Cambridge
O Level

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Cambridge Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/21**

Paper 2 **May/June 2017**

MARK SCHEME

Maximum Mark: 100

Published

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	Partial marks
1(a)	4 : 2 : 3 final answer	**2**	**B1** for 24 : 12 : 54–(24+12) or 12 : 6 : 9
1(b)	$c = 14$, $v = 2$ and $t = 13$	**2**	**B1** for 2 correct or 10 cars, 10 vans and 5 trucks soi
2(a)	36 000	**2**	**M1** for seeing 36720 as 102[%]
2(b)	12.3	**4**	**B1** for 14 688 or 40% **B1** for 5508 or 32.6[%] to 32.7[%] or 0.326 to 0.327 **M1** for $\frac{36720 - \textit{their}14688 - \textit{their}5508 - 12000}{36720}$ or $100 - (15 + \textit{their}32.7 + \textit{their}40)$
3(a)	GCB, HPC, HPB, HCB, RPC,RPB, RCB	**2**	**B1** for 5 correct and none incorrect or for 6 correct
3(b)(i)	$\frac{3}{9}$ or $\frac{1}{3}$ or 0.333(..) or 33.3(..)%	**1**	FT dep on B1 scored in **(a)**
3(b)(ii)	$\frac{6}{9}$ or $\frac{2}{3}$ or 0.666 – 0.667 or 66.6% – 66.7%	**1**	FT dep on B1 scored in **(a)**
3(b)(iii)	$\frac{2}{9}$ or 0.222(...) or 22.2(...)%	**1**	FT dep on B1 scored in **(a)** After 0 scored in **(i) (ii)** and **(iii)**, **SC1** for $\frac{3}{k}, \frac{6}{k}, \frac{2}{k}$
4(a)(i)	$\begin{pmatrix} 0 & 1 \\ 8 & 1 \end{pmatrix}$	**2**	**B1** for $\begin{matrix} 0 & 1 \\ 8 & 1 \end{matrix}$ or 2 elements correct in a 2 × 2 matrix with brackets
4(a)(ii)	$\frac{1}{4}\begin{pmatrix} -1 & 1 \\ -6 & 2 \end{pmatrix}$ oe isw	**2**	**B1** for for determinant = 4 soi or $k\begin{pmatrix} -1 & 1 \\ -6 & 2 \end{pmatrix}$
4(b)	$\frac{1}{2}\begin{pmatrix} 4 & -3 \\ 14 & -2 \end{pmatrix}$ or $\begin{pmatrix} 2 & -1.5 \\ 7 & -1 \end{pmatrix}$ oe	**2**	**B1** for $2\mathbf{C} = 3\mathbf{B} - \mathbf{A}$ or $-2\mathbf{C} = \mathbf{A} - 3\mathbf{B}$ soi or $\begin{pmatrix} 4 & -3 \\ 14 & -2 \end{pmatrix}$ or **M1** for $\begin{pmatrix} 2 & 0 \\ 4 & -1 \end{pmatrix} + 2\mathbf{C} = 3\begin{pmatrix} 2 & -1 \\ 6 & -1 \end{pmatrix}$
5(a)	17	**1**	
5(b)	Smooth curve through 7 correct points	**3**	Mark the curve first **B2** for at least 5 ft plots correct **B1** for at least 4 ft plots correct

Question	Answers	Mark	Partial marks
5(c)	–1.7 to –1.4, –0.5 to –0.2, 1.7 to 2.0	**2**	FT **B1** for 2 correct
5(d)	3 to 5 with tangent drawn	**2**	**B1** for ruled solid tangent drawn
5(e)(i)	Correct ruled line drawn	**1**	
5(e)(ii)	$a = 7$, $b = 4$	**2**	**B1** for one correct or $a = 6.8$ to 7.2 and $b = 3.8$ to 4.2
5(e)(iii)	–2.4 to –2.1 or –0.7 to –0.5	**1**	FT
6(a)(i)	14.4[2…]	**2**	**M1** for $12^2 + 8^2$
6(a)(ii)	128.6^o to 129^o	**3**	**M1** for $\tan\theta = \frac{12}{15}$ or $\tan\theta = \frac{15}{12}$ **A1** for 38.6 to 38.7 or 51.3 to 51.4 After A0, **SC1** for $90 + \tan^{-1}(\frac{12}{15})$ evaluated or $180 - \tan^{-1}(\frac{15}{12})$ evaluated
6(b)(i)	472 to 488	**2**	**B1** for 6.3 to 6.5 seen
6(b)(ii)	F correctly placed	**2**	**M1** for either $TF = 6$ cm plotted or correct angle
6(b)(iii)	242^o to 248^o	**1**	
7(a)	$3ab(4a - 5b^2)$	**1**	
7(b)(i)	$(2x + 3)^2$ isw	**1**	
7(b)(ii)	2, –5	**2**	**M1** for $2x + 3 = (\pm)\sqrt{49}$ soi
7(c)	$\frac{p+5}{4}$ final answer	**3**	**M2** for $\frac{4p+4-2p+6}{8}$ or $\frac{2p+2-p+3}{4}$ soi **M1** for $\frac{4(p+1)-2(p-3)}{2\times4}$ or $\frac{2(p+1)-(p-3)}{4}$ After 0, **SC1** for answer $\frac{p-1}{4}$ or $2p + 10$ or $p + 5$
7(d)	$m < -\frac{5}{6}$, $m < -0.833$[…] final answer	**2**	**M1** for $6m + 8 < 3$ or $3m + 4 < \frac{3}{2}$

Question	Answers	Mark	Partial marks
	SECTION B		
8(a)	Correct diagram	**1**	
8(b)	22 26 88 130	**2**	**B1** for 2 or 3 correct
8(c)	$4n + 6$ oe isw	**2**	**B1** for $4n \pm k$
8(d)	26	**1**	
8(e)	$(2n + 3)(2n + 2)$ leading to $4n^2 + 10n + 6$ with no errors	**2**	**B1** for either $(2n + 3)$ or $(2n + 2)$ used After 0, **SC1** for $4n^2 + 10n + 6$ shown using alternative method
8(f)	$4n^2 + 6n$ oe	**1**	
8(g)	7 cao	**3**	**M1** for $4p^2 + 10p + 6 = 8\times$ *their* $(4p + 6)$ **A1** for $4p^2 - 22p - 42[= 0]$ oe or **B2** for $[p = 7]$ total 272 grey 272 or **B1** for $[p = 6]$ total 240 grey 240
9(a)	140^o	**2**	**M1** for $180 - (360 \div 9)$ or $180(9 - 2) \div 9$
9(b)(i)	21.89.... with at least $7^2 + 18^2 - 2 \times 7 \times 18 \times \cos 115$ seen	**3**	**M1** for $7^2 + 18^2 - 2 \times 7 \times 18 \times \cos 115$ **A1** for 479.5 or 373 + 106.49.. or 373 + 106.5
9(b)(ii)	18.8^o to 19^o	**3**	**M2** for $\sin B = \frac{11\sin 28}{16}$ or **M1** for $\frac{\sin B}{11} = \frac{\sin 28}{16}$ oe
9(b)(iii)	95.47^o to 95.5^o	**4**	**B3** for 84.5 to 84.6 or **M2** for $\sin E = \frac{109 \times 2}{\text{their } DE \times 21.9}$ or **M1** for $109 = \frac{1}{2} \times 21.9 \times \text{their } DE \times \sin E$
10(a)(i)	60^o angle at centre is twice angle at circumference	**2**	**B1** for either correct
10(a)(ii)	70^o	**3**	**B2** for $y = 20$ or **B1** for $O\hat{A}B = 30$ or $O\hat{B}A = 30$ or 240
10(a)(iii)	110^o	**1**	FT 180 – **(a)(ii)** provided not negative answer

Question	Answers	Mark	Partial marks
10(b)(i)	$\frac{120}{360}\pi(r+4)^2 = \pi r^2$ $r^2 + 8r + 16 = 3r^2$ leading to $r^2 - 4r - 8 = 0$ without error	**3**	**B1** for $\frac{120}{360}\pi(r+4)^2$ **M1** for forming equation and expanding $(r+4)^2$
10(b)(ii)	$r = 5.46$ to 5.47	**3**	**B2** for $\frac{-(-4) \pm \sqrt{(-4)^2 - 4\times1\times-8}}{2}$ oe or **B1** for $\frac{-(-4) \pm \sqrt{p}}{2\times1}$ oe or $\frac{q \pm \sqrt{(-4)^2 - 4\times1\times-8}}{r}$ oe
11(a)	75 nfww	**3**	**M2** for $\frac{\sum \text{frequency} \times \text{midvalue}}{80}$ oe or **M1** for $\sum fc$
11(b)	25, 46, 64, 73, 78	**1**	
11(c)	8 points correctly plotted and joined	**2**	FT increasing curve **B1** for at least 6 points correctly plotted
11(d)(i)	74 to 76	**1**	
11(d)(ii)	36 to 44	**2**	**B1** for 52 to 56 and 92 to 96 seen
11(e)	54 to 62	**3**	**B1** for 27 to 29 **M1** for attempt to read at (80 – 2× *their* 28)
12(a)(i)	*D* correctly placed to the left of *AC*	**2**	**B1** for $DA = 9$ or $CD = 7$
12(a)(ii)	44^o to 48^o	**1**	FT
12(a)(iii)(a)	2.9 to 3.1	**1**	
12(a)(iii)(b)	19.1 to 20.8	**2**	**B1** for 13.2 to 13.4 seen
12(b)(i)	Opposite angles are both obtuse or both acute so their total is not 180 Or opposite angles are not supplementary	**1**	

Question	Answers	Mark	Partial marks
12(b)(ii)(a)	Correct region shaded		**B1** for arc 6 cm from *R* **B1** for angle bisector of *Q* **B1** for perpendicular bisector of *PR* After B2, **SC1** for 'correct' region shaded provided only slight inaccuracy with the other line/curve
12(b)(ii)(b)	7.9 to 8.3	**1**	FT