**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*.

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## 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

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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.<br>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<br>Both brackets essential | | 2 | 12 |
| | | | | | | |
| 7 | 11<br>Accept 10.99 (from = 3.14) | 2 | 11/2 , 5½ or 5.5<br>**or** Figs $\left(\frac{3+3}{360}\times 2\times\pi\times 105\right)$ seen | C1<br>M1 | 2 | |
| 8 | Condone missing outside brackets and<br>**Final answer** $\frac{x+7}{(x-3)(x+2)}$ *or* $\frac{x+7}{x^2-x-6}$ | us<br>2 | e of wrong letter if clear<br>Correct num, but brackets missing in denom<br>***or*** $\frac{2(x+2)-(x-3)}{(x-3)(x+2)}$ oe soi<br>[Condone **all** missing brackets]<br>[Only available if some working seen] | C1<br>M1 | 2 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 9 (a) | 10 | 1 | | | | |
| (b) | 8 | 1 | | | 2 | |
| 10(a) | 2.173 x $10^4$ cao | 1 | Accept . for x Do not accept calculator form | | | |
| (b) | 0.031 x $10^5$, 217.3 x $10^2$, 22.6 x $10^3$, 2.5 x $10^4$ or equivalents | 2 | Order reversed<br>**or** Least or greatest identified<br>Condone minor slips if intention clear | C1<br>C1 | 3 | |
| 11(a) | 2 | 1 | | | | |
| (b) | ($c$ =) 3 ($x$)<br>($d$ =) - 5 | 1<br>1 | One correct<br>**or** ($f^{-1}$ : $x$ ) $3x$ - 5 seen in working | C1<br>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<br>Accept ≥ for > etc throughout | 2 | **All** inequalities reversed<br>**or** Two inequalities correct | C1<br>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<br>Other value in range 196 to 204<br>**or** (BAC =) 109 to 111 **or** (BCA =) 47 to 49 **or**(ACS =) 19 to 21 or for S 19 to 21 W<br>seen or implied, possibly on diagram | C1<br><br><br><br>M1 | 3 | 9 |
| | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 16(a) | 1.515 m oe | 1 | **Unit essential** in this case | | | |
| (b) | 3.96 | 2 | Figs 396<br>**or** Figs $\frac{2 \times 0.55 \times 60 \times 60}{1000}$ | C1<br>M1 | 3 | |
| 17 | Both 3 and -5 | 3 | $3 \times 4 = x^2 + 3x - x \pm 3$ or better seen<br>**and** $(x + 5)(x - 3)$ oe seen, condoning missing outside brackets<br>**or** $\frac{-2 + \sqrt{64}}{2}$ obtained | M1<br><br>M1 | <br><br>3 | |
| 18 | 40 | 3 | $7^2 = 3^2 + \ell^{(2)}$ seen or implied, eg by $\sqrt{40}$<br>**or** $7^2 = 3^2 + 3^2 + \ell^{(2)}$ soi eg by 31 or $\sqrt{31}$<br>**or** 6, 7 used correctly | M2<br>M1<br>M1 | <br><br>3 | |
| 19(a) | 30 (%) | 2 | 70 (%)<br>**or** Figs $\left(\frac{400-280}{400} \times 100\right)$ | C1<br>M1 | | |
| (b) | ($) 20 | 2 | ($) 520<br>**or** Figs $\left(\frac{500 \times 6 \times 8}{100 \times 12}\right)$ seen, if intention clear | C1<br>M1 | 4 | 13 |
| | | | | | | |
| 20 | Circular arc, centre B, radius 6.5 ± 0.5 cm<br>One line parallel to one coast<br>One arc of circle linking two of these<br>Region clearly identified | 1<br>1<br>1<br>1 | Subtending at least 90° at B<br>Parallel by eye, 2 ± 0.5 cm from coasts as long as relevant coast or till it cuts circle<br>Dep on large circular arc and 3 parallel lines, but not lost for wrong measurements<br>Ignore superfluous lines | | <br><br><br>4 | |
| 21(a) | (i) 2 cao<br>(ii) 2.65 to 2.7(0) | 1<br>1 | Not 2/1<br>Ignore any attempt at $x = 0$ | | | |
| (b) | (i) 0.5<br>(ii) 3 | 1<br>1 | Do not accept $x < 2.65$<br>Condone intrusion of $y$ value of about 6.4<br>Accept ½ | | <br>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<br>**or** reference to angles in same segment soi | 1<br>1 | 4 | |
| 23(a) | Condone missing outside brackets, "=0", and use of wrong letter if clear<br>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<br>**or** Appropriate diagram or attempt to add 1.8<br>**and** 50 tan 30 oe or 50 x 0.577<br>**and** Rounding finally to the nearest integer provided some rounding has taken place<br>Accept a reasonable eye level used | C3<br>M1<br>M1<br>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<br>Factor 2 dep | 1<br>1 | Ignore reference to invariant line<br>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)<br>*C*' at (-7 , -2) | 1<br>1 | Labels not essential if triangle drawn<br>Labels essential if triangle not drawn<br>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

UNIVERSITY of CAMBRIDGE
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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | (a) | (i) | (a) 360 (m)<br>(b) 4800 (m) | | B1<br>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<br>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:<br>$k = \frac{\sqrt{h}}{3}$ , $k = \frac{h}{\sqrt{3}}$ $k = \frac{h}{3^2}$ |
| | (c) | | For numerical $\frac{p \pm (or + or-)\sqrt{q}}{r}$ | | | | as final answer |
| | | | $p$ = 23 and $r$ = 2 | | B1 | | |
| | | | $q$ = 205 or $\sqrt{q}$ = 14.3 | | B1<br>B1 | | or $\left(x - \frac{23}{2}\right)^2$ B1, 51.25 B1 |
| | | | $x$ = 18.66 | | B1 | 4 | |
| | (d) | | 4.34 | | | | 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 | | M1 | 2 | Possible GRAD answers |
| | | | or 9 sin their $D\hat{A}B$ | → 7.18→7.2 | A1 | | |
| | | (iii) | tan $DAB = \frac{4}{3}$ (or sin $DAB = \frac{7.2}{9}$ etc.) | | M1 | 2 | (a)(iii) 59.0… |
| | | | | → 53→53.14 | A1 | | |
| | (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) | | | (b)(ii) 77.5… |
| | | | | → 69.6 → 70 | A1 | 3 | |
| | | (iii) | (a) No: $PQR \neq 90$ or equiv | | B1 | | Ignore superfluous reasoning. |
| | | | (b) Mid pt of $PR$ | | B1 | 2 | |
| | | | | | | **12** | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | (a) | | $180 - \frac{360}{5}$ or $\frac{5-2}{5} \times 180$ o.e. | M1 | | | |
| | | | → 108º | A1 | 2 | AG | |
| | | | | B1 | | | |
| | (b) | (i) | 2 lines of symmetry | B1 | | | |
| | | | Rot. sym. of order 2 | B1 | 2 | | |
| | | (ii) | Rhombus | B1 | | Accept diamond. | |
| | | (iii) | 252º | B1 | | | |
| | | (iv) | 36º | B1 | 3 | | |
| | (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..)<br>+ $3^2$ (28.2..)<br>= 84.8 – 84.834 | M1<br>M1<br>A1 | 3 | |
| | (b) | | $I = \sqrt{16^2 + 4^2}$ (16.5)<br>→CSA = x 4 x 16.5<br>= 207 – 207.5 | M1<br>M1<br>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<br>= 267.9 → 268.2 | M1<br>A1 | 2 | |
| | | (iii) | $\frac{1}{3} r^2 d = \frac{268}{2}$<br>$\frac{1}{3} \frac{d^3}{16} = \frac{268}{2}$ o.e.<br>→ $d$ = 12.69 – 12.7 (cm) | M1<br>M1 | 3 | |
| | | | | | **12** | |
| 8 | (a) | | Scales<br>All 8 points correctly plotted (within 1 mm)<br>Smooth curve through pts (allow marginally incorrect pts) | S1<br>P1<br>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<br>Accept (1.1 , 128) , (5.2 , 128) |
| | (c) | | suitable tangent<br>22 – 40 | T1<br>T1 | 2 | |
| | (d) | | 98 | K1 | 1 | (2.5 , 98) not accepted |
| | (e) | (i) | 100 = $\frac{A}{2}$ + 2$B$ → 200 = $A$ + 4$B$ | E1 | | AG |
| | | (ii) | 140 = $A$ + $B$ or 100 = $\frac{A}{3}$ + 3$B$ etc.<br>$A$ = 120 $B$ = 20 | E1<br>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. 7.5$r$ + their 6.5$r$ |
| | | (iii) | 14$r$ = 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) $\frac{6}{40} \times \frac{34}{39}$ 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<br>**12** | Accept unsimplified answers |