MARK SCHEME for the October/November 2012 series

0580 MATHEMATICS

0580/41   Paper 4 (Extended), maximum raw mark 130
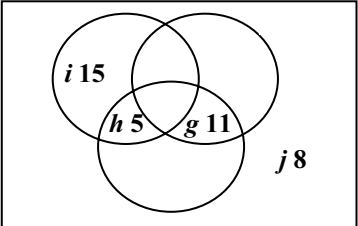
Abbreviations

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)**$/360 \times 140$ correctly evaluated (correct or to the nearest integer) **or M1** for $(360 - 60 - 72)/360 \times 180$ [114] **or** 56ft (their **(a)(ii)**$/360 \times 140$) 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
	$\div 80$ 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

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	C1	Within 1 mm radially of potted points. In absence of plot[s], allow curve to imply plot[s]
		correct shape		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	1	
		($h =$) 5	1ft	ft 16 – their 11
		($i =$)15	1ft	ft 20 – their 5
		($j =$) 8	1ft	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	

	(e) (i)	$\dfrac{20}{8010}$ oe [0.0025[0]]	2	**M1** for $\dfrac{5}{90} \times \dfrac{4}{89}$ oe After **M0**, **SC1** for $\dfrac{5}{90} \times \dfrac{5}{90}$ oe
	(ii)	$\dfrac{598}{8010}$ oe [0.0747]	3	**M2** for $\left(\dfrac{23}{90} \times \dfrac{13}{89}\right) + \left(\dfrac{13}{90} \times \dfrac{23}{89}\right)$ oe or **M1** for one product soi [0.0373..] After **M0**, **SC1** for $2\left(\dfrac{23}{90} \times \dfrac{13}{90}\right)$ oe
4	**(a) (i)**	2.5 or $\dfrac{5}{2}$	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)	$\dfrac{x+1}{x+8}$ 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 $\dfrac{20000}{(20 \times 24 \times 46)} \times 100$ 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 $\sqrt[3]{\dfrac{20000}{4/3\pi}}$ oe or answer figs 168 to 16842 or **M1** for $\sqrt[3]{\dfrac{20000}{4/3\pi}}$ [4770 – 4780] seen

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)	$-\mathbf{p} + \mathbf{q}$	1	Condone column vector used
	(ii)	$-\frac{3}{5}\mathbf{p} + \frac{3}{5}\mathbf{q}$ 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)	$360 \div 5$	1	Accept longer correct methods
	(ii)	$(180 - 72) \div 2$ 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)	$2 \times 7 \times \sin(72/2)$ oe	M2	**M1** for $7 \times \sin(72/2)$ oe <u>Alt methods</u> **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

	(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 × $\pi 7^2$	
	(iv) 12.66 to 12.67 or 12.7	**2**	**M1** for 7 + 7 cos 36 oe $\quad$ [7 + 5.66…] e.g 8.23 cos54 + 8.23 sin72 oe $\quad$ [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 $\quad\quad x + 9$ 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. $(4x + 6)(x + 5)$	
	$\quad\quad 2x^2 + 3x + 10x + 15$ or better	**B1**	Expands brackets correctly	
	$\quad\quad 4x^2 + 26x + 30$	**E1**	No errors seen and two previous stages shown	
	(c) (i) $\quad 4x^2 + 26x - 45$ [= 0] soi	**B1**		
	$\quad\quad \dfrac{-26 \pm \sqrt{(26)^2 - 4(4)(-45)}}{2(4)}$	**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 $\quad$ (1396) If in form $\dfrac{p + \sqrt{q}}{r}$ or ; $\dfrac{p - \sqrt{q}}{r}$ **B1 ft** for –26 and 2(4) or better	
	$\quad\quad -7.92, 1.42$ 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 $2x + 3$	

9	**(a)** 5.79×10^7 oe	1	Accept ans in range 57890000 to 57900000
	5.21	1	5.207
	39.5	1	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 $\times 10^{12}$	3	**B2** for any correct equivalent
			or **M1** for $300\,000 \times 3600 \times 24 \times 365$ 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