

**Mathematics C (Graduated Assessment)**

General Certificate of Secondary Education

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

**Mark Scheme for June 2011**

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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.

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**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.  
**W** marks are workless marks, which are independent of **M** (method) marks and are awarded for a correct final 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  $180 \times (\textit{their} '37' + 16)$ , or FT  $300 - \sqrt{(\textit{their} '5^2 + 7^2')}$ . Answers to part questions which are being followed through are indicated by eg FT  $3 \times \textit{their} (a)$ .  
  
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.
  - **cao** means **correct answer only**.
  - **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**.

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 **W** marks. Deduct 1 mark from any **A** or **W** 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.

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.

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.

## MARK SCHEME

## Section A

Question		Answer	Marks	Part marks and guidance													
1	(a)	Frequencies used or shown on graph eg 14, 19, 10, 6, 9, 2  Frequency axis scaled          Bars correct height	1  1          1	<i>Eg is given for intervals 0-9, 10-19, ...</i> Condone 2 errors or omissions  Any consistent scaling (min 2 values and 0 soi)      FT their widths eg 0-10 is 2 cm wide 0-9 could be 1.8 or 2 cm wide Allow gaps between bars.  Frequency polygon plots at intent of mid-point of group  Condone one error in plotting of bars or frequency polygon points	These are the other acceptable intervals: <table style="margin-left: auto; margin-right: auto;"><thead><tr><th>Interval</th><th>Frequencies</th></tr></thead><tbody><tr><td>0-10,11-20,21-30,31-40 ...</td><td>17, 18, 8, 8, 7, 2</td></tr><tr><td>0-4,5-9,10-14,15-19 ...</td><td>10, 4,10,9,7,3,4,2,4,5,1,1</td></tr><tr><td>0-5,6-10,11-15,16-20 ...</td><td>10,7,11,7,6,2,6,2,4,4,1</td></tr><tr><td>0-19,20-39,40-59</td><td>33, 16, 11</td></tr><tr><td>0-20,21-40,41-60</td><td>35, 16, 9</td></tr></tbody></table> Tolerance $\frac{1}{2}$ square for heights and widths For intervals 0-9, 10-19 etc accept bars 0-9,10-19, 20-29 or condone bars 0-9,9 -19,19-29.  Eg Frequency polygon with interval 0-9 accept plot from 4.5 to 5.  Condone plots not joined.	Interval	Frequencies	0-10,11-20,21-30,31-40 ...	17, 18, 8, 8, 7, 2	0-4,5-9,10-14,15-19 ...	10, 4,10,9,7,3,4,2,4,5,1,1	0-5,6-10,11-15,16-20 ...	10,7,11,7,6,2,6,2,4,4,1	0-19,20-39,40-59	33, 16, 11	0-20,21-40,41-60	35, 16, 9
Interval	Frequencies																
0-10,11-20,21-30,31-40 ...	17, 18, 8, 8, 7, 2																
0-4,5-9,10-14,15-19 ...	10, 4,10,9,7,3,4,2,4,5,1,1																
0-5,6-10,11-15,16-20 ...	10,7,11,7,6,2,6,2,4,4,1																
0-19,20-39,40-59	33, 16, 11																
0-20,21-40,41-60	35, 16, 9																
	(b)	$\frac{17}{60}$ oe	2	<b>M1</b> for 17 or FT <i>their</i> '6 + 9 +2' <b>Or W1</b> for 43/60	Equivalentents include 0.28[3...], 28.[3...]% 17 ÷ 60 gains M1												
2	(a)	43.2[0]	1														
	(b)	1.8	1		allow $1\frac{4}{5}$												

Question		Answer	Marks	Part marks and guidance	
3		$x = 135$	2	M1 for $6 \times 180$ oe ( eg 1080) or [exterior =] $360/8$ soi or $(360 - 90)/2$	There are various correct ways the angles may be obtained. Do not apply nfw throughout this question.
		$y = 45$	2	correct or FT $180 - \textit{their } x'$ M1 for $360 - 90 - 90 - \textit{their } x$ or $\textit{their } x - 90$ or $\textit{their } x \div 3$ or $\textit{their } x + y = 180$ oe  SC1 for $x = 90$ and $y = 90$	No FT for $x = 90$
4	(a)	$2^2 \times 3^2$ or $2 \times 2 \times 3 \times 3$	2	M1 for 2, 3 [and 1] only seen	May be seen in tree or incorrect answer eg $2^2 + 3^2$ eg 2, 3, 5 scores M0
	(b)	180	2	M1 for any multiple of 180	$5 \times 2^2 \times 3^2$ scores M1
5	(a) (i)	W L W W L L W	2	M1 for first 3 correct	
	(ii)	62.5 oe	2	M1 for $5/8$ or $5 \div 8$ oe FT <i>their</i> (i) or W1 for 62 or 63 without working or more accurate values shown	If W L W W L L L then M1 for 50% or $\frac{1}{2}$ similarly for all wins then M1 for 100% If W L W L W L W and 62.5 then 2 scored If 0.625 in working then 63 as answer allow 2 marks.
	(b) (i)	Malik's median = 54 or 55 Leo's IQR = 38 or 39 or 40	1 2	W1 for LQ or UQ (ie 20 or 58 or 59 or 60)	Mark readings in table for (i) and (ii) marks. Similarly for W1 mark 20 or 58 or 59 seen. However check that 60 is not from eg Kevin: $60 - 42 = 18$ .
		17 or 18 Leo	1 1	correct or FT <i>their</i> (i) for smallest IQR	40, 40 and Leo (or Leo and Malik) scores 1 40, 40 and Malik scores 0

Question		Answer	Marks	Part marks and guidance
6		$2\frac{8}{15}$ or $2\frac{16}{30}$	3	<p><b>W2</b> for <math>\frac{38}{15}</math> or <b>M2</b> <math>3 - \frac{7}{15}</math></p> <p><b>Or M1</b> for attempt to convert both fractions to a <u>common denominator</u> with at least 1 numerator correct eg <math>\frac{5}{15}</math> or <math>\frac{12}{15}</math> or <math>\frac{65}{15}</math> or <math>\frac{27}{15}</math> <b>and M1</b> the result of their subtraction changed correctly to mixed number (their subtraction must involve borrowing/ conversion of an integer)</p> <p>If <b>0</b> scored allow <b>SC1</b> for 2.53(...)</p> <p>BOD the meaning of the negative fraction</p> <p>common denominator a multiple of 15</p> <p>Allow M1 for <math>\frac{7}{15}</math> or <math>\frac{-7}{15}</math> or <math>3\frac{7}{15}</math></p> <p>eg <math>4\frac{5}{15} - 1\frac{11}{15} = 2\frac{9}{15}</math> gets M1M1 but <math>4\frac{5}{15} - 1\frac{4}{15} = 3\frac{1}{15}</math> gets M1M0 (no conversion required)</p>
7	(a)	-9	3	<p><b>M1</b> for <math>5x + 19 = 2x - 8</math> <b>and</b> <b>M1</b> for <math>3x = -27</math> FT their 1<sup>st</sup> step <b>and</b> <b>M1</b> for <math>x = b/a</math> FT <i>their</i> 2<sup>nd</sup> step <math>ax = b</math> for <math>a \neq 1, -1, 0</math> or <math>b</math></p> <p>or <math>2.5x + 9.5 = x - 4</math> and <math>1.5x = -13.5</math> Allow correct decimal for final M1 FT <math>-\frac{27}{3}</math> scores M2 but allow improper fractions for final M1 if no integral solution</p>

Question		Answer	Marks	Part marks and guidance	
	(b)	4, 3	3	4, 3 nfw, mark final answer for 3  <b>M2</b> for $(x-4)(x-3)$ <b>Or M1</b> for factors, using integers excluding 0, giving two terms correct when expanded or $(x \pm 4)(x \pm 3)$  <b>A1</b> (after <b>M1</b> or <b>M2</b> ) for solutions FT <i>their</i> factors only	Note $(x+4)(x+3)$ followed by 4, 3 scores M1 only Other methods : <b>M2</b> for $\frac{7 \pm \sqrt{1}}{2}$ or <b>M1</b> for substituting into the quadratic formula with at most one error or <b>M2</b> for $x = 7/2 \pm 1/2$ or <b>M1</b> for $(x - 7/2)^2 = 1/4$
8	(a)	$x^2$	1		
	(b)	$x^7$	1		
	(c)	$\frac{1}{2x^2 + 3}$	2	<b>M1</b> for $3x(2x^2 + 3)$ or $\frac{3}{6x^2 + 9}$ or $\frac{x}{(2x^3 + 3x)}$ or <b>W1</b> for $2x^2 + 3$	
9	(a)	$19 = 9c + d$	1	accept $d = 19 - 9c$ oe	
	(b)	$c = 3$ and $d = -8$	2	correct or FT their $k = pc + rd$ in (a)  <b>M1</b> $21 = 7c$ , or better, or FT their (a)	condone 1 error when equating coefficients and subtracting equations. FT for M1 may be from $19 = -9c + d$ after $19 = (-3)^2 c + d$ in (a)
10		Giles = $\frac{1}{4}$ and Harry = $\frac{1}{4}$ oe John = $\frac{1}{2}$ oe	1 1	<b>SC1</b> for $G=H$ and $G+H+J=1$ apart from $G = H = J = 1/3$	eg $G=0.2$ $H=0.2$ $J=0.6$ scores SC1
11	(a)	Explanation eg Common angle and right angles in both triangles	1		



Question		Answer	Marks	Part marks and guidance	
	(b)	54	3	<b>M2</b> for $(3/5)^3$ or $(5/3)^3$ seen or <b>M1</b> for 3/5 or 5/3 seen	Allow $0.6^3$ 1.66.. <sup>3</sup> , 27 : 125, 125 : 27 Allow 0.6 1.66.., 3:5, 5:3 M1 implied by an answer of 150
12	(a)	$(x - 4)^2 + 11$	1 2FT	<b>strict FT</b> their $a$ nfw <b>M1</b> for $b = 27 - \text{their } (-4)^2$  <b>SC1</b> $(x - 8)^2 + 11$	condone $(x + -4)^2$ Eg $(x - 8)^2 - 37$ scores 2FT allow $a = 4$ and $b = 11$ for 3 marks, and $a = -4$ and $b = 11$ for 2 marks if correct expression not seen
	(b)	(+)11	1	or FT <i>their</i> part (a) as long as (a) in form $(\dots)^2 + b$ and the expression in the bracket could equal 0	condone answer $(n, 11)$

Section A Total: 50

## Section B

Question			Answer	Marks	Part marks and guidance
13	(a)	(i)	136	3	<p><b>M1</b> for 2.25 seen <b>and</b> <b>M1</b> for 306/<i>their</i> time interval <b>Or</b> <b>M2</b> for <math>\frac{306}{135} \times 60</math></p> <p>eg M1 for 306/2.15 or 142.[..] or for 306/135 or 2.26 to 2.27</p> <p>Allow equivalent marks for those putting clocks forward on journey ie 3 marks for 244.8 or 245 allow M1 for 1.25 seen and M1 for 306/1.25 or M1 for 306/75 or 4.08 or 4.1 Or M2 for <math>\frac{306}{75} \times 60</math></p>
		(ii)	217.6 or 218	2FT	<p>Correct or FT 1.6 x <i>their</i> (i) for <b>M1A1</b></p> <p><b>M1</b> for their <math>136/5 \times 8</math></p> <p>or <b>SC1</b> 489.6 or 490</p> <p>Accept exact answers or sensible rounding/truncation eg 142(.3...) accept 227 to 228 2.26 to 2.27 or 2.3 accept 3.61 to 3.64 244.8 or 245 accept 391 to 392 all score M1A1</p>
	(b)		75	2	<p><b>M1</b> for <math>90 \div 1.20</math></p> <p>Allow M1 for <math>75 \times 1.2 [= 90]</math></p>

Question			Answer	Marks	Part marks and guidance
14	(a)		15.55	3	<p><b>M1</b> for <math>230 \times 18</math>, <math>165 \times 15</math>, <math>85 \times 10</math></p> <p><b>and M1</b> (dependent on attempt at their 7465) for <math>(\textit{their 7465})/480</math></p> <p>may be implied by 7465</p> <p>Allow M1 for at least two of 4140, 2475 and 850 seen even if not used ( or deleted) eg may be seen by table</p> <p>Allow M2 for answer 15.5 to 15.6</p> <p>Allow M2 to be implied by an answer of 6616.77[...] [obtained from failure to press (=)]</p> <p>NB An answer of 16 scores 3 if correct answer seen, 2 if correct working seen 0 if no working shown</p>
	(b)		11.7[0]	3	<p><b>W2</b> for 6.3[0]</p> <p><b>M2</b> for <math>0.65 \times 18</math> oe or <math>18 - 0.35 \times 18</math> oe</p> <p>or <b>M1</b> for 0.65 or 65/100 or <math>0.35 \times 18</math> oe</p> <p>If M0, allow <b>SC1</b> for correctly working out 65% of back stalls or balcony prices having seeing the price being used (answers 9.75 or 6.50).</p> <p>NB W0 for just 630 (<math>18 \times 35</math>)</p>
	(c)		Pie chart with 3 sectors correct and labelled Front, Back, Balcony Angles = $200^\circ$ , $90^\circ$ , $70^\circ$ ( $\pm 3^\circ$ )	3	<p><b>M2</b> for pie chart with sector sizes correct but mislabelled or 2 sectors within tolerance and 1 outside; all three labelled</p> <p><b>Or M1</b> for 200, 90 and 70 (or 55-56, 25 and 19-20[%]) seen or pie chart with 1 correct angle (condone wrong/no labels)</p> <p>Labels should not be 100, 45, 35 or angles or %; accept abbreviations; condone misspellings if intent clear.</p> <p>For unruled lines check the angle where the line crosses/would cross the circumference</p> <p>For the reflex angle measure the corresponding obtuse angle <math>160^\circ \pm 3^\circ</math></p>
15	(a)	(i)	$4x - 3$	2	<p>as final answer</p> <p><b>M1</b> for <math>10x - 6x - 3</math></p> <p>or <b>W1</b> for <math>4x</math> seen</p> <p><b>M1</b> for <math>4x + -3</math></p>

Question	Answer	Marks	Part marks and guidance	
	(ii) $x^2 + 6x + 9$	2	M1 for $x^2 + 3x + 3x + 9$ or better; 3 terms correct	eg $x^2 + 6x [+ b]$ scores M1 $x^2 + 9$ scores 0
	(b) $[x = ] \frac{y+7}{4}$ oe	2	M1 for $y + 7 = 4x$ oe (eg $y/4 = x - 7/4$ ) or SC1 for answer of $y + 7 \div 4$ or $y+7/4$ or $\frac{y}{4} + 7$ or for incorrect versions of $\frac{\pm y \pm 7}{\pm 4}$ oe	NB There is no FT mark from wrong 1st step eg $8y = 4x$ then $x = 2y$ scores 0  Allow M1 for correct reverse flow chart (ie correct operations and clearly in correct order eg as shown by arrows)
16	(a) $x$ .. [number of] usual price tickets $y$ .. [number of] cheap tickets	1	Accept normal, expensive, etc	Ignore numbers
	(b) (i) $x + y = 50$ drawn $y = 15$ drawn $20x + 12y = 720$ drawn	1 1 2	Mark 'intent' to draw straight lines.  M1 for line with negative gradient through (0, 60) or (36, 0) ( $\pm 1$ square)	If $x = 15$ and $y = 15$ are both drawn then the mark for $y = 15$ cannot be earned.  Condone 'part lines' if continued line would be correct. Allow dotted lines, Allow tolerance $\pm \frac{1}{2}$ square .
	(ii) Region satisfying 3 inequalities identified	1	can only FT from 1,1,1 (or 2) awarded in (b)(i)	Accept shaded region or the only region left blank with the rest shaded
17	(a) $9.39 \times 10^8$	3	M2 for $\pi \times 2 \times 1.495$ or figs 939[.....] isw or M1 for $\pi \times 1.495 \times 10^8$	4.69 to $4.7 \times 10^8$
	(b) 107 100 to 107 500 or 107 000 to 3sf	3	M2 for <i>their</i> (a) / (365 $\times$ 24) or M1 for 8760 seen or <i>their</i> (a) / 365 isw or <i>their</i> (a) / 24 isw or <i>their</i> (a) / 525 600 isw	

Question		Answer	Marks	Part marks and guidance	
18	(a)	$p = 2$ $q$ between 0 and 5	1 1	allow $2x$ accept $q < 5$ , $q$ is not 5	accept any value between 0 and 5 eg 3.1 (not 0 or 5)
	(b)	$r = -0.5$ oe $s = 5$	1 1	allow $-0.5x$ , $-1/2x$ allow (0,5)	allow $r \times p$ ( or 2 ) = -1 oe
19	(a)	197( ...)	3	<b>M2</b> for $\sqrt{100^2 + 80^2 + 150^2}$ <b>or M1</b> for correct 2D Pythagoras statement or $100^2 + 80^2 + 150^2$	could be in two stages eg $\sqrt{100^2 + 80^2}$ or = 128.(...) or $\sqrt{150^2 + 80^2}$ or = 170 or $\sqrt{150^2 + 100^2}$ or = 180.27(...) or 180.3
	(b)	49.4 to 49.6	3	<b>M1</b> for correct trig statement eg $\sin \text{BHF} = 150/\text{their BH}$ <b>and</b> <b>M1</b> for their inverse trig function seen or implied <b>and</b> <b>A1</b> (dep on <b>M1</b> ) for 50 .The second <b>M1</b> will also be implied.  <b>or</b> <b>W2</b> for 40.4 to 40.5	eg $\tan^{-1} 150/80$ scores 2 <sup>nd</sup> M1(condone absence of brackets) $\tan = 150/180$ then 39.8 scores 2 <sup>nd</sup> M1 (either check notation or check use with calculator) Their trig function must use dimensions of cuboid or calculated lengths.  Answer in gradients 55.01[...] scores W2 radians 0.864[...] scores W2

Question	Answer	Marks	Part marks and guidance
20	137 790 to 137 820	6	<p><b>W5</b> for 136 850 to 138 460 <b>OR</b></p> <p><b>W4</b> for 145 060 or 145 061 <b>OR</b></p> <p><b>W3</b> for 85593.(...) or 85590 <b>OR</b></p> <p><b>M1</b> for <math>240 \times 430 \times 0.5</math> <b>and</b> <b>M1</b> for <math>0.5 \times 220 \times 350 \times \sin 118</math> <b>and</b> <b>M1</b> for <i>their</i> <math>(240 \times 430 \times 0.5 + 0.5 \times 220 \times 350 \times \sin 118)</math></p> <p><b>and</b></p> <p><b>M1</b> for <i>their</i> area in <math>\text{m}^2/10\,000</math> soi <b>and</b> <b>M1</b> for <i>their</i> area in hectares <math>\times 16\,100</math></p> <p>Candidates may multiply by 16100 and then divide by 10000 Examiners to use a calculator to check whether candidate has multiplied by 16100 (only if <math>\times 16\,100</math> not shown) Alt method <b>M1</b> <math>16100/10000</math> soi <b>and</b> <b>M1</b> their area <math>\times</math> their <math>16100/10000</math></p> <p>The 4<sup>th</sup> and 5<sup>th</sup> <b>M1</b> can be earned for finding the area in hectares and the cost for one triangle. The 3<sup>rd</sup> <b>M1</b> can be earned from the addition of the two costs. Completely spurious areas can only earn the last 2 method marks.</p> <p>'Trapezium': eg <math>0.5 \times 650 \times 240</math> or 78000 candidates can score <b>M1M1</b> for 7.8 then <math>\times 16100</math>.</p>

Section B Total: 50

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