

**MARK SCHEME for the May/June 2011 question paper**  
**for the guidance of teachers**

**0580 MATHEMATICS**

**0580/42**

Paper 4 (Extended), maximum raw mark 130

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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<b>Page 2</b>	<b>Mark Scheme: Teachers' version</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>IGCSE – May/June 2011</b>	<b>0580</b>	<b>42</b>

### Abbreviations

cao	correct answer only
cso	correct solution only
dep	dependent
ft	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
www	without wrong working
art	anything rounding to
soi	seen or implied

Qu.	Answers	Mark	Part Marks
<b>1 (a)</b>	<b>(i)</b> 25	1	
	<b>(ii)</b> 15.5 (15.46 to 15.47)	1	
	<b>(iii)</b> 0.05 oe	2	B1 for 1/100 or 0.01 seen
<b>(b)</b>	8812.50 final answer    www 3	3	Condone 8812.5 M2 for $7500 \times 5 \times 0.035 + 7500$ oe (implied by final answers 8810, 8812, 8813 or 8812.5(0) seen) or B2 for 1312.5 as final answer or M1 for $7500 \times 5 \times 0.035$ oe (implied by final answers 1310, 1312, 1313)
<b>(c)</b>	<b>(i)</b> $2^2 \times 3 \times 5$	2	Allow $2 \times 2 \times 3 \times 5$ M1 for any correct <u>product</u> of 3 factors = 60 seen or correct factor ladder or correct tree (condone 1's on tree/ladder)
	<b>(ii)</b> 12	2	M1 for $2^2 \times 3$ or $2 \times 2 \times 3$ oe
	<b>(iii)</b> 240	2	M1 for $2^4 \times 3 \times 5$ or $2 \times 2 \times 2 \times 2 \times 3 \times 5$ oe SC2 only for both correct answers <b>(ii)</b> <b>(iii)</b> reversed
<b>2 (a)</b>	3.02 (3.023...)    www 4	4	M3 for $\sqrt{2^2 + 1.5^2 + 1.7^2}$ oe may be in two steps or $\sqrt{9.11}$ to 9.15... (3.018 to 3.026..) or M2 for $2^2 + 1.5^2 + 1.7^2$ oe implied by 9.11 to 9.15.... or M1 for any correct Pythag in 1 of the faces e.g. $2^2 + 1.5^2$
	<b>(b)</b> 34.1 to 34.3    cao    www 3	3	M2 for $\sin = 1.7/\text{their } EC$ or $\cos = \text{their } EG/\text{their } EC$ or $\tan = 1.7/\text{their } EG$ or complete long method (M1 for $CEG$ as required angle – accept on diagram if clear)
	<b>(c)</b>	<b>(i)</b> 2.95 cao <b>(ii)</b> Yes <b>and</b> because their <b>(c)(i)</b> < their <b>(a)</b>	1 1ft

Page 3	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2011	0580	42

3 (a)	(i) 142 to 150	2	B1 for 7.1 to 7.5 seen
	(ii) (0)59 to (0)63	1	
	(iii) 148° to 152° drawn Distance 6.8 to 7.2 cm drawn	1	Both marks available from the position of <i>B</i> as lines don't need to be drawn.
3 (b)	(iv) 328 to 332°	1	
	(v) 60                                  www 2	2	M1 for 20 <sup>2</sup> or better seen
3 (b)	667 (666.6 to 666.7)    www 3	3	B1 for 2.25 (h), 135 (mins), 8100 (sec) and M1 for 1500 ÷ their time in hours (time must be in range 2.09 to 3.25) (could be implied by 697 to 698)
3 (c)	(cos =) $\frac{1125^2 + 790^2 - 1450^2}{2 \times 1125 \times 790}$	M2	M1 for $1450^2 = 1125^2 + 790^2 - 2 \times 1125 \times 790 \cos Q$
	96.9 (96.87 to 96.88)    www 4	A2	A1 for (cos =) -0.1197...(which implies M2)
4 (a)	4	1	
	- 5.8 or - 5.75 or - 5.7	1	
4 (b)	- 2	1	
	10 correct plots ft	P3ft	ft from their values in (a) generous with (- 0.25, 12.1) P2 for 8 or 9 correct plots ft or P1 for 6 or 7 correct plots ft
	Correct shape curve through 10 points (condone 2 points slightly missed) Two separate branches not crossing <i>y</i> -axis	C1ft	ft their points if shape correct – ignore anything between - 0.25 and 0.25
4 (c)		B1	B1
	- 2.5 to - 2.3	1	C1 and B1 are independent
	- 0.5 to - 0.4	1	
4 (d)	2.75 to 2.9	1	
	Correct tangent drawn at <i>x</i> = -2	T1	Allow slight daylight
	- 4 to - 2.5	2	Dep on T1 M1 Rise/Tread attempt Dep on T1 or SC1 for answer in range 2.5 to 4 after T1

Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2011	0580	42

5 (a)	2, 3, 4, 5	3	M2 for $1 < n \leq 5$ seen (M1 for $1 < n$ or $n \leq 5$ ) Allow $2 \leq n < 6$ in M2 or M1 case If 0, B2 for 3 correct with no extras or 4 correct with 1 extra.
(b)	(i) $2x(x + 5y)$ (ii) $3(a - 2b)(a + 2b)$	2 3	B1 for $x(2x + 10y)$ or $2(x^2 + 5xy)$ B2 for $(3a - 6b)(a + 2b)$ or $(a - 2b)(3a + 6b)$ or correct answer seen in working or B1 for $3(a^2 - 4b^2)$ If B0, SC1 for $a^2 - b^2 = (a - 2b)(a + 2b)$
(c)	(i) $\frac{1}{2}x(x + 17) = 84$ or $x(x + 17) = 2 \times 84$ Correct proof of $x^2 + 17x - 168 = 0$ (ii) $(x - 7)(x + 24)$ (iii) 7 and -24 ft	M1 E1 2 1ft	Condone $\frac{1}{2}x \times x + 17 = 84$ but only for M mark No errors or omission of brackets anywhere SC1 for $(x + a)(x + b)$ where $a$ and $b$ are integers and $a + b = 17$ or $ab = -168$ Correct or ft from their factors if quadratic
(d)	-3          www 3	3	B2 for $15 - 6 = x - 4x$ oe or better M1 for $15 - x = 2(3 - 2x)$ or better or $7\frac{1}{2} - x/2 = 3 - 2x$
(e)	$\sqrt{(-5)^2 - 4 \times 2 \times -6}$  $p = -5$ and $r = 2 \times 2$  3.39, -0.89    final answers	B1 B1  B1 B1 B1B1	$(\sqrt{73})$ Dependent on $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ or $(x - \frac{5}{4})^2$ B1 $\sqrt{3 + \frac{25}{16}}$ B1 SC1 for 3.4 or 3.386... or 3.39 seen and -0.9 or -0.886... or -0.89 seen

<b>Page 5</b>	<b>Mark Scheme: Teachers' version</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>IGCSE – May/June 2011</b>	<b>0580</b>	<b>42</b>

<b>6 (a)</b>	<b>(i)</b> $45 < t \leq 55$	1	Allow any indication e.g. 4 <sup>th</sup> interval
	<b>(ii)</b> 52.6 (52.63.....)      www 3	3	M1 for $6 \times 10 + 15 \times 27.5 + 19 \times 40 + 37 \times 50 + 53 \times 62.5 + 20 \times 75 (= 7895)$ Allow 1 error/omission and M1 dep for $\div 150$
	<b>(b)</b> <b>(i)</b> 40, 77, 130, 150	2	B1 for 2 or 3 correct values
	<b>(ii)</b> Correct scales 6 correct plots ft	S1 P3ft	ft from <b>(i)</b> if increasing values. (35, 21) must be inside square 20 – 22 but (55, 77) may be inside or edge of square P2 for 4 or 5 correct plots ft P1 for 2 or 3 correct plots ft
	Curve or ruled lines through the 6 points	C1ft	ft their points if increasing condone graph starting at (20, 6)
	<b>(c)</b> <b>(i)</b> 54 to 55	1	
	<b>(ii)</b> 18.5 – 22.5	2	B1 for UQ = 62.5 to 65 or LQ = 42.5 to 44 seen
	<b>(iii)</b> Their reading at 60 – their reading at 50	1	
	<b>(iv)</b> $\frac{150 - \text{their reading at } 50 (\pm 2)}{150}$ oe	2	SC1 for $\frac{\text{their reading at } 50 (\pm 2)}{150}$ oe
	<b>(v)</b> If their <b>(iv)</b> is $\frac{k}{150}$ , then ft their $\frac{k}{150} \times \frac{k-1}{149}$	2ft	In <b>(iv)</b> and <b>(v)</b> , condone answers as decimals to 3 sf Penalise first occurrence only of 2sf decimals isw cancelling/conversion M1 for $\frac{k}{150} \times \frac{k-1}{149}$

Page 6	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2011	0580	42

7 (a)	87.5 (87.45 to 87.52)    www 4	4	M1 for $\frac{1}{2} \times 2.5 \times 9.5$ soi by 11.875 or 71.25 and M2 for $\frac{1}{2} \times 2.5^2 \times \sin 60 \times 6$ oe (16.23 to 16.24) or M1 for $\frac{1}{2} \times 2.5^2 \times \sin 60$ (2.706..) or 1 trapezium (8.1189..)
(b)	107.9 ..... to 108.0.....www3	3	Must see at least 4 figures M2 for $\frac{55}{360} \times \pi \times 15^2$ or M1 for $\frac{55}{360}$ seen
(c) (i)	2.29 (2.291 to 2.293)    www 2	2	M1 for $108 = 15\pi r$ oe allow 107.9 to 108.0... for their 108
(ii)	14.8 (14.82 to 14.83)    cao    www 3	3	M2 for $\sqrt{15^2 - \text{their } 2.29^2}$ (M1 for $h^2 + \text{their } 2.29^2 = 15^2$ )
(d)	70.9 to 71.5 cao    www 3	3	M2 for $\frac{\pi}{3}$ (their $2.29^2 \times \text{their } 14.8 - \text{their } 1.145^2 \times \text{their } 7.4$ )    (not 15 or 7.5) or $\frac{7}{8} \times \frac{\pi}{3} \times \text{their } 2.29^2 \times \text{their } 14.8$ or M1 for $1/8$ oe e.g. $\frac{7.5^3}{15^3}$ or $7/8$ or $(\frac{1}{2} \text{ their } R \text{ and } \frac{1}{2} \text{ their } h)$ seen
8 (a)	Correct enlargement	2	B1 for any enlargement of 2 in correct orientation
(b) (i)	Stretch only y- axis oe invariant (factor) 4	1 1 1	
(ii)	$\begin{pmatrix} 4 & 0 \\ 0 & 1 \end{pmatrix}$	2ft	Ft their factor 4 SC1 for $\begin{pmatrix} k & 0 \\ 0 & 1 \end{pmatrix} k \neq 0, \neq 1$ or $\begin{pmatrix} 1 & 0 \\ 0 & 4 \end{pmatrix}$ ft their factor 4
(c)	Shear only x-axis oe invariant (factor) 2	1 1 1	

Page 7	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2011	0580	42

9 (a)	(i) 3, 8, 15 in correct positions	2	B1 for 2 correct values in correct positions
	(ii) 12	3	M2 for $12 \times (12 + 2) (= 168)$ or $12, (12 + 2)$ or M1 for $n^2 + 2n = 168$ then M1 for $(n + a)(n + b)$ where $a$ and $b$ are integers and $ab = -168$ or $a + b = 2$ oe
	(b) (i) $2 + 3n$ oe	2	Allow unsimplified e.g. $5 + 3(n - 1)$ B1 for $3n$ oe seen
	(ii) $2^{n-1}$ oe	2	B1 for $2^k$ seen
(c)	$a = \frac{1}{2}, b = 1\frac{1}{2}$ cao	6	B1 for 12 or 30 seen but if 30 clearly only from Diagram 4 then B0. M1 for any 1 of $a + b + 1 = 3$ oe $8a + 4b + 2 = 12$ oe $27a + 9b + 3 = 30$ oe M1 for a 2 <sup>nd</sup> of the above equations M1 (indep) for correctly eliminating $a$ or $b$ from pair of linear equations B1 for one correct value