

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Ordinary Level**

**MARK SCHEME for the May/June 2014 series**

**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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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| Question  | Answers                                                                 | Mark | Part marks                                                                                                                                                                                                                                                                                                                            |
|-----------|-------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 (a)     | 138 to 140                                                              | 1    |                                                                                                                                                                                                                                                                                                                                       |
| (b)       | $D$ marked at intersection of correct arcs                              | 2    | <b>B1</b> for a correctly positioned $D$ with one correct construction arc or no correct arcs<br>Or, provided $D$ to the west of $AB$<br><b>B1</b> for $D$ on one correct arc or radii 5 cm and 6 cm reversed with arcs<br>Or, provided $D$ to the east of $AB$<br><b>B1</b> for $D$ on intersection of two correct construction arcs |
| (c)       | $103^\circ$                                                             | 1    | Tolerance $\pm 2^\circ$                                                                                                                                                                                                                                                                                                               |
| (d) (i)   | $P$ and $Q$ marked at intersection of perpendicular bisector and circle | 3    | <b>B1</b> for perpendicular bisector of $AC$ minimum 3 cm long<br><b>B1</b> for arcs radius 4.5 cm centre $B$ , minimum 3 cm long cumulatively<br><b>B1</b> for $P$ and $Q$ at correct positions                                                                                                                                      |
| (ii)      | $249^\circ$                                                             | 1    | Tolerance $\pm 2^\circ$                                                                                                                                                                                                                                                                                                               |
| 2 (a) (i) | 97                                                                      | 1    |                                                                                                                                                                                                                                                                                                                                       |
| (ii)      | $(c = \pm)\sqrt{\frac{4f+d}{6}}$                                        | 2    | <b>M1</b> for $4f = 6c^2 - d$ or better                                                                                                                                                                                                                                                                                               |
| (b)       | $x \geq 2$ cao                                                          | 2    | <b>B1</b> for final answer $\{+ \text{ or } -\} x * \{+ \text{ or } -\} 2$ , where $*$ can be wrong inequality or equals                                                                                                                                                                                                              |
| (c)       | $(3 + 5x)(3 - 5x)$ oe                                                   | 1    | Must be integers                                                                                                                                                                                                                                                                                                                      |
| (d)       | $(8p - 3q)(x - 2y)$ oe seen isw                                         | 2    | <b>M1</b> for $x(8p - 3q)$ oe or $-2y(8p - 3q)$ oe<br>Or $8p(x - 2y)$ oe or $-3q(x - 2y)$ oe                                                                                                                                                                                                                                          |

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| Question | Answers                                | Mark | Part marks                                                                                                                                                                                                                                       |
|----------|----------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (e)      | 1.12 and -2.32 <b>final answer</b>     | 4    | <b>B3</b> for one correct solution<br>or $x = 1.1$ to 1.121 <b>and</b> -2.321 to -2.3<br><br>If in the form $\frac{p \pm (or + or -) \sqrt{q}}{r}$<br><b>B1</b> for $p = -6$ and $r = 10$<br>And <b>B1</b> for $q = 296$ or $\sqrt{q} = 17.2...$ |
| 3        | (a) (i) 533.9(0) to 534                | 2    | <b>M1</b> for $32 \times 5.20 + 0.15 \times 2450$                                                                                                                                                                                                |
|          | (ii) 1760                              | 3    | <b>M1</b> for $409.6 - 28 \times 5.20 [= 264]$<br><b>M1</b> for 'their 264' $\div 0.15$                                                                                                                                                          |
|          | (b) (i) 3.75                           | 2    | <b>SC1</b> for an answer of 28.75, 28.7, 28.8, 15, 3.7, 3.8 or 0.0375                                                                                                                                                                            |
|          | (ii) 402.5[0] or 403 or 402            | 2    | <b>M1</b> for $\frac{920}{(4+5+7)} \times 7$                                                                                                                                                                                                     |
| 4        | (a) (i) $\frac{1}{3}$                  | 1    | After 0+0 allow <b>B1</b> for 2/6 <b>and</b> 4/6<br>Or 0.33 <b>and</b> 0.66 or better                                                                                                                                                            |
|          | (ii) $\frac{2}{3}$                     | 1    |                                                                                                                                                                                                                                                  |
|          | (b) (i) 25 numbers completed correctly | 1    |                                                                                                                                                                                                                                                  |
|          | (ii) (a) $\frac{18}{30}$ oe isw        | 1    | After 0+0+0 for (b),<br>If all 36 used <b>B1</b> for 18/36 <b>and</b> 10/36<br>If 35 used, <b>B1</b> for 18/35 <b>and</b> 9/35                                                                                                                   |
|          | (b) $\frac{8}{30}$ oe isw              | 1    |                                                                                                                                                                                                                                                  |
| 5        | (a) 78.1 to 78.13                      | 2    | <b>M1</b> for $\cos 35 = \frac{64}{AB}$ or better                                                                                                                                                                                                |
|          | (b) 127.9 to 128                       | 3    | <b>M1</b> for $64^2 + 80^2 + or - (2) \times 64 \times 80 \cos 125$<br><b>M1</b> for $AD^2 = 64^2 + 80^2 - 2 \times 64 \times 80 \cos 125$                                                                                                       |
|          | (c) 24.1 to 24.2°                      | 3    | <b>M1</b> for $\frac{\sin ADC}{64} = \frac{\sin 125}{their 128}$ oe<br><br><b>M1</b> for $\sin ADC = \frac{64 \times \sin 125}{their 128}$                                                                                                       |
|          | (d) 2900                               | 2    | <b>M1</b> for $0.5 \times (80 + 65) \times 40$                                                                                                                                                                                                   |

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| Question    | Answers                                 | Mark | Part marks                                                                                                                                                           |
|-------------|-----------------------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6 (a)       | $23 - 6n$ cao                           | 2    | <b>B1</b> for $-6n$ soi                                                                                                                                              |
| (b) (i)     | 4, 10, 18, 28                           | 2    | <b>B1</b> for 3 correct terms seen                                                                                                                                   |
| (ii)        | 3 and 24                                | 4    | <b>M1</b> for $\frac{n^2 + 3n}{5n - 12} = 6$ or better<br><b>M1</b> for $n^2 - 27n + 72 = 0$<br><b>B1</b> for either 3 or 24                                         |
| 7 (a) (i)   | 9600 cao                                | 2    | <b>M1</b> for $\frac{360}{60} \times 1600$ oe                                                                                                                        |
| (ii)        | $\frac{11}{60}$ cao                     | 1    |                                                                                                                                                                      |
| (iii)       | 1440 cao                                | 2    | <b>M1</b> for $\frac{(144 - 90)}{360} \times their 9600$ oe                                                                                                          |
| (b) (i)     | 40.1                                    | 3    | <b>M1</b> for<br>$12 \times 17.5 + 36 \times 25 + 45 \times 35 + 33 \times 50 + 24 \times 70$<br><b>M1</b> for division by <i>their</i> $(12 + 36 + \dots + 24)$     |
| (ii)        | Correct histogram                       | 3    | <b>B1</b> for 5 bars correct width and position<br><b>B1</b> for at least 3 correct heights $k \times (2.4, 3.6, 4.5, 1.65, 1.2)$<br><b>B1</b> for 5 correct heights |
| (iii)       | 38 or 39 or 40 or 41                    | 1    |                                                                                                                                                                      |
| 8 (a) (i)   | $\begin{pmatrix} 4 \\ -5 \end{pmatrix}$ | 1    |                                                                                                                                                                      |
| (ii)        | 6.4(0) to 6.41 or $\sqrt{41}$ cao       | 1    |                                                                                                                                                                      |
| (iii)       | $y = -1.25x + 7$ oe                     | 2    | <b>B1</b> for gradient = $-1.25$ or $y$ -intercept = $+7$ soi in a final equation                                                                                    |
| (iv)        | (12, $-8$ )                             | 2    | <b>B1</b> for one value correct                                                                                                                                      |
| (b) (i) (a) | $\mathbf{b} - \mathbf{a}$               | 1    |                                                                                                                                                                      |
| (b) (b)     | $3\mathbf{a}$ cao                       | 1    |                                                                                                                                                                      |
| (c)         | $4(\mathbf{b} - \mathbf{a})$            | 2    | <b>B1</b> for correct unsimplified $\overrightarrow{CD}$ or for $3(\mathbf{b} - \mathbf{a})$                                                                         |
| (ii) (a)    | 1 : 4                                   | 1    |                                                                                                                                                                      |
| (b)         | 1 : 15                                  | 1    |                                                                                                                                                                      |

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| Question       | Answers                                                                                                                 | Mark  | Part marks                                                                                                                                                                                              |
|----------------|-------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>9 (a)</b>   | $\sqrt{15^2 + 6^2} = 16.15(5\dots)$                                                                                     | 1     | Must be shown to at least 2 d.p.                                                                                                                                                                        |
| <b>(b)</b>     | 417 to 419                                                                                                              | 3     | <b>M1</b> for $\pi \times 6 \times 16.2$ soi by 305.4<br><b>M1</b> for $\pi \times 6^2$ soi by 113.1                                                                                                    |
| <b>(c)</b>     | 565 to 566                                                                                                              | 2     | <b>M1</b> for $\frac{1}{3} \times \pi \times 6^2 \times 15$ or better                                                                                                                                   |
| <b>(d)</b>     | 316 to 317                                                                                                              | 2FT   | FT <i>their</i> (c) $\times 0.56$ evaluated<br><b>B1</b> for figs 316(...) or 317(...)<br>or <i>their</i> (c) $\times$ figs 56 evaluated                                                                |
| <b>(e) (i)</b> | 18.89 to 18.9                                                                                                           | 2     | <b>M1</b> for $\sqrt[3]{2}$ or 1.25... seen oe                                                                                                                                                          |
| <b>(ii)</b>    | 662 to 665                                                                                                              | 2     | <b>M1</b> for $\left(\sqrt[3]{2}\right)^2$ or 1.58... seen oe                                                                                                                                           |
| <b>10 (a)</b>  | $[L =] \quad 2\left(x + \frac{50}{x}\right) \text{ or } 2x + 2\frac{50}{x}$<br>or $x + x + \frac{50}{x} + \frac{50}{x}$ | 2     | <b>B1</b> for $\frac{50}{x}$ seen                                                                                                                                                                       |
| <b>(b)</b>     | 41.5 to 41.6, 45                                                                                                        | 2     | <b>B1</b> for one correct                                                                                                                                                                               |
| <b>(c)</b>     | Correct smooth curve through the eight given points correctly plotted on correctly scaled axes                          | 3     | $\pm$ half a small square<br><b>B2</b> for seven or eight of the given points correctly plotted on <i>their</i> axes<br>or <b>B1</b> for six of the given points correctly plotted on <i>their</i> axes |
| <b>(d)</b>     | $2.8 \text{ to } 3.2 < x < 16.8 \text{ to } 17.2$                                                                       | B1 B1 | <b>M1</b> for attempt to read off two $x$ values at $y = 40$                                                                                                                                            |
| <b>(e) (i)</b> | $27.5 < \text{answer} < 28.5$                                                                                           | 1     |                                                                                                                                                                                                         |
| <b>(ii)</b>    | 7, 7 cao                                                                                                                | 1     |                                                                                                                                                                                                         |
| <b>(f)</b>     | 10, 10 cao                                                                                                              | 1     |                                                                                                                                                                                                         |

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| Question   | Answers                                                                                                                                                                                  | Mark                         | Part marks                                                                                                                                                                                                                                                                                     |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11 (a) (i) | $EC = BE$ or $AC = FE$ and<br>$\angle AEC = \angle FBE$ or $\angle ECA = \angle BEF$<br>Two correct reasons for their choices                                                            | B1<br>B1                     | Statements and reasons:<br>$EC = BE$ ; radii<br>$AC = FE$ ; diameters<br>$\angle AEC = \angle FBE [= 90^\circ]$ ; angle in semicircle<br>$\angle ECA = \angle BEF [= 60^\circ]$ ; equilateral triangle                                                                                         |
|            | Third statement, leading to correct congruence condition i.e. RHS, SAS, SSA                                                                                                              | B1                           |                                                                                                                                                                                                                                                                                                |
|            | (ii) $BFD$                                                                                                                                                                               | 1                            |                                                                                                                                                                                                                                                                                                |
|            | (iii) $\angle EBF = \angle DFB = 90^\circ$<br>Cointerior/interior/supplementary/allied angles [sum to 180]<br>OR<br>$\angle BEF = \angle EFD = 60^\circ$<br>Alternate angles [are equal] | 1<br>1dep<br>OR<br>1<br>1dep | Both $90^\circ$ could be marked on diagram<br><br>Both $60^\circ$ could be marked on diagram                                                                                                                                                                                                   |
|            | (iv) $120^\circ$                                                                                                                                                                         | 1                            | $120^\circ$ could be marked on diagram                                                                                                                                                                                                                                                         |
|            | (b) (i) 6.126 to 6.13                                                                                                                                                                    | 2                            | <b>M1</b> for $\frac{1}{2} \times 4 \times 4 \times \sin 130$<br><br>Or $\frac{1}{2}PQ \times$ perpendicular height (numerical)                                                                                                                                                                |
| (ii)       | 38.2 to 38.3                                                                                                                                                                             | 3                            | <b>M1</b> for $\frac{(360 - 130)}{360} \times \pi \times 4^2$ soi by 32.11<br>or $\frac{130}{360} \times \pi \times 4^2$ soi by 18.15<br>And <b>M1</b> for ‘their major sector area’ + ‘their triangle area’<br>Or for ‘their circle area’ – ‘their minor sector area’ + ‘their triangle area’ |