UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

0580 MATHEMATICS

0580/43 Paper 4 (Extended), maximum raw mark 130

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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)** 34.65	1	
	(ii) 41.58	2	M1 for 0.15 × 277.2 implied by 41.6 or 41.58 seen and not spoiled
	(iii) 264	3	M2 for 277.2 ÷ (1 + 0.05) o.e. or M1 for recognition that 105(%) = 277.20
(b)	**(i)** 1000	2	M1 for 2200 ÷ (2 + 4 + 5) × 5
	(ii) 3650	2	M1 for 2200 ÷ 44 × 73
2 (a)	**(i)** Image at (4, –4), (6, –4), (6, –6), (2, –6)	2	SC1 for reflection in y-axis
	(ii) Image at (–4, –4), (–4, –6), (–6, –6), (–6, –2)	2 **ft**	SC1 ft if rotated 90° anti-clockwise about (0, 0)
	(iii) Reflection	1 **ft**	ft their Z (name of transformation)
	$y = -x$	1 **ft**	independent (full details)
(b)	**(i)** Image at (2, 2), (3, 2), (3, 3), (1, 3)	2	SC1 for enlargement s.f. 0.5 with correct orientation, different centre or sf – 0.5, centre (0, 0)
	(ii) $\begin{pmatrix} 0.5 & 0 \\ 0 & 0.5 \end{pmatrix}$ cao	2	B1 B1 each column
(c)	**(i)** Image at (0, 4), (2, 4), (0, 6), (–4, 6)	2	SC1 if 3 vertices correct
	(ii) $\begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}$	2	SC1 for $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}$, $k \neq 0$ but can be algebraic or numeric or for $\begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix}$

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3 (a)	$(x + 5)^2 - 2x^2 = 1$ oe	M1	Equiv means equation in the three parts, allowing $(x + 5)^2$ expanded
	$(x + 5)^2 = x^2 + 10x + 25$ or $x^2 + 5x + 5x + 25$	B1	
	$x^2 + 10x + 25 - 2x^2 = 1$ $0 = x^2 - 10x - 24$	E1	For final line reached without any errors or omissions after any previous line with $(x + 5)^2$ expanded
(b)	12	3	M2 for $(x - 12)(x + 2)$ or full correct expression from formula. Allow SC1 for $(x + a)(x + b)$ and $ab = -24$ or $a + b = -10$ then SC1 **ft** (dependent on quadratic factors or two roots from formula) for correct selection of +ve root, if only one +ve. Answer of 12 and –2 scores M2 only
(c)	53.1 to 53.2 www 3	3	M2 for $2 \times \tan^{-1}(\frac{1}{2})$ o.e. i.e. any **complete** method or M1 for tan = $\frac{1}{2}$ o.e. i.e. any correct method leading to any angle in diagram (expressions can be implicit and bod which angle is being worked out) (Implied by 26.56 to 26.57 or 26.6, 63.43 to 63.44 or 63.4, 126.8 to 126.9) 53 or 127 without working score 0
4 (a)	$(\cos(A)) = \dfrac{6^2 + 8^2 - 9^2}{2.6.8}$	M2	M1 for correct implicit equation with cos*A*
	78.58… www 4	A2	A1 for 0.1979 to 0.198 (this implies M2)
(b)	**(i)** 78.6	1	Allow 78.58…
	(ii) $r = \dfrac{4.5}{\sin(78.6)}$ oe	M2	(M1 for $\sin(78.6) = \dfrac{4.5}{r}$) Allow 78.58… or their angle *BOM* for M2 or M1
	4.59**0** to 4.591 cao www 3	A1	
(c)	35.5 (35.48 to 35.57…) cao www 4	4	M1 Area triangle = 0.5 × 6 × 8 × sin (78.6) oe Allow 78.58.. (23.52..) M1 Circle = $\pi \times 4.59^2$ Allow 4.590 to 4.591 (66.15 to 66.22…) M1 (**dependent**) % = triangle / circle × 100 Dependent on first 2 M's

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5 (a)	9.11, 4.25, 2, …, 2, 4.25, 9.11	3	B2 for 4 or 5 correct and B1 for 2 or 3 correct
(b)	12 points plotted Smooth curve through 12 points Two branches, neither touching y-axis	5	P3, **ft** their **(a)**, P2 for 10 or 11 points, P1 for 8 or 9. C1 correct shape ft their points shape same. Ignore anything between – 0.5 and 0.5. B1 independent
(c)	**(i)** $x = 0$	1	
	(ii) tangent at –1.5	T1	
	–3 to –1.8	2	**Dependent** on tangent M1(also dep on T1) for attempt at rise/run or SC1 for 1.8 to 3
	(iii) –1.7 to – 1.55, –0.7 to –0.55, 0.55 to 0.7, 1.55 to 1.7	2	B1 for 1 or more correct
	(iv) $y = 2x$ drawn to meet graph twice	B1	
	1	B1	
	1.8 to 1.9	B1	
6 (a)	**(i)** 5.8	1	
	(ii) 4.6 to 4.65	1	
	(iii) 2.35 to 2.5	1	
	(iv) 172 or 171	2	SC1 for 28 or 29
(b)	**(i)** 72 to 76, 38 to 42	2	Must be integers. B1 either.
	(ii) Their correct $\Sigma fx \div 200$	4	M1 for 3 or 4 correct mid-values seen 2, 5, 6.5, 8.5 M1 for Σfx, **ft** their frequencies and x anywhere in interval, including boundaries $36 \times 2 + (72 \text{ to } 76) \times 5 + (38 \text{ to } 42) \times 6.5 + 50 \times 8.5$ M1 for $\div 200$ or their 200 (dependent on second M1) (74, 40 give 1127 then 5.635 (or 5.64 or 5.63)) Other pairs of frequencies from **(b)(i)** must have a sum of 114 to gain the A mark.
	(iii) $p \div 2$, q, where p, q are from **(b)(i)**	2**ft**	B1 either **ft** (ft their table)
	Histogram with two new columns of correct width		B1
	Two correct heights	2**ft**	B1 **ft** (ft their freq. densities)

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7 (a)	Correct tree diagram.	5	B1 for labels flower and not flower First pair B1 for $\frac{7}{10}$ and $\frac{3}{10}$ B1 for next three branches after flowers B1 for clear labels for colours B1 for $\frac{2}{3}$, $\frac{1}{4}$ and $\frac{1}{12}$ in correct places If three branches at ends of both branches of first pair, lose final B, unless probabilities of 0 indicated.
(b)	$\frac{33}{40}$ o.e. (0.825) cao	3	M2 for $1 - \frac{7}{10}\times\frac{1}{4}$ (M1 for $\frac{7}{10}\times\frac{1}{4}$ or $\frac{7}{10}\times\left(1-\frac{1}{4}\right)$) oe or M2 for $\frac{3}{10} + \frac{7}{10} \times \frac{2}{3} + \frac{7}{10} \times$ their $\frac{1}{12}$ or $\frac{3}{10} + \frac{7}{10}\times\frac{3}{4}$ oe
(c)	7 cao	2	M1 for $120 \times \frac{7}{10}\times$ their $\frac{1}{12}$
8 (a)	Arc centre *D*, radius 6 cm	1	
(b)	**(i)** Perp bisector of *AB*, with two pairs of arcs	2	At least 3 cm from *AB*. SC1 accurate without arcs or accurate arcs (but no choice)
	(ii) Bisector of angle *B*, with arcs	2	At least 5 cm from *B*. SC1 accurate without arcs or accurate arcs (but no choice)
(c)	**(i)** *Q* at intersection of loci	1	Dependent on at least both SC1's
	(ii) 2.7 cm to 2.9 cm cao	1	Dependent on **(c)(i)**
(d)	Region inside arc, to left of perp bisector and below angle bisector	1	Dependent on at least both SC1's in **(b)**
9 (a)	**(i)** 81	2	B1 for (f(2) =) 7
	(ii) 8.5	2	B1 for (f(0.5) =) 2.5
(b)	$\frac{x-1}{3}$ oe	2	M1 for $(x =)\frac{y-1}{3}$ or $(x =)\frac{f(x)-1}{3}$ or $3y = x - 1$ or $3f(x) = x - 1$ or – 1 then ÷3 in flowchart (must be clear)
(c)	$3x^2 + 12x + 13$ final answer	2	M1 for $3(x + 2)^2 + 1$ or better
(d)	$(x =)\ \frac{-3 \pm \sqrt{3^2 - 4(1)(1)}}{2(1)}$	2	B1 for $\sqrt{3^2 - 4(1)(1)}$ or better Seen anywhere If in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ oe, B1 for $p = -3$ and $r = 2(1)$ or $\left(x+\frac{3}{2}\right)^2$ B1 then $\sqrt{\frac{9}{4}-1}$ B1
	–2.62, – 0.38 final answer	1,1	If 0, SC1 for –2.6 or – 2.62 or –2.618… **and** –0.4(0) or – 0.38 or –0.382 to –0.381 seen **Answers only B1 B1**

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10 (a)	**(i) (a)** $\mathbf{p} + \mathbf{q}$	1	
	(b) $\frac{1}{2}\mathbf{p} - \frac{1}{2}\mathbf{q}$ oe	2	M1 for $\overrightarrow{LC} + \overrightarrow{CM}$ o.e. can be written in terms of **p** and/or **q**
	(c) $\frac{3}{4}\mathbf{p} + \frac{3}{4}\mathbf{q}$ oe cao	2	M1 for $\overrightarrow{AD} + \overrightarrow{DL} + \overrightarrow{LN}$ o.e can be written in terms of **p** and/or **q** ft their **(i)(b)**
	(ii) $\overrightarrow{AN}$ is a multiple of $\overrightarrow{AC}$ o.e	1	Must be vectors (dependent on answers to **(a)**, **(c)**)
(b)	**(i)** 30	2	M1 for $2x + x + 15 + 75 = 180$ or better
	(ii) 135	1**ft**	ft 165 – their x but only if final answer obtuse
11 (a)	**(i)** 10	1	
	(ii) $\frac{3\times 4}{2}$ or $\frac{3\times(3+1)}{2}$ (= 6)	1	
	(iii) 7260	1	
	(iv) 12 840	2	M1 for $S_{200} - S_{120}$ (20100 – 7260) or $\frac{80}{2}(121+200)$ o.e.
	(v) 160 400	2	M1 for $2(1 + 2 + 3 + \ldots\ldots + 400)$ o.e.
(b)	**(i)** 36, 100	1, 1	Ignore right-hand column
	(ii) 11025	1	
	(iii) $\left[\frac{n(n+1)}{2}\right]^2$ oe	1	isw
	(iv) 3 348 900	1	M1 for square root then × 2 (1056)
	(v) 32	2	or SC1 for answer 33

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