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**MATHEMATICS (US)**

**0444/31**

Paper 3 (Core)

**May/June 2017**

MARK SCHEME

Maximum Mark: 104

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**Published**

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**Abbreviations**

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

Question	Answer	Marks	Part marks
1(a)	17 35	<b>1</b>	
1(b)(i)	17 51	<b>1FT</b>	<b>B1</b> for <i>their (a)</i> + 16 minutes
1(b)(ii)	18 40 cao	<b>1</b>	
1(b)(iii)	4 nfw	<b>2</b>	<b>B1</b> for 36 minutes or 32 minutes
1(b)(iv)	14.2 cao	<b>4</b>	<b>M2</b> for $8.5 \div \textit{their} 36 \times 60$ soi or <b>M1</b> for $8.5 \div \textit{their} 36$ or $\textit{their} 36 \div 60$ soi or $8.5 \div \text{time in mins} \times 60$  <b>A1</b> for 14.17 or 14.16 to 14.17  If <b>A0</b> then <b>SC1</b> for <i>their</i> answer $\geq 2$ decimal places rounded to 1 decimal place
2(a)(i)	$78 \div 3 \times (3 + 5 + 6) [= 364]$	<b>1</b>	
2(a)(ii)	[kit] 130 [travel] 156	<b>3</b>	<b>M1</b> for $364 \div (3 + 5 + 6) \times 5$ (or $\times 6$ if travel first) or $78 \div 3 \times 5$ (or $\times 6$ if travel first) <b>A1</b> for one of kit or travel correct If zero scored, <b>SC1</b> for kit + travel = 286
2(b)	84	<b>2</b>	<b>M1</b> for $3 \div 13 [\times 364]$ or $364 - (10 \div 13 \times 364)$ or <b>B1</b> for 280
2(c)	320.32 final answer	<b>2</b>	<b>M1</b> for $(100 - 12) \div 100 [\times 364]$ or <b>B1</b> for 43.68
2(d)(i)	$W + 6 + L = 24$ oe	<b>1</b>	
2(d)(ii)	$3W + 6 = 54$ isw	<b>1</b>	
2(d)(iii)	[W=] 16	<b>2</b>	<b>M1</b> for $3W = 54 - 6$ or $W + 2 = 18$ or better or correct first step from an equation in $W$ only
	[L=] 2	<b>1FT</b>	<b>FT</b> is 18 – <i>their</i> $W$ If zero scored, <b>SC1</b> for both correct but reversed

Question	Answer	Marks	Part marks
3(a)	Quadrilateral	1	
3(b)	Enlargement	1	
	[Scale factor] 3	1	
	[Centre] (-3, -1)	1	
3(c)	Translation	1	
	$\begin{pmatrix} 10 \\ -7 \end{pmatrix}$	1	
3(d)	Vertices (6, 2), (7, -1), (8, -1), (9, 1)	2	<b>B1</b> for a correct reflection in $x = k$ or $y = 2$
3(e)	Vertices (-2, -2), (1, -3), (1, -4), (-1, -5)	2	<b>B1</b> for a 'correct' 90° clockwise rotation about the origin If zero scored, <b>SC1</b> for correct size and orientation but wrong position
4(a)(i)	4	1	
4(a)(ii)	3	1	
4(a)(iii)	2.81[25] or 2.813	3	<b>M1</b> for $(1 \times 3) + (2 \times 3) + (3 \times 2) + (4 \times 5) + (5 \times 2)$ oe <b>M1 dep</b> their total $\div 16$ soi
4(a)(iv)	4 bars correct height, correct width and correct gaps	2	<b>B1</b> for 2 bars correct heights and widths, or 4 correct heights
	Correct linear vertical scale shown	1	
4(b)	6 values correctly placed 7 12 [3] 22 [8] 6 9 [23] 15 [18] [12] [45]	2	<b>B1</b> for 3, 4 or 5 correctly placed
4(c)(i)	144	2	<b>M1</b> for $18 \div 45$ [ $\times 360$ ] oe or $120 \div 15 \times 18$ oe
4(c)(ii)	96	1FT	<b>FT</b> 240 – their (c)(i)
4(d)	Correct line from centre to circumference, angles 144° and 96°	1FT	<b>FT</b> their angles provided they sum to 240°
5(a)(i)	Radius	1	
5(a)(ii)	[Angle between] tangent [and] radius	1	
5(a)(iii)	41	1	
5(a)(iv)	Corresponding [angles]	1	

Question	Answer	Marks	Part marks
5(a)(v)	similar	1	
5(a)(vi)(a)	6.21 or 6.211 to 6.212	2	<b>M1</b> for $\tan 49 = \frac{OB}{5.4}$ or better
5(a)(vi)(b)	8.23 or 8.229 to 8.231	2FT	<b>M1</b> for $\cos 49 = \frac{5.4}{OA}$ or better or for $5.4^2 + \text{their (vi)(a)}^2$ or better
5(a)(vi)(c)	121 or 121.15 to 121.247	2FT	<b>M1</b> for $(\text{their (vi)(a)})^2 \times \pi$
5(b)	$5 \times 180$	1	
6(a)	7    -2    7    14	3	<b>B2</b> for 3 correct <b>B1</b> for 2 correct
6(b)	Correct smooth curve	4	<b>B3FT</b> for 8 or 9 correct plots or <b>B2FT</b> for 6 or 7 correct plots or <b>B1FT</b> for 4 or 5 correct plots
6(c)(i)	Ruled line, $x = -1$ , drawn	1	
6(c)(ii)	$x = -1$ oe	1	
6(d)(i)	Ruled line $L$ drawn, joining $(-5, 7)$ and $(0, -3)$	2	<b>B1</b> for one of the points correct and line drawn or both points correct and no or wrong line.
6(d)(ii)	$-3.3$ to $-3.5$ , $-0.5$ to $-0.7$	2FT	<b>B1FT</b> for one correct.
6(d)(iii)	$-2$	2	<b>M1FT</b> for <i>their</i> $\frac{\text{Rise}}{\text{Run}}$ from part <b>(d)(i)</b> or <i>their</i> $\frac{y_2 - y_1}{x_2 - x_1}$ If zero scored, <b>SC1</b> for answer 2
7(a)(i)	4800	1	
7(a)(ii)	192	2	<b>M1</b> for $2 \times 58.5 + 5 \times 15$ or <b>B1</b> for 117 or 75 seen
7(a)(iii)	208	2FT	<b>M1</b> for $[6000 -] (\text{their (a)(i)} + \text{their (a)(ii)} + 800)$ oe
7(a)(iv)	42	2FT	<b>M1</b> for <i>their (a)(iii)</i> $\div 4.95$
7(b)	2315.25 cao	3	<b>M2</b> for $2000 \times 1.05^3$ oe or <b>M1</b> for $2000 \times 1.05^2$ oe If zero scored, <b>SC1</b> for 315.25
8(a)	2	1	

Question	Answer	Marks	Part marks
8(b)	3 dots correctly placed 4 crosses correctly placed	1	
8(c)	18      28 10      12	1,1 1	If zero scored, <b>SC1</b> for <i>their</i> 18 + 10
8(d)(i)	Add two more each time oe	1	
8(d)(ii)	154	2	<b>M1</b> for $12^2 + 12 - 2$
8(e)(i)	$2n + 2$ oe final answer	2	<b>B1</b> for $2n + j$ or $kn + 2$ ( $k \neq 0$ or 1)
8(e)(ii)	49	2	<b>M1</b> for <i>their</i> <b>(e)(i)</b> = 100 provided <b>(e)(i)</b> is algebraic soi
9(a)(i)	4.4	1	
9(a)(ii)	660	1FT	<i>their</i> <b>(a)(i)</b> $\times$ 150
9(a)(iii)	220	1	
9(b)	14 [cm] from $Q$	2	<b>M1</b> for $2100 \div 150$ soi
	$100^\circ$ from $Q$	1	
9(c)(i)	3.82 cao	2	<b>M1</b> for $2100 \div 550$
9(c)(ii)	3[h] 49[min]	1FT	<i>their</i> time correctly converted