UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2010 question paper

for the guidance of teachers

4024 MATHEMATICS (SYLLABUS D)

4024/22 Paper 2, maximum raw mark 100

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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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

1	**(a)**	**(i)** $\frac{1}{8}$ Final ans	1	
		(ii) $5 - 2x$ Final ans	2	**B1** for $3x^2 - 2x - 3x^2 \pm 5$ or better soi
	(b)	17	2	**M1** for $3t - 4 = 7 + 2t + 6$ or better
	(c)	$(5p - 7q)(x + 2y)$	2	**B1** for $(5p \pm 7q)(x \pm 2y)$ or **M1** for $5p(x + 2y) - 7q(x + 2y)$ or $x(5p - 7q) + 2y(5p - 7q)$ or **B1** for the correct extraction of one common factor at any stage
	(d)	**(i)** $2 - x$ has the greater value	2	**B1** for $3x + 4 = -2$ or $2 - x = 4$ seen
		(ii) $x < -0.5$ Final ans	2	**B1** for $3x + x$, $2 - 4$ oe
2	**(a)**	**(i)** (\$) 935	1	
		(ii) (€) 600	1	
		(iii) (€) 550	2	**M1** for Figs $85 \times \frac{121}{187}$
	(b)	(Rs) 51.95	2	**M1** for Figs $\frac{4}{77}$
	(c)	**(i)** (\$) 375	1	
		(ii) (\$) 1087.5(0)	3	**B1** for $\frac{15}{100} \times 27\,000$ (= 4050) soi or **M1** for $\frac{1}{36}$ (their total interest + 27 000)

3	**(a)**	144	2	**B1** for $\frac{360}{10}$ or (10 – 2)180 or 10 × 180 oe
	(b)	38	3	**B2** for all angles by symmetry or **B1** for any angle deduced by symmetry **M1** for such as x + theirAHC + theirHCB + 80 = 360 oe
	(c)	**(i)** ½(12 + 10)h or better	2	**B1** for NY = h used as height soi or for ½(10 + 12) seen
		(ii) 13	2ft	$\frac{221}{k+6}$ ft dependent on their **(c)(i)** = kh or **M1** for their **(c)(i)** + their triangle = 221 or **B1** for ½ × 12 × h
4	**(a)**	**(i)** 52.1	2	Here and elsewhere accept answers rounding to the given 3 significant figure answers. **M1** for $\tan \text{SPQ} = \frac{9}{7}$ oe
		(ii) 7.37	2	**M1** for $\frac{RS}{9} = \cos 35$ oe
	(b)	147 isw	3	**M1** for $\frac{4}{l} = \sin 20$ oe and **A1** for 11.69(5...) or **B1** for 4π × their l
5	**(a)**	$90 < m < 95$	1	
	(b)	93.2(0) ,93 $\frac{7}{36}$	3	**B1** for 10 × 70 + 16 × 85 + 20 × 92.5 + 21 × 97.5 + 22 × 105 + 1 × 120 and **B1** for ÷ by 10 + 16 + 20 + 21 + 22 + 1
	(c)	**(i)** 4 **(ii)** 1 10	1 2	B1 for either
6	**(a)**	**(i)** Length of line AB 14 cm **(ii)** **(a)** Perpendicular bisector of AB **(b)** Circular arc, centre B, radius 9 cm	1 1 1	**(a)** and **(b)** long enough to be convincing loci
	(b)	Correct region shaded ft	1ft	
	(c)	**(i)** S_1 S_2 correctly marked ft	2ft 1	**B1** for either or **SC1** for S_1, S_2 on correct bearing from A
		(ii) 10° **(iii)** 336°	1 1	

7	**(a)**	**(i)** $\frac{13}{x}$	1	
		(ii) $\frac{13}{x+5}$	1	After 0 + 0, SC1 for AB and PQ implicit
	(b)	$3x^2 + 15x - 65$	3	**M2** for $\frac{13}{x} - \frac{13}{x+5} = 3$ or **M1** for their **(i)** – their **(ii)** = ±3
	(c)	2.78 –7.78	4	**B1** for $p = -15$ and $r = 6$ and **B1** for $q = 1005$ or $\sqrt{q} = 31.7...$ or **B1** for $(x + \frac{5}{2})^{(2)}$ and **B1** for $\frac{335}{12}$ or 5.28 and **B1** for one correct final ans or both 2.783 and – 7.783 or both 2.8, –7.8 **SC1** + 1 for 2.78 and –7.78 anw.
	(d)	**(i)** Accept any correct numerical expression	1	
		(ii) (±)4	2	**M1** for their 18.9 – 14.9
8	**(a)**	6.9	1	
	(b)	6 points ft plotted and joined.	3	**P2** for 6 correct plots ft or **P1** for at least 4 correct plots and dependent **C1** for a smooth curve
	(c)	2.5 ft	1	
	(d)	**(i)** 0.4	1	
		(ii) Tangent drawn parallel to the chord.	1	
	(e)	**(i)** Correct straight line	2	**L1** for good freehand or a potenial L2 that has been spoilt.
		(ii) 3.5 ft	1	
		(iii) $A = 5$ $B = -60$ soi	2	**B1** for one correct www or **M1** for $\frac{x^3}{10} - \frac{x}{2} = -x + 6$ or better seen

9	**(a)**	5	1	
	(b)	**(i)** 20.8, $20\frac{5}{6}$	2	**B1** for ½ × 5 × 5
		(ii) 21.6	3	**M2** for ½ their($\sqrt{5^2+5^2}$)^{2}sin 60 or **B1** for $x^2 = 5^2 + 5^2$ oe or **M1** for ½ × their x^2 × sin 60
		(iii) 2.89 (cm) ft	3ft	ft for (3 × their **(i)**) ÷ their **(ii)** evaluated or **M2** for $h = \frac{3 \times \text{their (i)}}{\text{their (ii)}}$ or **M1** for $\frac{1}{3}$ × their **(ii)** × h = their **(i)**
	(c)	**(i)** 14 **(ii)** 24 **(iii)** 36	1 1 1	
10	**(a)**	**(i)** Complete description	3	**B1** for Rotation or Enlargement **B1** for 180° or SF –1 **B1** for centre the midpoint of *RS*.
		(ii) Equal and parallel	1	
	(b)	**(i)** $\begin{pmatrix}2\\3\end{pmatrix}$	1	
		(ii) (0,0) (2,0) (0,1)	2	**B1** for two correct
		(iii) (2,3), (4,3) (2,4) ft	1ft	ft from **(ii)** and / or **(i)**
		(iv) **(a)** $\begin{pmatrix}2 & 0\\0 & 3\end{pmatrix}$	2	**B1** for either column correct or **M1** for $\begin{pmatrix}a & b\\c & d\end{pmatrix}\begin{pmatrix}0 & 1 & 0\\0 & 0 & 1\end{pmatrix} = \begin{pmatrix}0 & 2 & 0\\0 & 0 & 3\end{pmatrix}$
		(b) Complete description	2	**B1** for Stretching **B1** for 2 units in x direction and 3 units in y direction
11	**(a)**	19.6	4	**M1** for $17^2 + 4^2 \pm 2 \times 17 \times 4\cos 125$ soi **M1** for $\sqrt{17^2 + 4^2 - 2 \times 17 \times 4\cos 125}$ **A1** for 383.0... seen or 15.1
	(b)	**(i)** 3 900 or 3.9 **km**	3	**M1** for $\frac{PX}{4} = \tan 44$ oe **A1** for 3.86(27) (km)
		(ii) **(a)** 14 21	2	**B1** for 42 (mins) or 14 23 and 54 (secs) seen or **M1** for 15 03 – 39 min 6 sec soi
		(b) 352	3	**M2** for $\frac{17}{\text{their } 2.9} \times 60$ **M1** for $\frac{17}{\text{their } 2.9}$