MATHEMATICS (US) **0444/31**

Paper 3 (Core) **May/June 2018**

MARK SCHEME

Maximum Mark: 104

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.

Cambridge International will not enter into discussions about these mark schemes.

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This document consists of **7** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	27 360 045	**1**	
1(a)(ii)	1, 2, 4, 5, 10, 20	**2**	**B1** for 4 or 5 correct factors
1(a)(iii)	$\dfrac{7k}{9k}$ where $k \neq 1$	**1**	
1(a)(iv)	31 or 37	**1**	
1(b)(i)	$17 - 3 \times (5 - 3) = 11$	**1**	
1(b)(ii)	$(3 + 2)^2 - 4 = 21$	**1**	
1(c)	17	**1**	
2(a)(i)	7	**1**	
2(a)(ii)	4	**1**	
2(a)(iii)	<table><tr><td>Letters</td><td>Frequency</td></tr><tr><td>1</td><td>1</td></tr><tr><td>2</td><td>4</td></tr><tr><td>3</td><td>4</td></tr><tr><td>4</td><td>3</td></tr><tr><td>5</td><td>5</td></tr><tr><td>6</td><td>2</td></tr><tr><td>7</td><td>0</td></tr><tr><td>8</td><td>1</td></tr></table>	**1**	
2(a)(iv)	Correct dot plot	**1**	**FT** *their* frequency table

Question	Answer	Marks	Partial Marks
2(b)(i)	<table><tr><td>Book</td><td>Tally</td><td>Frequency</td></tr><tr><td>Com</td><td></td><td></td></tr><tr><td>Sci Fi</td><td></td><td></td></tr><tr><td>Poetry</td><td></td><td>3</td></tr><tr><td>Music</td><td></td><td>9</td></tr><tr><td>Rom</td><td>‖</td><td>2</td></tr><tr><td>Crime</td><td></td><td></td></tr></table>	2	**B1** for 3 and 9 or **M1** for [romance =] $60 - (16 + 10 + their\ 3 + their\ 9 + 20)$ soi
2(b)(ii)	11	1	**FT** $20 - their$ music frequency
2(b)(iii)	$\dfrac{26}{60}$ or equivalent fraction	2	**B1** for a numerator of 26 or a denominator of 60 soi or for an answer of 0.433[…]
2(b)(iv)	95%	2	**M1** for $\dfrac{60 - their\ 3}{60} \times 100$ oe or **B1** for [poetry =] 5% seen
3(a)	Rhombus	1	
3(b)(i)	(0, –2)	1	
3(b)(ii)	136	1	
3(c)(i)	5.4	1	
3(c)(ii)	21.5 or 21.6	1	**FT** *their* **(c)(i)** $\times 4$
3(d)(i)	Reflection y-axis oe	2	**B1** for each
3(d)(ii)	Rotation 180 oe (0, 0) oe	3	**B1** for each
3(e)	Triangle (1, –2) (1, –4) (6, –2)	2	**B1** for $\begin{pmatrix} 1 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -2 \end{pmatrix}$
4(a)	4 points correctly plotted	2	**B1** for 2 or 3 points correctly plotted
4(b)	(40, 18) indicated	1	
4(c)	Positive	1	
4(d)	Correct ruled line	1	
4(e)	76 to 80	1	**FT** *their* ruled line of best fit

Question	Answer	Marks	Partial Marks
5(a)	9	2	**M1** for $(1-\frac{1}{3})\times13.5$ oe or for $13.5 - (\frac{1}{3}\times13.5$) oe or **B1** for 4.5[0]
5(b)(i)	1 45pm	1	
5(b)(ii)	2[h]54[min]	1	
5(b)(iii)	13	2	**M1** for 16 39 + 46 – 17 12 oe or **B1** for 17 25 or 33 seen
5(c)	Complete correct method	M2	**M2** for 0.62... and 0.58… or 0.59 and 0.57 [c/ml] oe or 1.60…or 1.61 and 1.70… and 1.75… [ml/c] oe or **M1** for one correct calculation or correct value
	Extra large	A1	
5(d)	19 47	3	**M1** for $\frac{76}{48}$ soi or for 18 12 + *their* time **A1** for 1[h] 35[min] or 95[min] seen
6(a)(i)	3300	2	**B1** for 11cm seen
6(a)(ii)	117	1	
6(a)(iii)	*C* correctly marked	2	**B1** for line indicating correct bearing of 320 measured or for any point 5.5 cm from *B* or for 5.5 (cm) seen
6(b)	Correct ruled perpendicular bisector with two pairs of arcs and correct ruled angle bisector of *SRG* with appropriate arcs and lines intersecting	4	**B2** for correct ruled perpendicular bisector with 2 pairs of arcs or **B1** for correct perpendicular bisector drawn without arcs/with spurious arcs or for appropriate arcs but no perpendicular bisector drawn **B2** for correct ruled angle bisector with appropriate arcs or **B1** for correct angle bisector drawn without arcs/with spurious arcs or for a set of appropriate arcs with no angle bisector drawn If lines do not intersect, maximum 3 marks

Question	Answer	Marks	Partial Marks
7(a)(i)	4500	**2**	**M1** for $15 \times 15 \times 20$ If zero scored **SC1** for 8100 as final answer
7(a)(ii)	9	**2**	**M1** for *their* $4500 \div 500$
7(b)(i)	12	**2**	**M1** for $\dfrac{15}{5} = \dfrac{36}{h}$ or better
7(b)(ii)	6	**2**	**M1** for $150 \div (5 \times 5)$
8(a)(i)	Diameter	**1**	
8(a)(ii)	Chord	**1**	
8(b)	Angle [in] semi circle [is 90]	**1**	
8(c)(i)	67.4 or 67.38…..	**2**	**M1** for $\cos [A =] \dfrac{20}{52}$ or better
8(c)(ii)	$\left[(BC)^2\right] = \sqrt{52^2 - 20^2}$	**M2**	**M1** for $20^2 + (BC)^2 = 52^2$
8(c)(iii)	480	**2**	**M1** for $0.5 \times 20 \times 48$ or better
8(c)(iv)	582 or 581.8 to 582.0	**3**	**M1** for $\left[\dfrac{1}{2} \times\right] \pi \times \left(\dfrac{52}{2}\right)^2$ or better **M1** for *their* $338\pi -$ *their* **9(c)(iii)**
9(a)(i)	−4	**1**	
9(a)(ii)	$2x + k \qquad k \neq 3$	**1**	
9(a)(iii)	(0, −5)	**1**	
9(a)(iv)	2.5	**2**	**M1** for $7 = 4k - 3$ or better
9(b)(i)	1, −5, −3, 1, 7	**3**	**B2** for 4 correct **B1** for 3 correct
9(b)(ii)	Correct smooth curve	**4**	**B3FT** for 8 or 7 correct plots or **B2FT** for 5 or 6 correct plots or **B1FT** for 3 or 4 correct plots
9(b)(iii)	(0.5, *h*) where $-5.5 \leqslant h < -5$	**1**	
9(b)(iv)(a)	Correct line of symmetry drawn	**1**	
9(b)(iv)(b)	$x = 0.5$ oe	**1**	

Question	Answer	Marks	Partial Marks
10(a)(i)	48	3	**B1** for 240 **M1** for $\dfrac{[\textit{their}\,240]}{10+2+3}[\times3]$ soi by 16
10(a)(ii)	128	2	**M1** for $\dfrac{k}{15}\times\textit{their}\,240$ oe where $k = 2$, 10 or 8 or for $\textit{their}\,\textbf{(a)(i)}\div3\times k$ oe where $k = 2$, 10 or 8
10(b)	84.7[0] or 84.69 to 84.7	3	**M2** for $600\times\left(1+\dfrac{4.5}{100}\right)^{3}$ oe or **M1** for $600\times\left(1+\dfrac{4.5}{100}\right)^{2}$ oe
10(c)	223.84	3	**M2** for $\dfrac{600\times0.864-325}{0.864}$ oe or better or **M1** for 600×0.864 or $\dfrac{325}{0.864}$