For groups 20 – 29, 30 – 39 etc allow plots at 24 – 26.</p>	<p>May be implied by attempt at freq polygon or bar graph with these heights correct; condone eg 20 – 30, 30 – 40 etc if freqs correct</p> <p>Allow bars of the 'correct' height</p> <p>Ignore lines from endpoints to axes; if bars and polygons, ignore bars</p>
20 – 29	4														
30 – 39	4														
40 – 49	10														
50 – 59	6														
60 – 69	6														
15	(a)	(i)	32.[2...]	2	<p>M1 for $\frac{29}{90}$ or $\frac{(16+13)}{(16+13+36+25)}$</p>										
		(ii)	Percentage of females absent for more than 5 days	1											

Question		Answer	Marks	Part marks and guidance																			
	(b)	6.05(...) or 6.06 or 6.1	4	<p>M1 for 1, 4, 8, 23 condone 1 error M1 for $37 \times 1 + 24 \times 4 + 17 \times 8 + 12 \times 23$ ($37 + 96 + 136 + 276$)</p> <p>M1 for <i>their</i> '545' $\div 90$ A1 FT for 22 to 24 used in place of 23 allow 6 after M3 awarded and no errors in working</p> <p>After 0, allow SC1 for 5.3(1..)</p>	<p>FT <i>their</i> '1, 4, 8, 23' including eg 2, 5, 10, 35 but not 2, 2, 4, 24 Addition may be implied</p> <p>A1 FT for 5.92 or 5.9 or 6 from 22 OR 5.98.. or 5.99 or 6 from 22.5 OR 6.1(2..) or 6 from 23.5 6 or 6.18(...) or 6.19 or 6.2 from 24</p>																		
16		Min 1200, max 5000 indicated	1																				
		LQ at 2700, UQ at 3600	1	Vertical lines																			
		Median 3100 within completed box plot	1																				
17		2 correct trials of x for $1.1 < x \leq 1.15$ with one outcome less than 4 and one greater than 4	M3	<p>M2 for 2 correct trials of x for $1.1 \leq x \leq 1.2$ Or M1 for any value of x substituted for $1 < x < 2$</p>	<p>Evaluation not required for M1 if correct substitution evident</p> <table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>1.1</td> <td>3.7(62)</td> </tr> <tr> <td>1.2</td> <td>4.6(56)</td> </tr> <tr> <td>1.11</td> <td>3.8(4...)</td> </tr> <tr> <td>1.12</td> <td>3.9(2...)</td> </tr> <tr> <td>1.13</td> <td>4.0(1...)</td> </tr> <tr> <td>1.14</td> <td>4.1(0...)</td> </tr> <tr> <td>1.15</td> <td>4.1(9...)</td> </tr> <tr> <td>1.125</td> <td>3.9(7...)</td> </tr> </tbody> </table>	x	y	1.1	3.7(62)	1.2	4.6(56)	1.11	3.8(4...)	1.12	3.9(2...)	1.13	4.0(1...)	1.14	4.1(0...)	1.15	4.1(9...)	1.125	3.9(7...)
	x	y																					
1.1	3.7(62)																						
1.2	4.6(56)																						
1.11	3.8(4...)																						
1.12	3.9(2...)																						
1.13	4.0(1...)																						
1.14	4.1(0...)																						
1.15	4.1(9...)																						
1.125	3.9(7...)																						
	1.13	1	Independent mark	<p>Accept answers to 1dp, truncated or rounded</p>																			

Question		Answer	Marks	Part marks and guidance	
18	(a)	178.(4) or 1.78(4...)	4	<p>M3 197.(...) or $\sqrt{38976}$ M2 $32^2 + GC^2 = 200^2$ or $\sqrt{(200^2 - 32^2)}$ M1 for attempted use of Pythagoras' theorem (or trig with angle ACG or GAC) with AG 32cm Allow SC1 for $\sqrt{(200^2 - 16^2)}$ and SC2 for 180.(3...)</p>	eg $200^2 + 32^2$
	(b)	9[.2...]	3	<p>M2 for $\sin^{-1}(32/200)$ oe [FT <i>their</i> GC] Or M1 for $\sin ACD = 32/200$ oe Or M1 <i>their</i> inverse trig function used correctly FT <i>their</i> trig function (must use lengths from diagram or calculations)</p>	<p>eg $\cos^{-1}(197.4/200)$ or $\cos^{-1}(178.4/180.7)$ or $\sin^{-1}(28.9/180.7)$</p> <p>Condone M1 for $\sin^{-1}(24/200)$ (assuming BE = 8). If eg $\cos C = 32/200$ then $C = 80.8$ this is sufficient evidence for use of inverse trig function.</p> <p>Allow M1 for correct sine rule statement eg $\frac{32}{\sin C} = \frac{200}{\sin 90}$</p> <p>For cosine rule allow M1 for $32^2 = 200^2 + GC^2 - 2 \times 200 \times GC \cos ACD$ and M2 for $\cos^{-1}\left(\frac{200^2 + GC^2 - 32^2}{2 \times 200 \times GC}\right)$</p> <p>grads 10.(2...) implies M2 rads 0.16(0...) implies M2</p>

Question		Answer	Marks	Part marks and guidance	
19	(a)	$\frac{(106 + 41 + 27 + 65)}{4}$	1		
	(b) (i)	Estimate 56 to 58	1		Ignore any calculation
	(ii)	<i>Their</i> '4 × (b)(i)' – 204 correctly evaluated	2	M1 for 65 + 99 + 40 + n or (b)(i) × 4 soi	
20	(a)	5.3 to 5.4	2	M1 for (12/21) × 9.4	
	(b)	3.49 to 3.5	2	M1 for (21/18) ³ or 1.58... or (18/21) ³ or 0.629... M1 implied by 3.4 to 3.52...	
21	(a)	$x^2 + (3x + 1)^2 = 33$ $9x^2 + 3x + 3x + 1$ $10x^2 + 6x - 32 = 0$	M1 M1 A1		Accept $5x^2 + 3x = 16$ at last stage
	(b)	(-2.1, -5.3)	4	B3 for -2.1(1...) Or M2 for $\frac{-3 - \sqrt{329}}{10}$ or $\frac{-3 + \sqrt{329}}{10}$ Or M1 for $\frac{-3 \pm \sqrt{3^2 - 4 \times 5 \times -16}}{10}$ Allow B3 for (1.5, 5.5)	Marks for (b) can be gained in (a) Condone 1.5 and -2.1 seen for B3 Condone 2 errors for M1 If M1 or M2 scored allow 1FT for correct coordinates from substitution of <i>their</i> negative 1dp answer in $y = 3x + 1$ (or $x^2 + y^2 = 33$ if evidence of <i>their</i> substitution seen)

APPENDIX 1

Exemplar responses for question 3(b)

Response	Mark awarded
32 is an even number	0 not sufft
Nothing adds up to make 32 in the sequence given or used in it	0 not sufft
Each term in the sequence is always an odd number	1
If you keep adding 4 it doesn't get to 32	1
No, the 7 th number in the sequence is 29 and plus 4 would give 33	1
No, you would have to change the sequence to fit it in	0
No, although 32 is a multiple of 4 you add 1 each time	1
No, although 32 is a multiple of 4 you add 1 each time which means the closest it gets to 32 is 29 or 34	1bod condone slip at end
No, $32-1=31$, $31\div 4=17.7$ is the reverse of $4n+1$ and 31 does not go into $4x$ table and all numbers are odd	1
No, $5\times 4+1=21$ and then multiplying 21, 32 is skipped. As it equals 85	0
No, it is an even number and doesn't fit the sequence	0 not sufft
No, the nth term means it becomes larger than 32	0
No – it's going up in odd numbers and 32 is even	1
No - $4 \times 7 + 1$ is too low and $4 \times 8 + 1$ is too high	1
No – each nth term goes up in fours and 32 is even	0 not quite enough
No – the sequence is going up in fours and it started on an odd number	1
No – the 7 th term is 29 and the 8 th term is 33	1
No, (the sequence goes up in 4s and in the sequence is) 5, 9, 13, 17, 21, 25, 29 and 33	1

Exemplar responses for question 6(a)(ii)

Response	Mark awarded
Should be 1/6	1
Results are not even	1
Results are too spread out	1
Because there are 6 numbers and $\frac{1}{4}$ of the time she got a 5, and she got 5 a lot more times than any other	1
Because the probability of getting 5 should be 1/6	1
Because the probability to get each score should be equal and be 1/6, but to get 5 is $\frac{1}{4}$ and is higher than the rest	1
The frequency of each score should be a lot more similar, the range between 2 and 5 is far too big	1
Because there were more results for 5 than for any other number	1

Because 5 was more frequent	1
Not all similar	1
Probability of getting each number has a big difference	1
Could be heavier on the side with 5	0
Because on the dice 5 has been scored 50 times	0
Because the range is large	1
Should be near the same for each outcome	1

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

© OCR 2012

