

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
GCE Ordinary Level

**MARK SCHEME for the October/November 2011 question paper  
for the guidance of teachers**

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| <p style="text-align: center;"><b>4024 MATHEMATICS (SYLLABUS D)</b></p> <p><b>4024/22</b>                      Paper 2, maximum raw mark 100</p> |
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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      |
| soi | seen or implied            |

| Qu | Answers                                  | Mark   | Part Marks   |
|----|--|--------|--|
| 1  | (a) $(m =) \frac{A - h^2}{4h}$ final ans | 3      | <b>M1</b> for $A = 4hm + h^2$ or $\frac{A}{h} = 4m + h$<br>and (indep.) <b>M1</b> for $4hm = A - h^2$ or<br>$4m = \frac{A}{h} - h$ or for isolating the term in $m$<br>after the first <b>M0</b> .   |
|    | (b) $(x - 2y)(3a + 5b)$                  | 2      | <b>M1</b> for $x(3a + 5b) - 2y(3a + 5b)$ or<br>$3a(x - 2y) + 5b(x - 2y)$<br>or for correct extraction of one common<br>factor at any stage.  |
|    | (c) 2 or -1.6                            | 3      | <b>C2</b> for one correct www or<br><b>M2</b> for $5x - 1 = \pm 9$ or $5(5x + 8)(x - 2) = 0$<br>oe or<br><b>M1</b> for $(5x - 1)^2 = 81$ soi or<br>for $5x - 1 = 9$  |
| 2  | (a) 43(.0)                               | 2      | <b>M1</b> for $\sin x = \frac{3.73}{5.47}$ (0.6819) oe   |
|    | (b) $(\pm) 2.5(0)$                       | 4      | <b>M2</b> for<br>$5.32^2 + 3.73^2 - 2 \times 5.32 \times 3.73 \times \cos 25$<br>or <b>M1</b> for $\cos 25 = \frac{3.73^2 + 5.32^2 - x^2}{2 \times 3.73 \times 5.32}$ or<br>for $5.32^2 + 3.73^2 + 2 \times 5.32 \times 3.73 \times \cos 25$<br><b>A1</b> for 6.246 seen or 8.84 |
|    | (c) (i) 245<br>(ii) 16.7                 | 1<br>2 | <b>B1</b> for $\tan y = \frac{30}{100}$ or $\frac{100}{30}$ ( $y = 73.3$ )   |
| 3  | (a) (i) One line of symmetry             | 1      |  |
|    | (ii) 10 : 1                              | 3      | <b>B1</b> for $\pi (r \text{ or } R)^2$ and a further<br><b>B1</b> for a valid attempt at an expression or<br>equation involving $R$ and $r$   |

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|   | (b) (i) Convincing explanation                                     | 2 | B1 for $AOB = 72$ soi or<br>B1 for $ACB = 108$ and conclusion involving 360                      |
|   | (ii) $7(\pi r)$  | 2 | M1 for $(5 \times) \frac{252}{360} \times 2\pi r$  |
| 4 | (a) (i) (a) 20   | 1 |  |
|   | (b) 25   | 2 | M1 for figs $\frac{60 \times their12 - 540}{60 \times their12}$ oe                               |
|   | (ii) 6.25  | 2 | B1 for $\div$ by figs 16   |
|   | (b) (i) $63 \times 6 + 4x \leq 500$ or<br>$63 + x \leq 100$ oe isw | 1 |  |
|   | (ii) 93  | 2 | M1 for $63 \times 6 + 4x (<) 500$ or better seen<br>SC1 for answer 30.                           |
|   | (c) (i) 435  | 1 |  |
|   | (ii) 7.2(0)  | 2 | M1 for $\div$ by figs 145  |
| 5 | (a) $x = 5$ $y = 4$  | 2 | B1 for one correct www or<br>M1 for $\begin{pmatrix} 3x - 11 \\ x + y \end{pmatrix}$ soi         |
|   | (b) (i) (a) $(a, c)$   | 1 |  |
|   | (b) $(b, d)$   | 1 |  |
|   | (ii) $\begin{pmatrix} 1 & -3 \\ 3 & -2 \end{pmatrix}$              | 1 |  |
|   | (iii) Reflection in $x$ -axis                                      | 2 | B1 for Reflection only.  |
| 6 | (a) $\begin{pmatrix} 6 \\ 2 \end{pmatrix}$                         | 1 |  |
|   | (b) $\frac{1}{3}$ oe isw   | 1 |  |
|   | (c) $P = -3$ $Q = 21$  | 2 | M1 for $7P + Q = 0$ or $9P + Q = -6$ or<br>B1 for an equation with $m =$ their (b) or<br>$c = 7$ |
|   | (d) (i) $(18, -5)$   | 1 |  |
|   | (ii) $(\pm) 13$  | 1 |  |

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|   | (iii) (a) (12, 11)                              | 2   | B1 for $(x =) 12$  |
|   | (b) $2\overrightarrow{AB}$                      | 1   |  |
| 7 | (a) (i) 27.7                                    | 2   | M1 for $\frac{1}{2} \times 8 \times 8 \times \sin(\text{their } 60)$ oe  |
|   | (ii) Convincing explanation                     | 1   |  |
|   | (iii) 4.62                                      | 2   | M1 for $\frac{AF}{\sin 30} = \frac{8}{\sin 120}$ oe such as<br>$\frac{4}{AF} = \cos 30$  |
|   | (b) (i) 111                                     | 1ft | Accept $4 \times$ their (a)(i) ft  |
|   | (ii) 60.3                                       | 3ft | M1 for $(VF^2 =) 8^2 - (\text{their (a)(iii)})^2$<br>A1 for $(VF =) 6.53$ or ft soi<br>SC1 for $\frac{1}{3} \times$ their (a)(i) $\times$ their $VF$ |
|   | (c) (i) $2 \pm 0.01$                            | 2   | M1 for $\sqrt[3]{}$ of ratio of their volumes soi  |
|   | (ii) 8  | 1   |  |
| 8 | (a) (i) 1240                                    | 1   |  |
|   | (ii) 11 correct plots (and smooth curve)        | 2   | P1 for 7 correct plots (joined.)   |
|   | (iii) (4.6)                                     | 1ft | ft from their graph at $y = 42$  |
|   | (b) (i) 1100                                    | 1   |  |
|   | (ii) Correct line, ruled                        | 2   | L1 for freehand line or line with intercept 25 or gradient 3.75  |
|   | (c) (4.8)                                       | 1ft |  |
|   | (d) (i) $6 \leq \text{gradient} \leq 7$ (\$/yr) | 2   | M1 for correct tangent   |
|   | (ii) 3.75 (\$/yr)                               | 1   |  |
|   | (iii) (2)                                       | 1ft |  |
| 9 | (a) Complete congruency case www                | 3   | R1 for $A = B (= 90)$<br>S1 for $AP = BQ$ or $AB = BC$ <u>stated</u>   |
|   | (b) Convincing explanation www                  | 2   | C1 for stating $ABP = BCQ$   |
|   | (c) (i) Angle in a semicircle                   | 1   |  |
|   | (ii) B 2  | 1   |  |

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|    | (iii) (a) 6<br>(b) Convincing explanation wwww<br>(c) 12<br>(d) 45  | 1<br>1<br>1<br>2               | <b>B1</b> for $\frac{1}{2} \times 6 \times$ their (c) or $\frac{1}{2} \times 6 \times 3$ seen   |
| 10 | (a) (i) $3x$ seen<br>(ii) $7 - 2x$ oe seen<br>(b) (i) $x^2 - 28x + 49 = 0$<br>(ii) 1.88      26.1<br><br>(iii) 1.88 with convincing reason<br>(Accept the accuracy marked in (ii))<br>(iv) 10.6 or 10.5 cao | 1<br>2<br>2<br>4<br><br>2<br>1 | <b>M1</b> for $[28 - 2(x + \text{their } 3x)] \div 4$<br>AG so wwww<br><b>M1</b> for $3x^2 = (7 - 2x)^2$<br><b>B3</b> One correct or<br>both 1.875 and 26.12 seen or<br>both 1.9 and 26.1 or better seen<br><br>or<br><b>B1</b> for $p = 28$ and $r = 2$ and<br><b>B1</b> for $q = 588$ or $\sqrt{q} = 24.248$<br><br><b>B1</b> for $(x - 14)^{(2)}$ and<br><b>B1</b> for 147 or 12.12<br><br><b>B1</b> for 1.88 (or the accuracy marked in (ii)) |
| 11 | (a) (i) 7 correct plots and smooth curve<br><br>(ii) (43)<br>(iii) (18)<br>(iv) (26)  | 3<br><br>1ft<br>1ft<br>1ft     | <b>P2</b> for 7 correct plots or<br><b>P1</b> for 4 correct plots<br><b>SC1</b> for ogive curve<br><b>SC1</b> for all heights correct<br><br>ft's dependent on ogive curve  |

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|  | (b) (i) Completion of diagram | 2 | <b>B1</b> for two correct probabilities   |
|  | (ii) (a) $\frac{1}{11}$       | 1 |   |
|  | (b) $\frac{k10}{k11}$ isw     | 2 | <b>B1</b> for two of the following products correct<br>$\frac{8}{12} \times \frac{7}{11} + \frac{8}{12} \times \frac{4}{11} + \frac{4}{12} \times \frac{8}{11}$ |
|  | (iii) $\frac{k}{55k}$ isw     | 1 |   |