UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Ordinary Level

MARK SCHEME for the June 2004 question papers

4024 MATHEMATICS (Syllabus D)

4024/01	**Paper 1, maximum raw mark 80**
4024/02	**Paper 2, maximum raw mark 100**

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.

UNIVERSITY of CAMBRIDGE
International Examinations

TYPES OF MARK

Most of the marks (those without prefixes, and 'B' marks) are given for accurate results, drawings or statements.

- **M** marks are given for a correct method.
- **B** marks are given for a correct statement or step.
- **A** marks are given for an accurate answer following a correct method.

ABBREVIATIONS

a.r.t. Anything rounding to
b.o.d. Benefit of the doubt has been given to the candidate
c.a.o. Correct answer **only** (i.e. no 'follow through')
e.e.o. Each error or omission
f.t. Follow through
o.e. Or equivalent
SC Special case
s.o.i. Seen or implied
ww Without working
www Without wrong working
* Indicates that it is necessary to look in the working following a wrong answer

June 2004

GCE ORDINARY LEVEL

MARKING SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 4024/01

MATHEMATICS (Syllabus D)
Paper 1

UNIVERSITY of CAMBRIDGE
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1 (a)	(0).07 cao	1				
(b)	8(.00....) (%)	1			2	
2 (a)	$\frac{2}{3}$ cao	1				
(b)	$\frac{19k}{21k}$ cao	1	Allow decimal in range (0).904 to (0).905		2	
3 (a)	70 cao	1	(Not 70/1)			
(b)	1 + 72 + (4 x 2) = 10	1	Both brackets needed. Ignore extra <u>pairs</u> if not wrong		2	
4 (a)	$9x^6$	1				
(b)	4	1	Accept ± 4, but not - 4 or $16^{½}$	2		
5 (a)	64	1				
(b)	58	1			2	
6 (a)	10	1				
(b)	$\frac{1}{\text{their (a)}}$ $\begin{pmatrix} 2 & 1 \\ -4 & 3 \end{pmatrix}$ or correct answer	1	Accept equivalents Both brackets essential		2	12
7	11 Accept 10.99 (from = 3.14)	2	11/2 , 5½ or 5.5 **or** Figs $\left(\frac{3+3}{360}\times 2\times\pi\times 105\right)$ seen	C1 M1	2	
8	Condone missing outside brackets and **Final answer** $\frac{x+7}{(x-3)(x+2)}$ *or* $\frac{x+7}{x^2-x-6}$	us 2	e of wrong letter if clear Correct num, but brackets missing in denom ***or*** $\frac{2(x+2)-(x-3)}{(x-3)(x+2)}$ oe soi [Condone **all** missing brackets] [Only available if some working seen]	C1 M1	2	

9 (a)	10	1				
(b)	8	1			2	
10(a)	2.173×10^4 cao	1	Accept . for x Do not accept calculator form			
(b)	0.031×10^5, 217.3×10^2, 22.6×10^3, 2.5×10^4 or equivalents	2	Order reversed **or** Least or greatest identified Condone minor slips if intention clear	C1 C1	3	
11(a)	2	1				
(b)	(c =) 3 (x) (d =) - 5	1 1	One correct **or** (f^{-1} : x) $3x$ - 5 seen in working	C1 M1	3	
12(a)	-8(.0)	1				
(b)	22½ **or** 22.5 cao	2	$\frac{6}{t} = \frac{4}{15}$ oe or better seen (not just in ratio form)	M1	3	15
13(a)	Ruled straight line through (0 , 0) and (157.5 , 40 000)	1	Allow tolerance of ½ small square at points			
(b)	(i) 8500 to 9000	1				
	(ii) $\frac{1}{8}$ or (0).125 cao	1	Condone 1: 8		3	
14(a)	2½, 2.5 or 5/2	1	Ignore reference to y coordinate if it is -1			
(b)	$y > -1$, $y < x + 3$ and $y + 2x < 4$ oe Accept ≥ for > etc throughout	2	**All** inequalities reversed **or** Two inequalities correct	C1 C1	3	
15(a)	(0)68$^{(0)}$	1	Ignore embellishments (eg N 68 E)			
(b)	199 to 201 $^{(0)}$	2	Ignore embellishments such as S 199 W Other value in range 196 to 204 **or** (BAC =) 109 to 111 **or** (BCA =) 47 to 49 **or**(ACS =) 19 to 21 or for S 19 to 21 W seen or implied, possibly on diagram	C1 M1	3	9

16(a)	1.515 m oe	1	**Unit essential** in this case			
(b)	3.96	2	Figs 396 **or** Figs $\frac{2 \times 0.55 \times 60 \times 60}{1000}$	C1 M1	3	
17	Both 3 and -5	3	$3 \times 4 = x^2 + 3x - x \pm 3$ or better seen **and** $(x + 5)(x - 3)$ oe seen, condoning missing outside brackets **or** $\frac{-2 + \sqrt{64}}{2}$ obtained	M1 M1	 3	
18	40	3	$7^2 = 3^2 + \ell^{(2)}$ seen or implied, eg by $\sqrt{40}$ **or** $7^2 = 3^2 + 3^2 + \ell^{(2)}$ soi eg by 31 or $\sqrt{31}$ **or** 6, 7 used correctly	M2 M1 M1	 3	
19(a)	30 (%)	2	70 (%) **or** Figs $\left(\frac{400-280}{400} \times 100\right)$	C1 M1		
(b)	($) 20	2	($) 520 **or** Figs $\left(\frac{500 \times 6 \times 8}{100 \times 12}\right)$ seen, if intention clear	C1 M1	4	13
20	Circular arc, centre B, radius 6.5 ± 0.5 cm One line parallel to one coast One arc of circle linking two of these Region clearly identified	1 1 1 1	Subtending at least 90° at B Parallel by eye, 2 ± 0.5 cm from coasts as long as relevant coast or till it cuts circle Dep on large circular arc and 3 parallel lines, but not lost for wrong measurements Ignore superfluous lines		4	
21(a)	(i) 2 cao (ii) 2.65 to 2.7(0)	1 1	Not 2/1 Ignore any attempt at $x = 0$			
(b)	(i) 0.5 (ii) 3	1 1	Do not accept $x < 2.65$ Condone intrusion of y value of about 6.4 Accept ½		4	8

22(a)	(i)107(°)	1	Accept on diagram if necessary			
	(ii) 34(°)	1	Accept on diagram if necessary			
(b)	Completely correct solution	2	Any reference to angle at centre, 146 = 2 x 73 or CEA=2xCBA **or** reference to angles in same segment soi	1 1	4	
23(a)	Condone missing outside brackets, "=0", and use of wrong letter if clear If only "solutions" (even incorrect) in answer space, award marks in working space					
	5(a - 2)(a + 2) oe	2	Incomplete factorisation seen e.g. $5(a^2 - 4)$, *(5a - 10)(a* + 2) etc	M1		
(b)	(i) - 8	1				
	(ii) $-\frac{k}{2k}$ or - (0).5 cao	1	No follow through. Not ± .		4	8
24	31 (m)	4	30.6 , 30.7, 30.65 or 30.8 **or** Appropriate diagram or attempt to add 1.8 **and** 50 tan 30 oe or 50 x 0.577 **and** Rounding finally to the nearest integer provided some rounding has taken place Accept a reasonable eye level used	C3 M1 M1 M1	4	
25(a)	(i) $2^4 \times 3^2 \times 7^2$ oe	2	Attempted division by same prime at least twice, soi	M1		
	(ii) (±) 84 cao	1	Not just - 84			
(b)	*(p* =) (±) *9, (q* =) (±) 4	1	Any combination of + and - acceptable			
(c)	Any irrational, with no rationals given	1	= 3.142 does not score		5	9

26(a)	(One way) stretch Factor 2 dep	1 1	Ignore reference to invariant line No other transformation to be stated			
(b)	(i) $\begin{pmatrix} 8 \\ 0 \end{pmatrix}$	1	Brackets essential. Not (8 , 0)			
	(ii)(a) *A*' at *A*, (4 , 0) *C*' at (-7 , -2)	1 1	Labels not essential if triangle drawn Labels essential if triangle not drawn Accept (good) freehand triangle			
	(b) 4	1	Indep		6	6

June 2004

GCE ORDINARY LEVEL

MARKING SCHEME

MAXIMUM MARK: 100

SYLLABUS/COMPONENT: 4024/02

MATHEMATICS (Syllabus D)
Paper 2

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1	(a)	(i)	(a) 360 (m) (b) 4800 (m)	B1 B1	2	f.t. 5160 – their 360
		(ii)	$\frac{6000 \times 3}{10}$ o.e. M1 = 1800 (m)	A1	2	sc1 for 4200 or 600s or 10min seen.
		(iii)	$\frac{6000}{7}$ (s) M1 = 14m 17s	A1	2	Allow M1 if 857. …seen
	(b)	(i)	1 : 250000	B1	1	Allow n = 250000
		(ii)	$2 \times \frac{6}{5}$ (figs) o.e. M1 = 2.4 cm	A1	2	e.g. $\frac{6000 \times 100}{250000}$ Accept 0.024m NB: figs 24→M1 immediately
					9	
2	(a)		$(t - 5)(2v + 1)$ o.e.	B2	2	sc1 for any factor e.g. $2(tv - 5v)$ or if solution given.
	(b)		$\frac{h}{k} = 9$ or $\sqrt{h} = 3\sqrt{k}$ M1 → $k = \frac{h}{9}$	A1	2	sc1 for any of: $k = \frac{\sqrt{h}}{3}$, $k = \frac{h}{\sqrt{3}}$ $k = \frac{h}{3^2}$
	(c)		For numerical $\frac{p \pm (or + or-)\sqrt{q}}{r}$ p = 23 and r = 2 q = 205 or $\sqrt{q}$ = 14.3 x = 18.66	B1 B1 B1 B1		as final answer or $\left(x - \frac{23}{2}\right)^2$ B1, 51.25 B1
	(d)		4.34		4	sc1 for 18.6→18.7 and 4.3→4.35 or for any two answers given to 2 dec. places.
			$\begin{pmatrix} 8 & 4 \\ -6 & 0 \end{pmatrix}$ Accept a = 8, b = 4 etc	B2	2	sc1 for 3 elements correct or $3Y = 2\begin{pmatrix} 12 & 6 \\ -9 & 0 \end{pmatrix}$
					10	
3	(a)	(i)	30 (cm^2)	B1	1	
		(ii)	$\frac{1}{2} \times 5h + \frac{1}{2} \times 6 \times 4$ = their 30 or 9 sin their $D\hat{A}B$ → 7.18→7.2	M1 A1	2	Possible GRAD answers
		(iii)	tan $DAB = \frac{4}{3}$ (or sin $DAB = \frac{7.2}{9}$ etc.) → 53→53.14	M1 A1	2	(a)(iii) 59.0…
	(b)	(i)	cos 51 = $\frac{RS}{8}$ o.e. M1 → 5 → 5.04	A1	2	(b)(i) 5.56…
		(ii)	$\frac{\sin Q}{8} = \frac{\sin 95}{8.5}$ M1 → $\frac{8\sin 95}{8.5}$ M1 (dep) → 69.6 → 70	A1	3	(b)(ii) 77.5…
		(iii)	(a) No: $PQR \neq 90$ or equiv (b) Mid pt of PR	B1 B1	2	Ignore superfluous reasoning.
					12	

4	(a)		180 – $\frac{360}{5}$ or $\frac{5-2}{5}$ x 180 o.e.	M1			
			→ 108º	A1	2	AG	
				B1			
	(b)	(i)	2 lines of symmetry	B1			
			Rot. sym. of order 2		2		
				B1			
		(ii)	Rhombus				
				B1		Accept diamond.	
		(iii)	252º				
				B1			
		(iv)	36º		3		
				B1			
	(c)	(i)	40º				
				B1			
		(ii)	100º				
				B1			
		(iii)	120º		3		
					10	f.t. 220 – their 100	f.t.
5	(a)		$n(S \cup F)'$ or $n(S' \cap F')$ or n( ) - $n(S \cup F)$	B1	1		
	(b)		$y + 80 + 35 - x = 100$ o.e. M1 → $x - 15$	A1	2		
	(c)	(i)	$x$min = 15	B1			
		(ii)	$y$max = 20	B1	2		
					5		
6	(a)		$p = 14$ $q = 27$	B1	1	both	
	(b)		$k = 2$	B1	1	Accept $3n + 2$	
	(c)		$7n$	B1			
			-1	B1	2	Accept unsimplified	
	(d)		$R = 41$ $B = 20$	B1			
			9 fences with either $\frac{400}{41}$ or $\frac{200}{20}$	B1	2	NB: 9 fences without working sc1	
					6		

7	(a)		2 3^2 (56.5..) + 3^2 (28.2..) = 84.8 – 84.834	M1 M1 A1	3	
	(b)		$I = \sqrt{16^2 + 4^2}$ (16.5) →CSA = x 4 x 16.5 = 207 – 207.5	M1 M1 A1	3	
	(c)	(i)	$\frac{r}{d} = \frac{4}{16}$ or $r = \frac{4d}{16}$	B1	1	A.G Alternatively: 4 and 16 with mention of shape or similarity o.e.
		(ii)	$V = \frac{1}{3}$ x x 4^2 x 16 = 267.9 → 268.2	M1 A1	2	
		(iii)	$\frac{1}{3} r^2 d = \frac{268}{2}$ $\frac{1}{3} \frac{d^3}{16} = \frac{268}{2}$ o.e. → d = 12.69 – 12.7 (cm)	M1 M1	3	
					12	
8	(a)		Scales All 8 points correctly plotted (within 1 mm) Smooth curve through pts (allow marginally incorrect pts)	S1 P1 C1	3	Lost for st. lines, incomplete, grossly thick.
	(b)	(i)	116 – 117	V1		Accept (4.5 , 116)
		(ii)	1.1 – 1.2 and 5.2 to 5.3	V1	2	DiHo Accept (1.1 , 128) , (5.2 , 128)
	(c)		suitable tangent 22 – 40	T1 T1	2	
	(d)		98	K1	1	(2.5 , 98) not accepted
	(e)	(i)	100 = $\frac{A}{2}$ + 2B → 200 = A + 4B	E1		AG
		(ii)	140 = A + B or 100 = $\frac{A}{3}$ + 3B etc. A = 120 B = 20	E1 B2	4	sc1 for attempt to solve 200 = A + 4B and 2nd equation in A and B
					12	

9	(a)		$(BC^2) = 7^2 + 8^2 -$ (or +) (2).7.8.cos 120 (or 60)	B1			
			$BC^2 = 7^2 + 8^2 - 2.7.8 \cos 120 \rightarrow BC = 13$	B1	2	AG	Possible GRAD answers (a) 12.4… (AG) (b) 26.62…
	(b)		Area = $\frac{1}{2}$.7.8.sin 120	M1			
			= 24.2 – 24.25 (cm^2)	A1	2		
	(c)	(i)	$\frac{1}{2}$.13.r	B1			
		(ii)	$+\frac{1}{2}$.7.r + $\frac{1}{2}$.8.r M1 = 14r	A1			f.t. 7.5r + their 6.5r
		(iii)	14r = 24.2	M1			Complete alternative method M1 A1
			r = 1.728 → 1.733	A1	5		
	(d)		24.2 – x 1.73^2 M1 24.2	M1			
			= 61 – 61.2 (%)	A1	3		
					12		
10	(a)		Widths 2, 1, 1, 2, 2, 3	M1			
			Heights 3½, 8, 6, 5, 1½, 2	M1			
			All correct (inc. given scales)	A1	3		
	(b)		11 < x ≤ 12	B1	1		
	(c)		fx (496) M1 f (40) M1 = 12.4 indep	A1	3		Allow any clear indication.
	(d)		26	B1	1		fx = 63 + 84 + 69 + 130 + 45 + 105 = 496 Allow 1 omission or 2 incorr mid pts
	(e)	(i)	0	B1			not $\frac{0}{40}$
		(ii)	$\frac{6}{40}$	B1			isw
	(f)		(2x) $\frac{6}{40}$ x $\frac{34}{39}$ M1 = $\frac{17}{65}$	A1	4		
					12		

11	(a)	(i)	Number of events	B1		
		(ii)	(a) $\begin{pmatrix}44\\46\end{pmatrix}$	B1 + B1		sc1 for (44, 46)
			(b) School scores, totals, no of points o.e.	B1 indep of (a)		
		(iii)	$\begin{pmatrix}55\\55\end{pmatrix}\rightarrow$ Yes, (tie)	B1	5	
	(b)	(i)	$\overrightarrow{PX} = -\frac{1}{3}p + \frac{1}{3}q$ o.e	B1		Accept unsimplified answers
		(ii)	$\overrightarrow{OX} = \frac{2}{3}p + \frac{1}{3}q$ o.e	B1		Accept unsimplified answers
		(iii)	$\overrightarrow{QY} = p + (k-1)q$ o.e	B1	3	Accept unsimplified answers
		(iv)	$\lambda\overrightarrow{OX} = \overrightarrow{QY}$ M1 $k = \frac{3}{2}$	A1	2	
		(v)	$\overrightarrow{PZ} = \frac{1}{2}q$	B2	2 **12**	Accept unsimplified answers