

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 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) <i>P</i> correctly placed ft	2ft	B1 for perpendicular bisector of <i>BC</i> or Arc centre <i>A</i> 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 M2 for $\begin{pmatrix} 8 \\ 4 \end{pmatrix} = (\pm) \begin{pmatrix} h-5 \\ k-2 \end{pmatrix}$ or M1 for $\overrightarrow{AB} = (\pm)\overrightarrow{CD}$
4	(a) $3.5 < x \leq 4$	1	
	(b) Correct frequency polygon	2	B1 for 5 correct plots or 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 All points consistently mis-plotted.
	(d) (i) ft at $y = 50$ (3.4)	1ft	
(ii) ft at $y = 10$ (2.3)	1ft		

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

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	(iii) 3.9 14.1 (iv) 10.2 ft	3 1ft	B1 for $\sqrt{(-18)^2 - 4 \times 1 \times 55}$ soi and B1 for $\frac{-(-18) + (or -)\sqrt{their 104}}{2 \times 1}$ soi If B1 or B0 at this stage, allow M1 for both values of $\frac{p \pm \sqrt{q}}{r}$
9	(a) 4050 (b) Correct plots ft and curve (c) (1700) ft (d) (i) (870) ft (ii) Rate of increase (of number of bacteria per hour) (e) ($k =$) 50 ($a =$) 3 (f) (i) Correct straight line (ii) 3.45 ft	1 3 1 2 1 1 2 1	P2 for 5 correct plots ft or P1 for 4 correct plots ft M1 for a tangent at $t = 2.5$ L1 for correct intercept or Correct gradient
10	(a) (i) 11.9 (ii) 1.73 or 1.74 (iii) 9.1% ft (b) (i) 19 100 (ii) 22 ft	2 4 2ft 1 3ft	B1 for $k \times 2\pi r \times h$ M1 for $\frac{1}{2} \times 0.8 \times 0.8 (\times \sin 90)$ oe and M1 for $(\frac{90}{360})\pi \times 0.8^2$ and M1 for (<i>their</i> 0.5026 – <i>their</i> 0.32) $\times 9.5$ M1 for $\frac{(a)(ii)}{19.1} \times 100$ M1 for figs $\frac{25(000)}{their (b)(i) \times 6(0)} = N$ and B1 for $N \times 10^3$
11	(a) (i) Shear, scale factor $\frac{3}{2}$ (ii) $\begin{pmatrix} 1 & 1.5 \\ 0 & 1 \end{pmatrix}$	2 2	B1 for Shear only or SF 1.5 B1 for one element incorrect or M1 for $\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 1 & 3 & 3 \\ 2 & 2 & 6 \end{pmatrix} = \begin{pmatrix} 4 & 6 & 12 \\ 2 & 2 & 6 \end{pmatrix}$

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