UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2012 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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UNIVERSITY of CAMBRIDGE
International Examinations

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)	6 correct plots	**2**	**P1** for 4 or 5 correct plots.
(ii)	Positive	**1**	
(iii)	Line of best fit	**1**	**Ruled** line at least from $x = 5$ to $x = 48$, with at least 3 points on each side and cuts axes between (5, 0) and (0, 20)
(iv)	English (integer) value on line at M = 22	**1ft**	**Strict ft** from their single ruled line $5 \varnothing x \varnothing 48$.
(b)	(26 + 39 + 35 + 28 + 9 + 37 + 45 + 33 + 16 + 12) ÷ 10	**M2**	**M1** for 26 + 39 + 35 + 28 + 9 + 37 + 45 + 33 + 16 + 12, condone one slip **or SC1**, for at least 2 values eg (26 + 39 +…) ÷ 10
(c)	46 cao www 3	**3**	**M2** for (31 × 12 – 28 × 10) ÷ 2 soi by 92 ÷ 2 **or M1** for 31 × 12 soi by 372 or 92
2 (a)	445 final answer www 3	**3**	**M2** for 351.55 ÷ (1 – 0.21) oe or **M1** for 351.55 = (100 – 21) (%)
(b)	640 or 4640	**2**	**M1** for 4000 × 0.08 × 2 oe
	4622.5 or 622.5	**2**	**M1** for 4000 × $(1.075)^2$ oe or 4000 × 0.075 (= 300) **and** (4000 + their 300) × 0.075 **and** total interest = the sum of their 2 interests.
	Alex by 17.5(0) cao final answer www 6	**2**	**M1** for S I amount – C I amount or reverse or simple interest – compound interest or reverse

3 (a) (i)	$x > 4$	1	
(ii)	$y > 9$	1	
(iii)	$x + y < 20$	1	
(b)	$5x + 10y < 170$ seen	1	
(c) (i)	$x = 4$ ruled $y = 9$ ruled	1 1	Each line long enough to enclose their region Condone good freehand or dotted $y = 9$ must be **between** 8.8 and 9.2
	$x + y = 20$ ruled	2	**B1** for gradient = – 1 or y intercept = 20 or x intercept = 20. Exclude lines parallel to either axis.
	$x + 2y = 34$ ruled	2	**B1** for y intercept = 17 or x intercept = 34. Exclude lines parallel to either axis.
	Correct region indicated cao	1	**Dependent** on all 6 marks for the 4 lines.
(ii)	145 cao (from 11, 9) www 2	2	**M1** for using $5x + 10y$ when $x + y = 20$ and integers (x, y) is in their region

4			In all parts of **(a)** candidates may refer to a marked in diagram. Allow if clear even if rea more complicated as long as it is full. Reasons dependent on correct answers
(a) (i)	42 **Alternate** oe	**1** **1**	Not **alternate segment**
(ii)	90 **semicircle** oe	**1** **1**	Allow **diameter**
(iii)	42 **same segment** oe	**1** **1**	**same arc**
(iv)	138 **cyclic quad** oe	**1** **1**	**key words must not be spoiled**
(b)	10.9 (10.90 to 10.91) www 3	**3**	**M2** for $\sqrt{12^2 - 5^2}$ oe i.e explicit or **M1** for $12^2 = 5^2 + PQ^2$ oe i.e implicit Allow full marks for $\sqrt{119}$ as final answer Use of trig method must be complete to explicit expression for possible **M2**
(c) (i)	$AD = CD$ **and** $DE = DG$ (Angle) CDG = (angle)ADE (Sides of) square **or** 90° + angle ADG oe	**1** **1** **R1**	Extra pair of sides loses this mark. Extra pair of angles loses this mark As in **(a)**, for all 3 marks allow references to diagram if completely clear. **R** mark dep on at least one pair of sides stated or pair of angles stated
(ii)	Congruent	**1**	

5	(a)	(£) 2.37 or 2.371 to 2.372 www 2	2	**M1** for 34.95 ÷ 1.17 implied by 29.87…or or **SC1** for 2.77 or 2.78 or 2.775
	(b)	154 days 4 hours cao	3	**M1** for $4.07 \times 10^{12} \div (1.1 \times 10^{9})$ implied by figs 3 / or 154. (….) **A1** for 3700 seen or 3.7×10^{3} seen or $154\frac{1}{6}$ oe or 154 rem 4
	(c) (i)	9.25	1	
	(ii)	Lower = 51.3375 final answer Upper = 52.8275 final answer	1 1	After 0 scored **SC1** for answers reversed or 9.35 **and** 5.65 seen or 51.3375 **and** 52.8275 seen
6	(a)	$(x =)$ 64 www 3	3	**B2** for $x + 2x + x = 360 - 114 + 10$ or better or **M1** for $x + 2x + 114 + x - 10 = 360$
	(b) (i)	–1 n^2 oe $5n$ oe $n^2 + 5n$ oe	1 1 1 1	
	(ii)	20	2	**M1** for their $n^2 + 5n = 500$ or 20 **and** 25 seen
	(c)	**Final answer** $\frac{x-4}{2x-1}$ cao www 4	4	**B1** for $(x - 4)(x + 4)$ **B2** for $(2x - 1)(x + 4)$ or **SC1** for $(2x + a)(x + b)$ where either $a + 2b = 7$ or $ab = -4$
7	(a)	(5, 3)	1	
	(b) (i)	$3\mathbf{a} + \mathbf{c}$	1	
	(ii)	$3\mathbf{a} + \frac{1}{2}\mathbf{c}$ **or** $\frac{1}{2}(6\mathbf{a} + \mathbf{c})$	2	**M1** for $\overrightarrow{OM}$ oe e.g $OA+AM$ or correct unsimplified answer
	(iii)	$\mathbf{a} + \mathbf{c}$	1	
	(iv)	$\frac{3}{2}\mathbf{a} + \frac{1}{2}\mathbf{c}$ or $\frac{1}{2}(3\mathbf{a} + \mathbf{c})$	2	**M1** for $-\mathbf{c} + \frac{3}{2}\times$ their (iii) or $\mathbf{a} + \frac{1}{2}\times$ their (iii) or correct unsimplified answer or any correct route e.g. $CE + ED$
	(c)	(CD) parallel (to OB) oe cao $CD = \frac{1}{2}\ OB$ oe cao	1dep 1dep	Part (c) dependent on simplified (i) and (iv) Dep on (i) = $k \times$ (iv) Dep on (i) = 2 × (iv) must be scalars

8			**Throughout question, penalise non-redu fraction only once**; isw any conversion and a decimals in working and on branches but not fi answers if fractions not seen.
(a) (i)	$\frac{2}{3}$	**1**	
(ii)	$\frac{1}{3}, \frac{2}{3}, \frac{2}{5}, \frac{3}{5}, \frac{1}{6}, \frac{5}{6}$ correctly placed	**2**	**B1** for $\frac{1}{3}$ and $\frac{2}{3}$ and $\frac{3}{5}$ or $\frac{5}{6}$ correctly placed
			For method marks in **(b)** and **(c)**, ft tree with each probability $0< p <1$
(b)	$\frac{4}{9}$ cao www 3	**3**	**M2** for $1 - \frac{2}{3} \times \frac{5}{6}$ or $\frac{1}{3} + \frac{2}{3} \times \frac{1}{6}$ or $\frac{1}{3} \times \frac{2}{5} + \frac{1}{3} \times \frac{3}{5} + \frac{2}{3} \times \frac{1}{6}$ **M1** for $\frac{1}{3} + \frac{2}{3} \times \frac{5}{6}$ or **two** of $\frac{1}{3} \times \frac{2}{5}, \frac{1}{3} \times \frac{3}{5}, \frac{2}{3} \times \frac{1}{6}$ **added**
(c)	$\frac{14}{45}$ cao www 3	**3**	**M2** for $\frac{1}{3} \times \frac{3}{5} + \frac{2}{3} \times \frac{1}{6}$ or their $\frac{4}{9} - \frac{1}{3} \times \frac{2}{5}$ **M1** for one of $\frac{1}{3} \times \frac{3}{5}$ or $\frac{2}{3} \times \frac{1}{6}$ from a maximum of two products added.
9	Accurate ruled perp. bisector with correct intersecting arcs	**2**	**B1** for accurate with no/wrong arcs or **M1** for correct intersecting arcs Ignore one extra perp. bisector
	Accurate ruled angle bisector with correct intersecting arcs	**2**	**B1** for accurate with no/wrong arcs or **M1** for correct intersecting arcs Ignore one extra angle bisector
	Compass drawn arc centre F radius 5.5 cm long enough to enclose region	**2**	**M1** for compass drawn arc centre F
	Correct region indicated cao	**1**	Accept dotty lines but not freehand for all three

10 (a) (i)	$8x^6y^9$ **final answer**	**2**	**B1** for any two of 8, x^6, y^9 in a single term answer
(ii)	$\frac{x^2}{3}$ oe but not $\frac{1}{3x^{-2}}$ oe **final answer**	**3**	**B2** for $\frac{3}{x^2}$ or $3x^{-2}$ or $\frac{1}{3x^{-2}}$ as answer or **B1** for $\frac{x^6}{27}$ oe as answer or $\frac{1}{\sqrt[3]{\frac{27}{x^6}}}$ seen or **SC1** for 3 or x^2 or x^{-2} seen in answer
(b)	$6x^2 + 11xy - 10y^2$ **final answer**	**3**	**B2** for 3 of $6x^2 - 4xy + 15xy - 10y^2$ ($11xy$ implies 2 terms) or **B1** for 2 of $6x^2 - 4xy + 15xy - 10y^2$
(c) (i)	$\frac{V - \pi r^3}{2\pi r^2}$ or $\frac{V}{2\pi r^2} - \frac{r}{2}$ oe but not triple fractions **final answer**	**2**	**M1** for correct subtraction or correct division by $2\pi r^2$ **seen**
(ii)	$\frac{V^2}{3}$ **final answer**	**2**	**B1** for $V^2 = 3h$ or $\frac{V}{\sqrt{3}} = \sqrt{h}$ or $h = \left(\frac{V}{\sqrt{3}}\right)^2$
(d)	$\frac{5x}{12}$ **final answer**	**2**	**B1** for 2 of $\frac{6x}{12}$, $\frac{20x}{12}$, $\frac{-21x}{12}$ oe implied by $\frac{10x}{24}$ ie 2 with common denominator = at least 6
11 (a)	452 or 452.1 to 452.4…	**2**	**M1** for $\pi \times 12^2$ Allow full marks for 144π as final answer
(b)	59.9 or 59.86 to 59.91 cao www 5	**5**	**M1** for $\pi \times 24 \times 7$ (soi by 527 to 528) oe or $\frac{22}{360} \times \pi \times 24$ oe (soi by 4.60 to 4.61) **and M1 dep** for $\frac{22}{360} \times \pi \times 24 \times 7$ (soi by 32.2 to 32.3) **and M1** for $\frac{22}{360} \times$ their (a) oe may restart (soi by 27.6 to 27.7) **and M1 dep on M3** for adding two areas
(c)	$11 \div \cos 50$ soi by 17.(11…) oe (their AC)$^2 + 31^2 -$ $2 \times$ their $AC \times 31\cos 100$ art 37.9 cao www 6	**M2** **M2** **A2**	**M1** for $\cos 50 = \frac{11}{AC}$ oe i.e. implicit **M1** for implicit cos rule **A1** for 1433 to 1443

12 (a)	$10x + 4y = 10.7$ oe $8x + 6y = 10.1$ oe	**1** **1**	
	Multiplying or dividing equation(s) by number(s) suitable for elimination	**M1**	Allow one arithmetic error. If substitution, correctly making one variable the subject of one equation.
	Elimination of one variable	**M1**	Allow one arithmetic error. If substitution method then M is for the actual substitution.
	$x = 0.85$ cao $y = 0.55$ cao	**A1** **A1**	**SC1** for correct fractions After **M0**, **SC2** for **both** correct answers If working in cents, likely mark is 0 for equations, **M2** for method, **A2** if answers converted to dollars, **A1** if left in cents
(b)	$\frac{--5 \pm \sqrt{(-5)^2 - 4.2.-8}}{2.2}$	**B2**	**B1** for $\sqrt{(-5)^2 - 4.2.-8}$ $(\sqrt{89})$ **B1** for $\frac{p+\sqrt{\ }}{r}$ or $\frac{p-\sqrt{\ }}{r}$ with $p = --5$ or 5 **and** $r = 2 \times 2$ or 4 Completing the square **B1** for $\left(x - \frac{5}{4}\right)^2$ **and** **B1** for $\sqrt{4 + \frac{25}{16}}$
	3.61 or –1.11 **final answer**	**B1B1**	After B0 B0 for answers, **SC1** for 3.6 or 3.608… **and** -1.1 or -1.108 or 3.61 and –1.11 seen **Correct answers without working score max 2**