MARK SCHEME for the October/November 2014 series

0580 MATHEMATICS

0580/43   Paper 4 (Extended), maximum raw mark 130

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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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
nfww	not from wrong working
soi	seen or implied

Qu.			Answers	Mark	Part Marks
1	(a)	(i)	5.37[1...]	2	**M1** for $[AD^2 =]\ 2.6^2 + 4.7^2$ oe or better
		(ii)	54.1 or 54.11 to 54.12	3	**M2** for tan $[BCD =]\ \dfrac{4.7}{(17-11-2.6)}$ oe or **B1** for 3.4 seen
		(iii)	65.8	2	**M1** for $\dfrac{11+17}{2} \times 4.7$ oe
	(b)		263.2 or 263	3FT	**FT** *their* **(a)(iii)** $\times$ 4 correctly evaluated **M2** for *their* **(a)(iii)** $\times \left(\dfrac{9.4}{4.7}\right)^2$ oe or **M1** for [scale factor =] $\left(\dfrac{9.4}{4.7}\right)^2$ or $\left(\dfrac{4.7}{9.4}\right)^2$ soi
2	(a)	(i)	$\dfrac{920}{8} \times 7$ [=805] oe	1	$\dfrac{2990}{26} \times 7$ [= 805]
		(ii)	30.8 or 30.76 to 30.77	2	**M1** for $\dfrac{8}{(11+8+7)}$ [$\times$ 100]
	(b)		1211 final answer	5	**B4** for 13 926.5[0] [area A total sales] or **B3** for 11 040 [area B] **and** 10 867.50 [area C] or 21 907.5 [area B + area C] or **B2** for 11 040 [area B] **or** 10 867.50 [area C] or **M1** for 736 [B tickets] and **M1** for 483 [C tickets] After 0 scored **SC2** for answer of 1196 or **SC1** for 13 754 (A total sales)

(c)	37 720	3	**M2** for $\dfrac{35834}{0.95}$ oe or **M1** for 35834 associated with 95[%]	
3 **(a)** **(i)**	52 Angles in **same segment**	1 1dep	Accept same arc, same side of same chord	
(ii)	104 **Angle** at **centre** is **twice** angle at **circumference**	1 1	Accept double, 2 × but not middle, edge	
(iii)	34 Angle between **tangent** and **radius** **= 90°**	1 1	Accept right angle, perpendicular	
(b) **(i)**	7.65 to 7.651	4	**M2** for $8.9^2 + 7^2 - 2 \times 8.9 \times 7 \times \cos56$ or **M1** for correct implicit formula and **A1** for 58.5 to 58.6	
(ii)	49.3 or 49.33 to 49.34…	3	**M2** for $[\sin BEC =] \dfrac{7\sin56}{their\ \textbf{(b)(i)}}$ oe or **M1** for $\dfrac{\sin56}{their\ \textbf{(b)(i)}} = \dfrac{\sin BEC}{7}$ oe	
4 **(a)** **(i)**	Ariven with comparable form for both shown or difference between the two fractions shown	1	Accept probabilities changed to decimals or percentages (to 2sf or better)	
(ii)	$\dfrac{6}{15}$ oe	2	**M1** for $\dfrac{3}{5} \times \dfrac{2}{3}$	
(iii)	$\dfrac{7}{15}$ oe	3	**M2** for $\dfrac{3}{5} \times \dfrac{1}{3} + \dfrac{2}{5} \times \dfrac{2}{3}$ oe $1 - their\ \textbf{(a)(ii)} - \dfrac{2}{5} \times \dfrac{1}{3}$ or **M1** for $\dfrac{3}{5} \times \dfrac{1}{3}$ or $\dfrac{2}{5} \times \dfrac{2}{3}$ seen	
(b) **(i)**	Completes tree diagram correctly	3	**B2** for 5 values correct or **B1** for 1 value correct	
(ii)	$\dfrac{126}{350}$ oe $\left[\dfrac{9}{25}\right]$	2	**M1** for $\dfrac{3}{5} \times \dfrac{6}{7} \times \dfrac{7}{10}$	

	(iii)	$\dfrac{344}{350}$ oe	3	**M2** for $1-their\dfrac{2}{5}\times their\dfrac{1}{7}\times their\dfrac{3}{10}$ oe or $\dfrac{3}{5}+\dfrac{2}{5}\times\dfrac{6}{7}+\dfrac{2}{5}\times\dfrac{1}{7}\times\dfrac{7}{10}$ **M1** for $their\dfrac{2}{5}\times their\dfrac{1}{7}\times their\dfrac{3}{10}$ oe or identifies the 7 routes or attempt to add 7 probabilities with at least 5 correct $\dfrac{9}{25}+\dfrac{27}{175}+\dfrac{3}{50}+\dfrac{9}{350}+\dfrac{6}{25}+\dfrac{18}{175}+\dfrac{1}{25}$ oe
5 (a) (i)		$\begin{pmatrix} 0 & -4 \\ 4 & 0 \end{pmatrix}$	1	
	(ii)	$\begin{pmatrix} -1 & 1 \\ 1 & -1 \end{pmatrix}$	1	
	(iii)	$\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$	2	**B1** for three correct elements
	(iv)	$\begin{pmatrix} -13 \\ 5 \end{pmatrix}$	2	**B1** for either correct in this form
(b)		$\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$	3	**M1** for understanding to find the inverse of **Q** **and M1** for det = 1 or for $k\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$ $k\neq0$ Alternative $\begin{pmatrix} 1 & -2 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} a & b \\ c & d \end{pmatrix}=\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ Leading to $a - 2c = 1$ and $c = 0$ then $a = 1$ and $b - 2d = 1$ and $d = 1$ then $b = 2$ **M2** all four equations, **M1** for a pair of correct equations
6 (a) (i)		$\dfrac{x^8}{3}$ final answer	1	
	(ii)	$15x^7y^3$ final answer	2	**M1** for 2 elements correct
	(iii)	$16x^8$ final answer	2	**M1** for $16x^k$ or kx^8

(b)	$\sqrt{([-]7)^2 - 4.3 - 12}$ or better and $p = [--]7$ and $r = 2(3)$ oe	**B1** **B1**	or for $\left(x - \dfrac{7}{6}\right)^2$ Must see $\dfrac{p + \sqrt{q}}{r}$ or $\dfrac{p - \sqrt{q}}{r}$ or both or for $\dfrac{7}{6} \pm \sqrt{4 + \left(\dfrac{7}{6}\right)^2}$	
	3.48, –1.15 cao	**B1B1**	After **B0**, **SC1** for answer 3.5 and –1.1 or 3.482… and –1.149 to –1.148 seen or for 3.48, –1.15 seen or for answer –3.48 and 1.15	
(c)	$\dfrac{x+5}{x^2}$ or $\dfrac{1}{x} + \dfrac{5}{x^2}$ final answer nfww	**3**	**B1** for $(x+5)(x-5)$ and **B1** for $x^2(x-5)$	
7 **(a)**	$\dfrac{1}{2} \times 8 \times 8 \times \sin 56$ oe 26.52 to 26.53	**M1** **A1**	or [½ × 2] 8sin28 × 8cos28 or [½ × 2] × 7.06… × 3.75…	
(b) **(i)**	72.[0] or 71.87 to 72.0	**3**	**M2** for $26.5/(\pi \times 6.5^2) \times 360$ oe or **M1** for $\dfrac{x}{360} \times \pi \times 6.5^2 = 26.5$ or better	
(ii)	21.1 or 21.2 or 21.14 to 21.17	**3**	**M2** for $\dfrac{their \, \textbf{(b)(i)}}{360} \times \pi \times 2 \times 6.5 + 2 \times 6.5$ oe or **M1** for $\dfrac{their \, \textbf{(b)(i)}}{360} \times \pi \times 2 \times 6.5$ oe or $\dfrac{their \, \textbf{(a)}}{0.5 \times 6.5}$	
(c) **(i)**	$\dfrac{30}{360} \times \pi \times r^2 - \dfrac{1}{2} \times r^2 \times \sin 30$ oe $\dfrac{1}{12} \times \pi \times r^2 - \dfrac{1}{4} \times r^2$ $\dfrac{1}{4} r^2 \left(\dfrac{1}{3}\pi - 1\right)$	**M2** **A1** **A1**	**M1** for $\dfrac{30}{360} \times \pi \times r^2$ or $\dfrac{1}{2} \times r^2 \times \sin 30$ Dep on **M2 A1** and no errors seen	
(ii)	20.6 or 20.7 or 20.55 to 20.71	**3**	**M2** for $[r^2 =] \dfrac{5}{\frac{1}{4}\left(\frac{1}{3}\pi - 1\right)}$ or **M1** for one correct rearrangement step to r from $\dfrac{1}{4} r^2 \left(\dfrac{1}{3}\pi - 1\right) = 5$	

8	(a)	(i)	(1, 2)	1+1	
		(ii)	$y = 3x – 1$ cao final answer	3	**M1** for gradient $= \dfrac{8 - -4}{3 - -1}$ oe and **M1** for substituting (3, 8) or (–1, –4) into *their* $y = 3x + c$ or for finding y-intercept is –1
	(b)	(i)	$(x + 5)(x – 2)$ isw solutions	2	**SC1** for $(x + a)(x + b)$ where $ab = –10$ or $a + b = 3$
		(ii)	[$a =$] –5 [$b =$] 2 [$c =$] –10	3FT	**B1FT** for each of *their* 5 and *their* –2 from (b)(i) and **B1** for c = –10
		(iii)	$x = –1.5$	1FT	**FT** $x = (their\ (a + b))/2$
	(c)		Inverted parabola	B1	
			x-axis intercepts at –2 and 9	B2	**B1** for each After **B0** allow **SC1** for $(9 – x)(2 + x)$ oe
			y-axis intercept at 18	B1	
	(d)	(i)	$p = 6$ $q = 43$	3	**B2** for $(x + 6)^2 – 43$ or $p = 6$ or $q = 43$ or **M1** for $(x + 6)^2$ or $x^2 + px + px + p^2$ and **M1** for $–7 – (their\ 6)^2$ or $p^2 – q = –7$ or $2p = 12$
		(ii)	–43	1FT	**FT** – *their q*
9	(a)	(i)	7	4	**M2** for $\dfrac{16 \times 11 + 17 \times 10 + 18p + 19 \times 4 + 20 \times 8}{11 + 10 + 4 + 8 + p} = 17.7$ or better or **M1** for sum of two correct products or better or for [total =] $11 + 10 + 4 + 8 + p$ and **B1** for $582 + 18p = 17.7 (33 + p)$
		(ii)	17	1FT	**STRICT FT** median for *their p* if integer
	(b)	(i)	64	2	**M1** for $\dfrac{320}{6.4} \times 1.28$ oe
		(ii)	40	2	**M1** for $\dfrac{320}{480} \times 60$ oe
		(iii)	1.6[0]	2FT	**FT** *their* (b)(i) / *their* (b)(ii) evaluated correctly to 2dp **M1** for *their* (b)(i) / *their* (b)(ii) or $\dfrac{480}{6.4} \times 1.28 \div 60$

	(c)	9.9125 cao	5	**B4** for answer 9912.5 or **M1** for 25 to 35 × 290 to 310 oe and **B1** for 32.5 used and **B1** for 305 or 5 mins 5 secs used and **M1** indep for any correct conversion seen m to km	
10	**(a) (i)**	$5x + 14$ final answer	2	**M1** for $5x + k$ or $kx + 14$	
	(ii)	14.2	3	**M1** for $5x = 32 - 14$ **FT** *their* expression in **(a)(i)** **A1FT** for $x = 3.6$	
	(b)	$8a - 3b + 14 = 32.5$ or better $5a + 4b + 13.5 = 39.75$ or better Equates coefficients of either a or b $40a - 15b = 92.5$ $40a + 32b = 210$ or $32a - 12b = 74$ $15a + 12b = 78.75$ Adds or subtracts to eliminate $47b = 117.5$ $47a = 152.75$ [$a =$] 3.25 [$b =$] 2.5	**B1** **B1** **M1** **M1** **A1** **A1**	$8a - 3b = 18.5$ $5a + 4b = 26.25$ or rearranges one of *their* equations to make a or b the subject e.g. $a = \dfrac{3b + 18.5}{8}$ **Dep** on previous method or correctly substitutes into the second equation e.g. $\dfrac{5(3b + 18.5)}{8} + 4b = 26.25$ After **M0** scored **SC1** for 2 correct values with no working or for two values that satisfy one of their original equations	