MARK SCHEME for the October/November 2014 series

0444 MATHEMATICS (US)

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

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

			Correct answer	Mark	Part marks
1	**(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 $\dfrac{8}{(11+8+7)}$ [× 100]
	(b)		1211 final answer	5	**B4** for 13926.5[0] [area A total sales] or **B3** for 11040 [area B] **and** 10867.50 [area C] or 21907.5 [area B + area C] or **B2** for 11040 [area B] or 10867.50 [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 13754 (A total sales)
	(c)		37720	3	**M2** for $\dfrac{35834}{0.95}$ oe or **M1** for 35834 associated with 95%
2	**(a)**	**(i)**	104 **Angle** at **centre** is **twice** angle at **circumference**	1 1	Accept double, 2 × but not middle, edge
		(ii)	128 **Opposite** angle of **cyclic quadrilateral** oe	1 1	
		(iii)	34 Angle between **tangent** and **radius** = **90°**	1 1	Accept right angle, perpendicular

	(b)	**(i)**	7.65 to 7.651	4	**M2** for $8.9^2 + 7^2 - 2 \times 8.9 \times 7 \times \cos 56$ 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 $[\sin BEC =] \dfrac{7 \sin 56}{their\ \textbf{(b)(i)}}$ oe or **M1** for $\dfrac{\sin 56}{their\ \textbf{(b)(i)}} = \dfrac{\sin BEC}{7}$ oe
3	**(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
4	**(a)**	**(i)**	$\dfrac{x^8}{3}$ final answer	1	
		(ii)	$15x^7 y^3$ final answer	2	**M1** for 2 elements correct
		(iii)	$16x^8$ final answer	2	**M1** for $16x^k$ or $k\,x^8$

(b)	$\sqrt{([-]7)^2 - 4.3.-12}$ or better and $p = [--]7$ and $r = 2(3)$ oe 3.48, –1.15 cao	**B1** **B1** **B1B1**	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 $\dfrac{7}{6} +$ or $- \sqrt{4 + \left(\dfrac{7}{6}\right)^2}$ 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 ans nfww	**3**	**B1** for $(x + 5)(x - 5)$ and **B1** for $x^2(x - 5)$
5 **(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* **(b)(i)** – $\dfrac{2}{5} \times \dfrac{1}{3}$ 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 $\dfrac{3}{5} + \dfrac{2}{5} \times \dfrac{6}{7} + \dfrac{2}{5} \times \dfrac{1}{7} \times \dfrac{7}{10}$ or **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
6	**(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 $\dfrac{26.5}{\left(\pi \times 6.5^2\right)} \times 360$ 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 $\dfrac{their\,\mathbf{(b)(i)}}{360} \times \pi \times 2 \times 6.5 + 2 \times 6.5$ oe or **M1** for $\dfrac{their\,\mathbf{(b)(i)}}{360} \times \pi \times 2 \times 6.5$ oe or $\dfrac{their\,\mathbf{(a)}}{0.5 \times 6.5}$
	(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 $\dfrac{1}{4}r^2\left(\dfrac{1}{3}\pi - 1\right) = 5$	
7	**(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	
8	**(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 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 $\dfrac{480}{6.4} \times 1.28 \div 60$	
9 (a)	$\begin{pmatrix} -4 \\ 2 \end{pmatrix}$	**1**		
(b)	5.83 or 5.830 to 5.831	**2**	**M1** for $\sqrt{5^2 + 3^2}$	
(c) (i)	$\dfrac{3}{5}$ oe	**1**		
(ii)	$y = -\dfrac{5}{3}x + 2$	**2**	**B1** for $y = -\dfrac{5}{3}x + b$ $y = mx + 2$ or **M1** for $y = -\dfrac{1}{their\ \mathbf{(c)(i)}}x + 2$ **SC1** for $-\dfrac{5}{3}x + 2$	
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	**B1** **B1**	$8a - 3b = 18.5$ $5a + 4b = 26.25$
	Equates coefficients of either a or b	**M1**	or rearranges one of *their* equations to make a or b the subject e.g. $a = \dfrac{3b + 18.5}{8}$
	$40a - 15b = 92.5$ $40a + 32b = 210$ or $32a - 12b = 74$ $15a + 12b = 78.75$		
	Adds or subtracts to eliminate $47b = 117.5$ $47a = 152.75$	**M1**	Dep on previous method or correctly substitutes into the second equation eg $\dfrac{5(3b + 18.5)}{8} + 4b = 26.25$
	$[a =] 3.25$	**A1**	After **M0** scored, **SC1** for 2 correct values with no working
	$[b =] 2.5$	**A1**	or for two values that satisfy one of their original equations
11 (a)	First graph moved one unit to right	**1**	
	Second graph moved up one unit	**1**	
	Third graph straight parts moved up to $y = 2$	**1**	
	Third graph curved part moved so that maximum at (0, 4)	**1**	
(b)	C	**1**	
	A	**1**	
	D	**1**	
	B	**1**	