CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0580 MATHEMATICS

0580/42 Paper 4 (Extended), maximum raw mark 130

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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

Question	Answer	Mark	Part marks
1 (a)	1848 final answer	**2**	**M1** for $1650 \times \left(1+\frac{12}{100}\right)$ oe
(b) (i)	1750	**2**	**M1** for $\frac{500}{9-5}$ [×5] or [×9] or any equation which would lead to $4x = 500$ or $4x = 2500$ or $4x = 4500$ or $4x = 7000$ when simplified
(ii)	$64\frac{2}{7}$ or 64.3 or 64.28 to 64.29	**1**	
(c) (i)	33 : 20 oe	**2**	**B1** for 33 : 6 or 20 : 6 or 5.5 oe seen or 3.33…oe seen or **M1** for two ratios with a common number of children implied by $20k$ **and** $33k$ seen, $k > 0$
(ii)	236	**3**	**M2** for $\frac{24}{2} \times 11 + \frac{24}{3} \times 10$ oe or $((3 \times 11) + (2 \times 10)) \times 24 \div 6$ or $\frac{6}{6+20+33} \times x = 24$ or **M1** for $\frac{24}{2} \times 11$ or $\frac{24}{2} \times 13$ soi or $\frac{24}{3} \times 10$ or $\frac{24}{3} \times 13$ soi oe or $24 \div 6$ soi
(d)	17[.00]	**3**	**M2** for $20.40 \div \left(1+\frac{20}{100}\right)$ oe or **M1** for (100 + 20)% oe associated with 20.40 seen

Question	Answer	Mark	Part marks
2 (a) (i)	66	1	
(ii)	24	1FT	**FT** 90 – *their* **(a)(i)**
(iii)	66	2FT	**FT** 90 – *their* **(a)(ii)** **M1** for [*BOD* =] 180 – 48 or 180 – 2 × *their* **(a)(ii)**
(iv)	114	1FT	**FT** 180 – *their* **(a)(iii)**
(b)	83.6 or 83.60[…]	2	**M1** for $\frac{1}{2} \times 15 \times 15 \times \sin(180 - 48)$ oe or $\frac{1}{2} \times 15 \times 15 \times \sin(180 - 2 \times$ *their* **(a)(ii)**$)$ oe
(c)	Opposite angles add up to 180 OR Angle in a semicircle [=90]	1	

Question	Answer	Mark	Part marks
3 (a) (i)	$\frac{600}{x+20}$ final answer	1	
(ii)	$\frac{600}{x} - their\ \frac{600}{x+20} = 1.5$ oe	M1	
	$600(x + 20) – 600x = 1.5x(x + 20)$ or $\frac{600(x+20)-600x}{x(x+20)}$ [= *their* 1.5]	M1	Correctly clearing, or correctly collecting into a single fraction, two fractions both with algebraic denominators, one being $\frac{600}{x}$
	$600x + 12\,000 – 600x = 1.5x^2 + 30x$ [$0 = 1.5x^2 + 30x – 12\,000$]	M1	Dep on previous **M1**, correctly multiplying *their* brackets **and** clearing fraction
	$0 = x^2 + 20x – 8000$	A1	With no errors or omissions seen, dep on **M3**
(b)	–100, 80	3	**M2** for $(x + 100)(x – 80)$ or **M1** for $(x + a)(x + b)$ where $ab = –8000$ or $a + b = 20$ OR **B1** for $\sqrt{20^2 - 4\times1\times(-8000)}$ or better and **B1** for $\frac{-20+\sqrt{q}}{2\times1}$ or $\frac{-20-\sqrt{q}}{2\times1}$
(c)	6.67 or 6.666 to 6.667 oe	2FT	**FT** $\frac{12}{2(their\ 80)+20} \times 100$ correctly evaluated to at least 3 sf **M1** for choosing and using *their* positive root

Question	Answer	Mark	Part marks
4 (a) (i)	9π final answer	2	**M1** for $\frac{135}{360} \times 2 \times \pi \times 12$ oe
(ii)	**(a)** 4.5[0] or 4.497 to 4.504…	2FT	**FT** *their* 9 ÷ 2 **M1** for $2\pi r =$ *their* 9π or $12\pi r = \frac{135}{360}\pi 12^2$ oe
	(b) 11.1 or 11.12[…]	3FT	**FT their** $\sqrt{12^2 - \textit{their}\,4.5^2}$ to 3 sf or better (*their* 4.5 < 12) **M2** for $\sqrt{12^2 - \textit{their}\,4.5^2}$ (*their* 4.5 < 12) or **M1** for $12^2 = h^2 +$ *their* 4.5^2 oe (*their* 4.5 < 12)
(b) (i)	75 nfww	3	**M2** for $l = \frac{35}{7} \times 15$ or $x = \frac{35}{7} \times 8$ oe or for 40 seen nfww or correct trig or Pythagoras' method leading to value rounding to 40.0 **M1** for $\frac{l}{15} = \frac{35}{7}$ oe or $\frac{x}{8} = \frac{35}{7}$ oe or $\frac{l-35}{8} = \frac{35}{7}$ oe or $\frac{l-35}{l} = \frac{8}{15}$ oe
(ii)	2730 or 2730.0 to 2730.4 nfww	3	**M2 dep** for $\pi \times 15 \times$ *their* $75 - \pi \times 8 \times$ (*their* $75 - 35$) [$+ \pi \times 8^2$] dep their 75 > 35 or 805π [2527.7 to 2530] nfww or 869 π [2728.6 to 2731.2] nfww or **M1** for $\pi \times 15 \times$ *their* 75 or $1125\,\pi$ [3532.5 to 3535.8] nfww seen or $\pi \times 8 \times$ (*their* $75 - 35$) or $320\,\pi$ [1004.8 to 1005.8] nfww seen or $\pi \times 8^2$ or 64π [200.9 to 201.2] nfww seen
(c) (i)	$16r^3$	2	**M1** for [$M =$] $k \times r^3$ or $1458 = k \times 4.5^3$ oe or $\frac{M}{1458} = \frac{r^3}{4.5^3}$ oe After **M0**, **SC1** for 16 seen
(ii)	8 : 27 oe	1	Must be numeric, e.g. 128:432

5	**(a)**	2 and 7	**2**	**B1** for each value
	(b)	Complete correct curve	**5**	**B3 FT** for *their* 9 or 10 points or **B2 FT** for *their* 7 or 8 points or **B1 FT** for *their* 5 or 6 points and **B1** independent for one branch on each side of the y-axis and **not touching** the y-axis **SC4** for correct curve with branches joined
	(c)	Correct tangent and $-13 \leqslant$ grad $\leqslant -8$	**3**	**B2** for close attempt at tangent at $x = 1$ and answer in range OR **B1** for ruled tangent at $x = 1$, no daylight at $x = 1$ Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = 0.8$ and 1.2 **and M1** (dep on **B1** or close attempt at tangent [at any point] for $\frac{rise}{run}$
	(d) (i)	5 to 6	**1**	
	(ii)	2 to 2.35 and –2.55 to –2.35	**2FT**	**FT** *their k* **B1FT** for each correct solution
	(e)	$[a =] -5$ $[b =] -1$ $[c =] 12$	**3**	**B2** for two correct values or for $x^3 - 5x^2 - x + 12$ [= 0] oe or **M1** for $x^2 - 2x + \frac{12}{x} = 3x + 1$

6	**(a)**	$95.5^2 + 83.1^2 - 2 \times 95.5 \times 83.1 \times \cos 101$	**M2**	**M1** for $\cos 101 = \dfrac{95.5^2 + 83.1^2 - AB^2}{2 \times 95.5 \times 83.1}$
		138.0…	**A2**	**A1** for 19054.[…] also implies **M2**
	(b)	110 or 109.7 to 109.8	**4**	**B3** for 36.2 or 36.20 to 36.24[1..] or **M2** for [sin =] $\dfrac{83.1 \times \sin 101}{138[.0..]}$ oe or **M1** for correct implicit version After **M0**, **SC1** for angle ABC = 42.76 to 42.8
	(c)	18.8 or 18.79[…]	**2**	**M1** for 46.2 × cos(45 + 21) oe After **M0**, **SC1** for answer 42.2 or 42.20 to 42.21
7	**(a)** **(i)**	316	**4**	**M1** for 100, 250, 325, 375, 450 soi **M1** for Σ*fm* with *m*'s in intervals including boundaries [15800] **M1** (dep on 2nd **M1**) for *their* Σ*fm* ÷ 50
	(ii)	Three correct blocks with heights 0.09, 0.36, 0.24 with correct widths and no gaps	**3**	**B2** for two correct blocks or **B1** for one correct block or three correct frequency densities soi
	(b)	Students have a greater range of estimates oe	**B1**	
		[On average] adults estimated a greater mass oe	**B1**	

8	(a) (i)	$x \geqslant 100$ final answer	1	
	(ii)	$y \geqslant 120$ final answer	1	
	(iii)	$x + y \leqslant 300$ final answer	1	
	(iv)	$40x + 80y \geqslant 16000$ or $0.4x + 0.8y \geqslant 160$	M1	with no errors seen but isw substitution of values after correct inequality
	(b)	$x = 100$ ruled	B1	
		$y = 120$ ruled	B1	
		$x + y = 300$ ruled	B1	
		$x + 2y = 400$ ruled	B2	Allow **B1** for line with negative gradient passing through (400, 0) or (0, 200) when extended
		Correct shading	B1	Dep on all previous marks earned Condone any clear indication of the required region
	(c)	200	2	**M1** for $x = 100$ and $y = 200$ selected or for $x \times 0.4 + y \times 0.8$ oe evaluated where (x, y) is an integer point in *their* [unshaded] region

9	**(a)**	$4x - 3x^2$ or $x(4 - 3x)$ nfww final answer	**3**	**B2** for $3x^2 - 6x - 6x^2 + 10x$ or **M1** for $3x^2 - 6x$ or $-6x^2 + 10x$
	(b) (i)	$(2 + y)(3w - 2x)$ oe final answer	**2**	**M1** for $3w(2 + y) - 2x(2 + y)$ or $2(3w - 2x) + y(3w - 2x)$
	(ii)	$(2x + 5y)(2x - 5y)$ final answer	**2**	**M1** for $(2x \pm 5y)(2x \pm 5y)$ or $(2x + ky)(2x - ky)$ or $(kx + 5y)(kx - 5y)$, $k \neq 0$ or $(2x + 5)(2x - 5)$ or $(2 + 5y)(2 - 5y)$
	(c)	$\frac{27x^6}{64}$ final answer	**2**	**B1** for 2 [out of 3] elements correct in the right form in final answer or final answer contains 27 and 64 and $x^{[-]6}$ or $\frac{3x^2}{4}$ seen or $\frac{729x^{12}}{4096}$ seen
	(d) (i)	$2n$ is even and subtracting 1 gives an odd number	**1**	Must interpret the $2n$ as even or not odd and then the -1 oe
	(ii)	$2n + 1$ oe final answer	**1**	
	(iii)	*their*$(2n + 1)^2 - (2n - 1)^2$	**M1**	Could use alternate correct expressions for consecutive **odd** numbers. Allow method and accuracy marks if correct. Could reverse the algebraic terms *their*$(2n - 1)^2 - (2n + 1)^2$ leading to $-8n$. Allow method and accuracy marks if correct.
		$4n^2 + 4n + 1 - 4n^2 + 4n - 1$	**M1**	**Dep on M1** for expanding brackets in *their* expressions. If seen alone and completely correct then implies previous **M1** Allow $4n^2 + 4n + 1 - (4n^2 - 4n + 1)$
		$8n$	**A1**	With no errors seen. After **0** scored, allow **SC1** for two correctly evaluated numeric examples of subtracting consecutive odd squares isw

10	**(a) (i)**	9.43[…]	**2**	**M1** for $5^2 + ([-]8)^2$ or better
	(ii)	(–3, 5)	**1**	
	(b) (i)	**(a)** $\frac{1}{2}(\mathbf{a} + \mathbf{b})$ or $\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$	**2**	**M1** for $\mathbf{a} + \frac{1}{2}\boldsymbol{AB}$ oe, e.g $\mathbf{a} + \boldsymbol{AM}$, $\boldsymbol{OA} + \frac{1}{2}\boldsymbol{AB}$
		(b) $\frac{1}{4}(\mathbf{a} + \mathbf{b})$ or $\frac{1}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}$	**1FT**	**FT** $\frac{1}{2}$ *their* **(b)(i)(a)** <u>in terms of **a** and/or **b**</u> in simplest form
		(c) $\frac{1}{4}(\mathbf{b} - 3\mathbf{a})$ or $\frac{1}{4}\mathbf{b} - \frac{3}{4}\mathbf{a}$	**2**	**M1** for $-\mathbf{a}$ + *their* **(b)(i)(b)** or any correct route
	(ii)	3 : 4 final answer	**3**	**M1** for $[\boldsymbol{AN} =] -\mathbf{a} + \frac{1}{3}\mathbf{b}$ **A1** for $\frac{1}{4} : \frac{1}{3}$ oe or $\boldsymbol{AN} = \frac{1}{3}(-3\mathbf{a} + \mathbf{b})$ or $3k$ to $4k$ After **0** scored **SC1** for final answer 4 : 3
	(c) (i)	Triangle drawn at (–3, –3), (–6, –3), (–6, $-4\frac{1}{2}$)	**3**	**B2** for 2 vertices correct in triangle or 3 correct co-ordinates soi in working or **B1** for 1 vertex in triangle correct soi or triangle of correct size and orientation but wrong position or **M1** for correct set up e.g. $\begin{pmatrix} -1.5 & 0 \\ 0 & -1.5 \end{pmatrix}\begin{pmatrix} 2 & 4 & 4 \\ 2 & 2 & 3 \end{pmatrix}$
	(ii)	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	**2**	**SC1** for 1 correct row or column or for $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$

11	**(a)**	$\frac{38}{56}$ or $\frac{19}{28}$ oe	**4**	[0.679 or 0.6785 to 0.6786] **M3** for $\frac{4}{8} \times \frac{4}{7} + \frac{3}{8} \times \frac{5}{7} + \frac{1}{8}$ [$\times \frac{7}{7}$] oe or **M2** for sum of two of the products isw $\frac{4}{8} \times \frac{4}{7}$, $\frac{3}{8} \times \frac{5}{7}$, $\frac{1}{8}$ [$\times \frac{7}{7}$] oe or **M1** for $\frac{4}{8} \times \frac{4}{7}$ or $\frac{3}{8} \times \frac{5}{7}$ oe isw or $\frac{1}{8} \times \frac{7}{7}$ isw After **0** scored, **SC1** for answer of $\frac{38}{64}$ oe
	(b)	$\frac{60}{336}$ or $\frac{5}{28}$ oe	**2**	**M1** for $\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6}$ or $\left(\frac{4}{8}\times\frac{3}{7}\times\frac{2}{6}\right) + 3\left(\frac{4}{8}\times\frac{1}{7}\times\frac{3}{6}\right)$ oe