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CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2012 series

0581 MATHEMATICS

0581/41 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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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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
1	**(a) (i)** 126	**2**	**M1** for $x + x + 18 + 90 = 360$ or better
	(ii) 144	**1 ft**	ft their $x + 18$
	(b) 16.66 . . . to 16.67 or 16.7 oe	**2**	**M1** for $60/360 \times 100$ oe (implied by answer 16.6)
	(c) (i) 22.18 to 22.19 or 22.2 oe	**3**	**M2** for $(35 + 36)/320 \times 100$ or **B1** for 36 or 35 or 71 seen
	(ii) 58 www	**2 ft**	For **2**ft, 114 – their **(a)(ii)**/360 × 140 correctly evaluated (correct or to the nearest integer) **or M1** for (360 – 60 – 72)/360 ×180 [114] **or** 56ft (their **(a)(ii)**/360 × 140) seen
	(d) (i) 50, 70, 100, 135	**M1**	At least 3 correct mid-values seen
	$(5 \times 50 + 14 \times 70 + 29 \times 100 + 32 \times 135)$ [= 8450]	**M1**	$\sum fx$ where x is in the correct interval allow one further slip
	÷ 80 or their $\sum f$	**M1**	Depend on second method
	106 or 105.6 or 105.625 or 105.62 or 105.63 cao www	**A1**	isw conversion to mins/secs & reference to classes
	(ii) 1		**B3** for 2.9 and 4.27
	2.9 oe		or **B2** for 2.9 **or** 4.27
	4.27 [4.266 to 4.267] oe	**4**	and **B1** for 1
			Or SC2 for 0.25 oe and 0.725 oe and 1.066 to 1.07 oe seen
			Or **SC1** for any pair of the above seen

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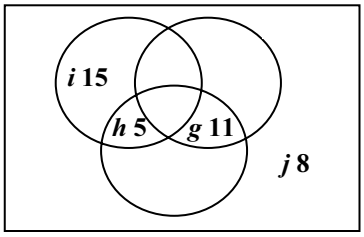
2	**(a) (i)** 14 –5.5 20	**1+1+1**	
	(ii) 10 correct points plotted	**P3 ft**	**P2** ft for 8 or 9 correct **P1** ft for 6 or 7 correct Centre of point must touch line if exact or be in correct square (including boundaries)
	Smooth curve through all 10 points correct shape	**C1**	Within 1 mm radially of potted points. In absence of plot[s], allow curve to imply plot[s] No ruled sections
	(b) –4.8 to –4.6, –0.4 to –0.2, 3 to 3.1 www	**1+1+1**	After 0 scored, **SC1** for $y = 2$ soi Penalise first occurrence of co-ord answers in **(b)** and **(d)(ii)**
	(c) Tangent drawn at $x = -4$	**T1**	Not chord or daylight
	Attempts y step/x step with correct scales	**M1**	Dep on **T1** or close attempt at tangent at $x = -4$
	6 to 11	**A1**	Dep on **M1** only
	(d) (i) Ruled line through (1, 15) and (3, –5)	**3**	**L2** for short line but correct or freehand full length correct line. **L1** for ruled or freehand line through (0, 10) (but not $y = 10$) or for ruled line with gradient –5
	(ii) 2.5 to 2.7	**1**	isw for extra solns from wrong curve/line
3	**(a)**  ($g =$)**11** ($h =$) **5** ($i =$)**15** ($j =$) **8**	**1** **1ft** **1ft** **1ft**	ft 16 – their 11 ft 20 – their 5 ft 39 – (their 11 + their 5 + their 15) ft for positive integers only
	(b) (i) 5	**1**	
	(ii) 51	**1 ft**	ft 36 + their i
	(c) (i) 15	**1**	
	(ii) 10	**1**	
	(d) (i) $\frac{13}{90}$ oe [0.144]	**1**	In **(d)** and **(e)** accept fraction**,** %, dec equivalents (3sf or better) throughout but not ratio or words isw incorrect cancelling/conversion
	(ii) $\frac{15}{90}$ oe [0.167]	**1**	

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	(e) (i) $\frac{20}{8010}$ oe [0.0025[0]]	**2**	**M1** for $\frac{5}{90} \times \frac{4}{89}$ oe After **M0, SC1** for $\frac{5}{90} \times \frac{5}{90}$ oe
	(ii) $\frac{598}{8010}$ oe [0.0747]	**3**	**M2** for $\left(\frac{23}{90} \times \frac{13}{89}\right) + \left(\frac{13}{90} \times \frac{23}{89}\right)$ oe or **M1** for one product soi [0.0373..] After **M0, SC1** for 2 $\left(\frac{23}{90} \times \frac{13}{90}\right)$ oe
4	**(a) (i)** 2.5 or $\frac{5}{2}$	**2**	**M1** for one correct step collected i.e $6x = k$ or $ax = 15$ or for $4x + 2x = 8 + 7$
	(ii) 13	**2**	**M1** for $x - 7 = 2 \times 3$ or better
	(b) (i) $27x^3y^{12}$ final answer	**2**	**B1** for 2 correct elements
	(ii) $4a^3b^{[1]}$ final answer	**2**	**B1** for 2 correct elements
	(iii) $\frac{x+1}{x+8}$ www final answer	**4**	**M2** for $(x - 8)(x + 1)$ seen or **SC1** for $(x + a)(x + b)$ where $a + b = -7$ or $ab = -8$ **and B1** for $(x + 8)(x - 8)$ seen
5	**(a)** 55.6 to 55.61 www	**3**	**M2** for $\sqrt{46^2 + 24^2 + 20^2}$ oe $\left\lfloor\sqrt{3092}\right\rfloor$ or **M1** for $46^2 + 24^2$ oe [soi by 2692 or art 51.9] or $46^2 + 20^2$ oe [soi by 2516 or art 50.2] or $24^2 + 20^2$ oe [soi by 976 or art 31.2]
	(b) 90.6 or 90.57 to 90.58	**3**	**M2** for $\frac{20000}{(20 \times 24 \times 46)} \times 100$ oe or **M1** for $20 \times 24 \times 46$ [22080]
	(c) 25.19 to 25.21, 30.23 to 30.246 or 30.2, 57.95 to 57.97 or 58[.0]	**3**	**M2** for $20 \times \sqrt[3]{2}$ or $24 \times \sqrt[3]{2}$ or $46 \times \sqrt[3]{2}$ **M1** for $\sqrt[3]{2}$ oe seen [1.259 to 1.261]
	(d) 16.8 to 16.842	**3**	**M2** for $\sqrt[3]{\frac{20000}{4/3\pi}}$ oe or answer figs 168 to 16842 or **M1** for $\sqrt[3]{\frac{20000}{4/3\pi}}$ [4770 – 4780] seen

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6	**(a) (i)** $\begin{pmatrix}-2\\-1\end{pmatrix}$	**1**	
	(ii) 7.28 [0] or $\pm\sqrt{53}$ as final answer	**2**	**M1** for $\sqrt{2^2+(-7^2)}$ oe
	(iii) [m =] 3.5 oe and [n =] –1.5 oe	**6**	**B1** for $-2m + 2n = -10$ oe and **B1** for $3m - 7n = 21$ oe and **M1** for correct attempt to equate one set of coefficients and **M1dep** for elimination allow 1 arithmetic error overall ft their sim eqns for both m's or **M1** for correct rearrangement (allow 1 slip) and **M1dep** for correct substitution ft their sim eqns for both m's and **A1** for 3.5 or –1.5
	(b) (i) **–p** + **q**	**1**	Condone column vector used
	(ii) $-\frac{3}{5}$ **p** + $\frac{3}{5}$ **q** oe	**1 FT**	Correct or ft $\frac{3}{5}$ (their **(b)(i)**) dep on $ap + bq$, $[a \neq 0, b \neq 0]$ Condone column vector used
	(iii) Parallel similar 9 : 25 oe	**1** **1** **1**	 Accept enlargement e.g 1 : 2.77 [7] or 0.36 : 1
7	**(a) (i)** 360 ÷ 5	**1**	Accept longer correct methods
	(ii) (180 – 72) ÷ 2 54 × 2	**M1** **E1**	Accept [(5 – 2) × 180] or 360 / 5 **M1** Then ÷ 5 180 – 72 **E1**
	(iii) 180 – 90 – 72	**1**	Accept other methods provided they are fully explained
	(b) 2 × 7 × sin(72/2) oe	**M2**	**M1** for 7 × sin (72/2) oe Alt methods **M2** for [DC^2 =] $7^2 + 7^2 - 2.7.7$ cos 72 or **M1** for implicit version or **M2** for (7 sin 72)/sin 54 or **M1** for DC/sin 72 = 7/sin 54 oe
	8.228 to 8.229	**E1**	Dep on **M2** and with no errors seen

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	(c) **(i)** 23.3[0..]	**2**	**M1** for ½ × 7 × 7 × sin 72 oe
	(ii) 116.5 to 116.52 or 117	**1 ft**	ft their **(c)(i)** × 5
	(iii) 30.78 to 30.8	**2**	**M1** for $72/360 \times \pi 7^2$
	(iv) 12.66 to 12.67 or 12.7	**2**	**M1** for 7 + 7 cos 36 oe [7 + 5.66…] e.g 8.23 cos54 + 8.23 sin72 oe [4.84 + 7.83]
	(d) 1.43 or 1.432 to 1.453 cao	**5**	**B4** for area of rectangle = 168.3 to 169.2 www or area of triangular corners = 51.6 to 52.5 www or **B3** for 13.3 to 13.32 seen or **M2** for [ZY =] 8.23 + 2(8.23sin18) oe or 2 (8.23 sin 54) or 2 × 7 sin 72 oe or **B1** for [CY =] 2.54[3] or 5.08 to 5.09 seen or [AX =] 6.65 to 6.66 seen
8	**(a)** $2x + 7$ final answer $x + 9$ final answer	**2**	**B1** for each, accept in either order After **0** scored allow **SC1** mark for both correct but unsimplified
	(b) $2(2x + 3)(x + 5)$ at any stage	**M1**	The × 2 could be embedded within one of the brackets e.g. $(4x + 6)(x + 5)$
	$2x^2 + 3x + 10x + 15$ or better	**B1**	Expands brackets correctly
	$4x^2 + 26x + 30$	**E1**	No errors seen and two previous stages shown
	(c) **(i)** $4x^2 + 26x - 45$ [= 0] soi	**B1**	
	$\frac{-26 \pm \sqrt{(26)^2 - 4(4)(-45)}}{2(4)}$	**B1 ft** **B1 ft**	ft their $4x^2 + 26x \pm k$ $[k \neq 0]$ oe In square root **B1 ft** for $(26)^2 - 4(4)(-45)$ or better (1396) If in form $\frac{p+\sqrt{q}}{r}$ or ; $\frac{p-\sqrt{q}}{r}$ **B1 ft** for –26 and 2(4) or better
	–7.92, 1.42 final answers	**B1 B1**	If **B0**, **SC1** for –7.9 **and** 1.4 or **both** answers – 7.920…., 1.420….. or for–7.92 , 1.42 seen
	(ii) 6.42 [0…]	**1 ft**	ft their greatest positive root If their $x \leq 2$ then ft $x + 5$ If their $x > 2$ then ft $2x + 3$

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9	**(a)** 5.79×10^7 oe 5.21 39.5	**1** **1** **1**	Accept ans in range 57890000 to 57900 5.207 39.50…. or 39.51 Accept answers to greater than 3sf
	(b) **(i)** 498.6... to 499	**2**	**M1** for $1.496 \times 10^8 \div 300\,000$
	(ii) 328 or 328.3...	**2**	**M1** for figs 197 or figs 328[3..] seen Or their 39.5 × their **(b)(i)**
	(c) 9.46[0] to 9.461×10^{12}	**3**	**B2** for any correct equivalent or **M1** for 300 000 × 3600 × 24 × 365 oe or for answer figs 946 to 9461
	(d) 63200 or 63235 to 63242 oe	**2**	**M1** for figs (their **(c)** ÷ 1496). Implied by first 3 figs correct