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O Level

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

Paper 2 **May/June 2017**

MARK SCHEME

Maximum Mark: 100

Published

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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° to 129°	**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° to 248°	**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 $\sin E = \frac{109 \times 2}{\textit{their } DE \times 21.9}$ or **M1** for $109 = \frac{1}{2} \times 21.9 \times \textit{their } DE \times \sin E$
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

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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