**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Ordinary Level**

# MARK SCHEME for the October/November 2013 series

## 4024 MATHEMATICS (SYLLABUS D)

**4024/21** 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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| Qu | Answers | Mark | Part Marks |
|---|---|---|---|
| 1 | **(a) (i)** 468 | 1 | |
| | **(ii)** 700 | 1 | |
| | **(iii)** 550 | 2 | **B1** for factor $\frac{1.10}{1.56}$ soi |
| | **(b)** 19 926 | 3 | **M2** for $\frac{x}{81}-\frac{x}{82}=\pm 3$ or<br>**B1** for $\frac{x}{81}$ or $\frac{x}{82}$ seen |
| 2 | **(a)** Correct triangle | 2 | **B1** for 40° or 8 cm. |
| | **(b)** Complete locus | 2 | **B1** for at least one parallel line or at least one circular arc. |
| | **(c)** $P$ correctly placed ft | 2ft | **B1** for perpendicular bisector of $BC$ or<br>Arc centre $A$ radius 6.5 |
| 3 | **(a)** (2,3) | 1 | |
| | **(b)** $\frac{4}{8}$ oe | 1 | |
| | **(c)** 2 ft | 2ft | **M1** for $y = (b)x + c$ |
| | **(d)** $\begin{pmatrix}8\\4\end{pmatrix}$ | 1 | |
| | **(e)** (–3,–2) and (13,6) ft | 3ft | **B2** for one correct point or<br>**M2** for $\begin{pmatrix}8\\4\end{pmatrix}=(\pm)\begin{pmatrix}h-5\\k-2\end{pmatrix}$ or<br>**M1** for $\overrightarrow{AB}=(\pm)\overrightarrow{CD}$ |
| 4 | **(a)** $3.5 < x \leqslant 4$ | 1 | |
| | **(b)** Correct frequency polygon | 2 | **B1** for 5 correct plots or<br>all heights consistently mis-plotted. |
| | **(c) (i)** Completed table | 1 | |
| | **(ii)** Correct cumulative frequency curve. | 2 ft | **P1** for 5 points plotted ft (and joined) or<br>All points consistently mis-plotted. |
| | **(d) (i)** ft at $y = 50$ (3.4) | 1ft | |
| | **(ii)** ft at $y = 10$ (2.3) | 1ft | |

| | | | |
|---|---|---|---|
| **5** | **(a)** 1 | **1** | |
| | **(b)** **(i)** $5(x + y)$ | **1** | |
| | **(ii)** $(3x + 4)(3x – 4)$ | **1** | |
| | **(c)** **(i)** $(2x – 3)(x + 4)$ | **1** | |
| | **(ii)** $\frac{3}{2} – 4$ | **1ft** | |
| | **(d)** 4 | **2** | **B1** for $k = 36$ or<br>**M1** for $L = \frac{k}{d^2}$ soi |
| **6** | **(a)** **(i)** 19.93 from correct rounding | **2** | **M1** for $\frac{CD}{31} = \cos 50$ oe |
| | **(ii)** 28.3 | **3** | **M1** for $\frac{31}{AC} = \cos 50$ oe and<br>**M1** for $AC – 19.93$<br>**SC** If 2nd **M** not earned, **A1** for 48.2 |
| | **(b)** **(i)** 25 | **1** | |
| | **(ii)** 37.2 or 37.3 | **3** | **M1** for $\frac{PR}{52} = \tan 65$ oe or $\frac{QR}{52} = \tan 55$ oe and<br>**M1** for $PR – QR$<br>**SC** If 2nd **M** not scored,<br>**A1** for 111.5 or 74.26 |
| **7** | **(a)** **(i)** The three facts for Congruency stated | **3** | **B1** for angle $EAD$ = angle $DAC$ and<br>**B1** for either $AE = AC$ or $AD$ common |
| | **(ii)** $(x =) z – y$ oe isw | **2** | **B1** for angle $AED = z$ or $z = x + y$ |
| | **(b)** 228 | **2** | **B1** for 132 seen or (angle $SQR$ =) 21 **and** (angle $SRQ$ =) 27 soi |
| **8** | **(a)** 7.14 | **3** | **M2** for reaching $7^2 + r^2 = 10^2$ soi or<br>**M1** for correct right angled triangle soi |
| | **(b)** **(i)** Equiangular triangles established | **3** | **B2** for two pairs with no reason. Or for one pair of equal angles with reason. Or<br>**B1** for any pair of equal angles. |
| | **(ii)** $x^2 – 18x + 55$ (=0) correctly found | **2** | **M1** for $\frac{x}{5} = \frac{11}{18 – x}$ oe |

| | | | |
|---|---|---|---|
| | **(iii)** 3.9 14.1 | **3** | **B1** for $\sqrt{(-18)^2 - 4\times1\times55}$ soi and<br>**B1** for $\frac{-(-18)+(or-)\sqrt{their104}}{2\times1}$ soi<br>If **B1** or **B0** at this stage, allow<br>**M1** for both values of $\frac{p\pm\sqrt{q}}{r}$ |
| | **(iv)** 10.2 ft | **1ft** | |
| **9** | **(a)** 4050 | **1** | |
| | **(b)** Correct plots ft and curve | **3** | **P2** for 5 correct plots ft or<br>**P1** for 4 correct plots ft |
| | **(c)** (1700) ft | **1** | |
| | **(d)** **(i)** (870) ft | **2** | **M1** for a tangent at $t = 2.5$ |
| | **(ii)** Rate of increase<br>(of number of bacteria per hour) | **1** | |
| | **(e)** ($k$ =) 50 ($a$ =) 3 | **1** | |
| | **(f)** **(i)** Correct straight line | **2** | **L1** for correct intercept or<br>Correct gradient |
| | **(ii)** 3.45 ft | **1** | |
| **10** | **(a)** **(i)** 11.9 | **2** | **B1** for $k\times2\pi r\times h$ |
| | **(ii)** 1.73 or 1.74 | **4** | **M1** for ½ × 0.8 × 0.8(× sin90) oe and<br>**M1** for $(\frac{90}{360})\pi \times 0.8^2$ and<br>**M1** for(*their* 0.5026 – their 0.32) × 9.5 |
| | **(iii)** 9.1% ft | **2ft** | **M1** for $\frac{\textbf{(a)(ii)}}{19.1}\times100$ |
| | **(b)** **(i)** 19 100 | **1** | |
| | **(ii)** 22 ft | **3ft** | **M1** for figs $\frac{25(000)}{their\textbf{(b)(i)}\times6(0)} = \text{N}$ and<br>**B1** for N × $10^3$ |
| **11** | **(a)** **(i)** Shear, scale factor $\frac{3}{2}$ | **2** | **B1** for Shear only or SF 1.5 |
| | **(ii)** $\begin{pmatrix}1 & 1.5\\0 & 1\end{pmatrix}$ | **2** | **B1** for one element incorrect or<br>**M1** for $\begin{pmatrix}a & b\\c & d\end{pmatrix}\begin{pmatrix}1 & 3 & 3\\2 & 2 & 6\end{pmatrix}=\begin{pmatrix}4 & 6 & 12\\2 & 2 & 6\end{pmatrix}$ |

| | | | |
|---|---|---|---|
| | **(b) (i)** Triangle $C$ | **2** | **B1** for two vertices correct or<br>**M1** for $\begin{pmatrix}2&0\\0&1\end{pmatrix}\begin{pmatrix}4&6&12\\2&2&6\end{pmatrix}$ |
| | **(ii)** Stretch(ing) | **1** | |
| | **(iii)** $\frac{1}{2}\begin{pmatrix}1&0\\0&2\end{pmatrix}$ oe isw | **2** | **B1** for det = 2 soi or $\begin{pmatrix}1&0\\0&2\end{pmatrix}$ soi or<br>**M1** for $\begin{pmatrix}2&0\\0&1\end{pmatrix}\begin{pmatrix}p&q\\r&s\end{pmatrix}=\begin{pmatrix}1&0\\0&1\end{pmatrix}$ |
| | **(iv)** 2 : 1 oe | **1** | |
| | **(c)** $\begin{pmatrix}2&3\\0&1\end{pmatrix}$ | **2** | **B1** for one element incorrect or<br>**M1** for $\begin{pmatrix}2&0\\0&1\end{pmatrix}\begin{pmatrix}1&1.5\\0&1\end{pmatrix}$ |
| **12** | **(a) (i)** $\frac{5\sin 65}{\sin 65-\sin 45}$ correctly obtained. | **3** | **M1** for $\frac{BC}{\sin 65}=\frac{AC}{\sin 45}$ oe soi and<br>**B1** for $AC = BC - 5$ oe |
| | **(ii)** 22.7 or 22.8 | **1** | |
| | **(b) (i)** $-\frac{11}{40}$ isw | **3** | **M2** for $13^2 = 6^2 + 10^2 - 2\times6\times10\times\cos PRQ$ or<br>**M1** for $13^2 = 6^2 + 10^2 + 2\times6\times10\times\cos PRQ$<br>**A1** for $\frac{33}{120}$ or<br>**M1** for $13^2 = 6^2 + 10^2 - \times6\times10\times\cos PRQ$<br>**A1** for $-\frac{33}{60}$ |
| | **(ii)** $\frac{11}{40}$ ft | **1ft** | |
| | **(c)** Correct triangle $DEG$ | **1** | |
| | **(d)** 6 | **3** | **B1** for Triangle $LMN$ with angle $M = 30$ soi and<br>**M1** for $\frac{1}{2}\times LM\times MN\times\sin 30$ soi |