MARK SCHEME for the October/November 2015 series

0444 MATHEMATICS (US)

0444/43	Paper 4 (Paper 4 (Extended)), maximum raw mark 130

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	Answer	Mark	Part marks
1 (a) (i)	3.9[0]	2	**M1** for $2.6 \div 2$
(ii)	$\dfrac{13}{18}$ cao	2	**B1** for any correct unsimplified fraction
(iii)	24	3	**M2** for $9 \div 0.375$ oe or **M1** for associating 9 with $(100 – 62.5)\%$
(b)	109 cao	3	**B2** for 108.5 to 108.6 or **M1** for $250 \times \left(1 - \dfrac{8}{100}\right)^{10}$ oe
2 (a) (i)	Image at $(-2, 5)$, $(1, 5)$, $(1, 7)$	2	**SC1** for translation $\begin{pmatrix} -4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 4 \end{pmatrix}$ or 3 correct vertices plotted but not joined
(ii)	Image at $(2, -3)$, $(5, -3)$, $(5, -5)$	2	**SC1** for a reflection in a horizontal line or in the line $x = -1$ or 3 correct vertices plotted but not joined
(b) (i)	Rotation	1	Alt Enlargement SF -1 $(-1, 0)$
	180 oe	1	
	$(-1, 0)$	1	Not as column vector
(ii)	Reflection	1	
	$y = -x$ oe	1	
(iii)	Stretch	1	
	x-axis oe invariant	1	
	[factor] 3	1	

Question			Answer	Mark	Part marks
3	**(a)**		43 200	**3**	**M2** for $0.5 \times (35 + 25) \times 12 \times 120$ oe or **M1** for $0.5 \times (35 + 25) \times 12$ oe
	(b)	**(i)**	$0.5 \times (25 + 30) \times 6 \times 120$ [= 19800]	**M2**	Dep on a valid method for obtaining the width of $30\,\text{cm}$ **B1** for $0.5 \times (25 + 35)$ oe
		(ii)	45.8 or 45.83…	**1FT**	**FT** for $\dfrac{19800}{their\,(\mathbf{a})} \times 100$
	(c)		1 h 39 min	**4**	**B3** for 1.65 [h] or 99 mins or $\dfrac{33}{20}$ or **M2** for $\dfrac{19800}{12 \times 1000}$ oe or **M1** for $\dfrac{19800}{12}$ or $\dfrac{19800}{1000}$ or 12×1000 If zero scored then **SC1** for figs 165 **and** **B1** for converting their time (in hours) into hours and minutes
	(d)		12.8 or 12.80 to 12.81	**3**	**M2** for $\sqrt[3]{\dfrac{19800}{3\pi}}$ or **M1** for $\pi r^2\, 3r = 19800$
	(e)		21[.0]	**2**	**M1** for $\dfrac{19800}{1000} + 1.2$

Question			Answer	Mark	Part marks
4	**(a)**		–1.5, 0.5	**2**	**B1**, **B1**
	(b)		Correct curve	**5**	**B3 FT** for 10 or 11 points or **B2FT** for 8 or 9 points or **B1FT** for 6 or 7 points and **B1** independent for two branches **SC4** for correct curve but branches joined
	(c)		1.25 to 1.35	**1**	
	(d)		–1	**1**	
	(e)	**(i)**	$2 - x$	**1**	
		(ii)	Ruled line with gradient –1 through (0, 2) and fit for purpose	**2FT**	**SC1** for **ruled** line, with gradient –1 or through (0, 2), but not $y = 2$ **FT** *their* $y = mx + c$ from **(e)(i)**, if $m \neq 0$ **SC1FT** for **ruled** line either with correct gradient or through (0, c) but not $y = c$
			1.15 to 1.25 cao	**1**	

Question		Answer	Mark	Part marks
5	**(a)**	2180 or 2181. … nfww	4	**M2** for $680^2 + 2380^2 - 2 \times 680 \times 2380 \cos 65$ oe or **M1** for correct implicit cosine formula **A1** for $4\,760\,000$ or $4\,758\,000$ to $4\,759\,000$
	(b)	78.7 or 78.71 …	3	**M2** for $\dfrac{2380 \sin 40}{1560}$ or **M1** for $\dfrac{1560}{\sin 40} = \dfrac{2380}{\sin M}$ oe
	(c)	309 or 308.7 …	2FT	**FT** 230 + *their* **(b)** **B1FT** 50 + *their* **(b)** for 129 or 128.7 … [i.e. for *C* from *M*]
	(d) (i)	23 39 oe	1	
	(ii)	650	2	**M1** for 1560 ÷ journey time
6	**(a)**	101.5625 or 102 or 101.5 to 101.6 nfww	4	**M1** for 55, 90, 110, 160 soi **M1** for Σfm with frequencies and each *m* in or on a boundary of a correct interval 2750, 2700, 4400, 6400 **M1 dep on 2nd M** for ÷ 160
	(b)	Correct histogram drawn with correct widths and heights 1, 1.5 and 2 (no gaps)	3	**B1** for each correct block If zero scored, **SC1** for correct heights or frequency densities
	(c)	$\dfrac{40}{160}$ oe	1	
	(d) (i)	$\dfrac{1560}{25440}$ oe	2	**M1** for $\dfrac{40}{160} \times \dfrac{39}{159}$
	(ii)	$\dfrac{4000}{25440}$ oe	3	**M2** for $\dfrac{40}{160} \times \dfrac{50}{159} + \dfrac{50}{160} \times \dfrac{40}{159}$ oe or **M1** for one of these products soi

Question	Answer	Mark	Part marks
7 (a)	83 nfww	4	**B3** for $17x = 1411$ or $17x = 14.11$ oe in form $ax = b$ or final answer of 0.83 or **B2** for $6x + 11x - 55 = 1356$ oe or $6x + 11x -[0.] 55 = 13[.]56$ or **M1** for $6x + 11(x - [0.0]5) = 13[.]56$
(b)	$\frac{1}{3}$ oe nfww	4	**M1** for $y(y+3)$ oe or $\frac{1}{2}(2y+1)(y+1)$ oe and **B2** for $2y^2 + 6y = 2y^2 + 2y + y + 1$ oe or better or **B1** for $(2y+1)(y+1) = 2y^2 + 2y + y + 1$ soi
(c)	25 nfww	4	**M1** for $\frac{4[.]80}{w-1}$ or $\frac{7[.]80}{2w-11}$ **M1** for $\frac{4[.]80}{w-1} = \frac{7[.]80}{2w-11}$ oe **M1** for $480(2w-11) = 780(w-1)$ oe or ALT **M1** for $n(w-1) = 4[.]80$ or $n(2w-11) = 7[.]80$ **M1** for $2wn - 11n = 7[.]80$ $2wn - 2n = 9[.]60$ oe **M1** for $9n = 180$ oe or better ALT **M1** for $n(w-1) = 4[.]80$ or $n(2w-11) = 7[.]80$ **M1** for $\frac{4[.]80+n}{n} = \frac{7[.]80+11n}{2n}$ **M1** for $9n = 180$ oe or better
(d) (i)	$\frac{1}{2}u(3u - 2) = 2.5$ One further correct step leading to $3u^2 - 2u - 5 = 0$ with no errors	**M1** **A1**	First step must involve $\frac{1}{2}u(3u - 2)$
(ii)	$(3u - 5)(u + 1)$	2	**SC1** for $(3u + a)(u + b)$ where $ab = -5$ or $a + 3b = -2$ [a, b integers]
(iii)	29.1 or 29.05…	3	**M2** for $\tan = \dfrac{their \, \frac{5}{3}}{3 \times their \, \frac{5}{3} - 2}$ or **M1** for substituting *their* positive value of u into [u and] $3u - 2$

Question	Answer	Mark	Part marks
8 (a) (i)	Angle A is common to both triangles oe $ADB = ABC$ Third angle of triangles equal oe	1 1dep	Accept $DAB = CAB$ oe Dep on previous mark
(ii)	Similar	1	
(iii)	8.25	2	**M1** for $\dfrac{16}{12} = \dfrac{11}{BD}$ oe or better
(b) (i)	75	1	
(ii)	70	2	**B1** for OAB or $OBA = 20$
(c)	36 nfww	5	**B4** for an equation in m that simplifies to $5m = 180$ or **B1** for each of 3 of the listed angles expressed in terms of m, in its simplest form, stated or labelled on diagram Angle $PQO = m$ Angle $QOR = m$ Angle $OQR = 2m$ Angle $PQR = 3m$ or $180 - 2m$ or $90 + \dfrac{m}{2}$ Angle $POR = 180 - m$ or $4m$ or $360 - 6m$ Reflex angle $POR = 360 - 4m$ or $6m$ or $180 + m$
9 (a)	8	1	
(b)	3	2	**B1** for [g(0.5) =] 2 soi or **M1** for $2\left(\dfrac{1}{x}\right) - 1$ or better
(c)	$\dfrac{x+1}{2}$ final answer	2	**M1** for $x = 2y - 1$ or $y + 1 = 2x$ or better or $\dfrac{y}{2} = x - \dfrac{1}{2}$
(d)	$4x - 3$	2	**M1** for $2(2x - 1) - 1$
(e)	$4x^2 - 4x + 7$	2	**B1** for $\left[(2x-1)^2\right] = 4x^2 - 2x - 2x + 1$
(f)	x	1	
(g)	$g^{-1}(x) = g(x)$	1	
(h)	fh(x)	1	

Question	Answer	Mark	Part marks
10	**A** $-13, -20$	1	
	$-7n + 22$ oe	2	**SC1** for $-7n + k$ or $kn + 22$ oe
	B $\dfrac{9}{22}, \dfrac{10}{23}$	1	
	$\dfrac{n+4}{n+17}$ oe	2	**B1** for $n+4$ oe or $n+17$ oe seen, but not in wrong position
	C $26, 37$	1	
	$n^2 + 1$ oe	1	
	D $162, 486$	1	
	$2 \times 3^{n-1}$ oe	2	**SC1** for $k \times 3^{n+p}$ $[k, p$ integers$]$ Accept $2 \times \dfrac{3^n}{3}$