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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2011 question paper for the guidance of teachers

0580 MATHEMATICS

0580/41 Paper 4 (Extended), maximum raw mark 130

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Abbreviations

cao	correct answer only
cso	correct solution only
dep	dependent
ft	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
www	without wrong working
art	anything rounding to
soi	seen or implied

Qu.	Answers	Mark	Part Marks
1	**(a)** **(i)** 4950	**2**	**M1** for 9000 × 0.55 oe
	(ii) 9 : 11	**1**	Accept 1 : 1.22 or 0.818 : 1 After 4050 in **(a)(i)** allow **SC1** for 11 : 9 etc
	(b) 1504	**1**	
	564	**1**	
	188	**1**	After 0 scored **M1** for 2256 ÷ (8 + 3 + 1) soi
	(c) **(i)** 6847.99 or 6848 or 6850	**3**	**M2** for 15000 × 0.77^3 oe (6847. (..)ww imp **M2**) or **M1** for 15000 × 0.77^2 oe soi (8893.5) After 0 scored **SC1** for art 27913 or 27910 or 27900
	(ii) 54.3 (54.33 to 54.35)	**3ft**	ft their (15000 – their **(c)(i)**)/15000 × 100 to 3sf or better **but not** for negative answer or from 4650 in **(c)(i)** leading to 69% **M2** for 1 – 0.77^3 (0.543..) or their (15000 – their **(c)(i)**)/15000 (× 100) or **SC2ft** their **(c)(i)**/15000 × 100 correctly evaluated (45.65 to 45.67 or 45.7) or **M1** for 0.77^3 (0.4565..) or their **(c)(i)**/15000

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2	**(a)** 0, 1, 2, 3	**3**	Additional values count as errors **B2** for one error/omission or **B1** for two errors/ omissions After **B0**, **M2** for $-1 < x \le 3.5$ seen, allow 7/2 for 3.5 or **M1** for $-1 < x$ or $x \le 3.5$ or $x = -1$ **and** $x = 3.5$ Allow **M2** for $0 \le x < 4$ or **M1** for $x \ge 0$ or $x < 4$
	(b) $\dfrac{x-2}{x-5}$ www final answer	**4**	**M3** for $\dfrac{(x+5)(x-2)}{(x+5)(x-5)}$ or **M2** for $(x + 5)(x - 2)$ seen or **M1** for $(x + a)(x + b)$ where $ab = -10$ or $a + b = 3$ and **M1** for $(x + 5)(x - 5)$ seen
	(c) **(i)** $5(x + 1) + 2(x - 3) = 3(x + 1)(x - 3)$ oe	**M1**	Allow if still over common denominator
	$x^2 - 3x + x - 3$ or better seen	**B1**	Allow $x^2 - 2x - 3$ seen or $3x^2 - 9x + 3x - 9$ or better seen
	$3x^2 - 13x - 8 = 0$	**E1**	With no errors seen and brackets correctly expanded on both sides
	(ii) $\dfrac{-(-13) \pm \sqrt{(-13)^2 - 4(3)(-8)}}{2(3)}$	**B1** **B1**	In square root **B1** for $(-13)^2 - 4(3)(-8)$ or better (265) If in form $\dfrac{p+\sqrt{q}}{r}$ or $\dfrac{p-\sqrt{q}}{r}$, **B1** for $-(-13)$ and 2(3) or better
	4.88 and –0.55 cao	**B1B1**	**SC1** for 4.88 and – 0.55 seen or – 0.5 and 4.9 or – 0.546… and 4.879 to 4.880

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3	(a)	(i)	$1.6 < h \le 1.7$	1	Condone alt. notation used for class
		(ii)	$\{1.35 \times 4 + 1.45 \times 13 + 1.55 \times 33 + 1.65 \times 45 + 1.75 \times 19 + 1.85 \times 6\} \div 120$	M3	(194/120) **M1** for mid-values soi (allow one slip) and **M1** for use of $\sum fx$ with x in correct interval (allow one more slip) and **M1** depend on 2nd **M** for dividing by 120
			1.62 or 1.616 to 1.617	A1	www4
	(b)	(i)	$\frac{6}{120}$ oe	1	Accept dec/% to 3 sf or better but not ratio isw cancelling/conversion (also for **(ii)**)
		(ii)	$\frac{2147}{2380}$ oe (0.902(1..))	3	**M2** for $\frac{k}{120} \times \frac{k-1}{119}$ where $\frac{k}{120}$ is 1 – their **(b)(i)** or if $k = 114$ or **M1** for 1 – their **(b)(i)** or for 114/120 seen After 0 scored **SC2** for ans 1/476 oe or **SC1** for 6/120 × 5/119
	(c)	(i)	95, 120	1	
		(ii)	Plots 7 points correctly exact or in correct square	P2ft	**P1ft** for 5 or 6 correct plots
			Curve or lines through 7 points	C1ft	ft their **increasing** curve within 1 mm of points
	(d)	(i)	1.61 to 1.63	1ft	ft their 60th reading on inc. curve to nearest 0.01
		(ii)	1.555 to 1.57	1ft	ft their 36th reading on inc. curve
4	(a)	(i)	$2.7 \times \frac{20}{12}$ oe $= 4.5$	E2	**M1** for (SF =) 20/12 or 12/20 (but not from 2.7/4.5 or 4.5/2.7)
		(ii)	$1/3\pi \times 4.5^2 \times 20 - 1/3\pi \times 2.7^2 \times 12$ or $(1 - (3/5)^3) \times 1/3\pi \times 4.5^2 \times 20$ oe	M3	**M1** for $1/3\pi \times 4.5^2 \times 20$ (424 ... or 135π) and **M1** for $1/3\pi \times 2.7^2 \times 12$ (91.6..or 29.16π)
			332.3 to 332.6 or 332 or 333	A1	
	(b)	(i)	$8^2 + (4.5 - 2.7)^2$ oe	M1	e.g. Alt: $20^2 + 4.5^2$ and $12^2 + 2.7^2$
			sq root	M1	Dep on 1st **M1** Alt: 20.5 – 12.3 Other complete correct methods are **M2**
			8.2	E1	No errors seen
		(ii)	185 or 186 or 185.5 or 185.45 to 185.51	5	**M4** for $\pi \times 4.5 \times 20.5 - \pi \times 2.7 \times 12.3$ or other complete correct method or **M3** for $\pi \times 4.5 \times 20.5$ or $\pi \times 2.7 \times 12.3$ (290 or 92.25π) (104.3...or 33.21π) or **B2** for (slant height of large cone =) 20.5 or (slant height of removed cone =) 12.3 or **M1** for $\sqrt{4.5^2 + 20^2}$ or $\sqrt{2.7^2 + 12^2}$ or 12/8 × 8.2 oe or 20/8 × 8.2 oe

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5	**(a)** 1, –1, 3.5	**1,1,1**	
	(b) 10 correct points plotted	**P3ft**	**P2ft** for 8 or 9 correct **P1ft** for 6 or 7 correct Allow points to be implied from curve
	Smooth curve through at least 8 points and correct shape	**C1ft**	Correct cubic shape, not ruled
	(c) **(i)** –2.2 to –2.1	**1ft**	Correct or ft their x values
	–0.65 to –0.45	**1ft**	
	2.5 to 2.7	**1ft**	If ft and more than 3 solns then 2 marks maximum
	(ii) (k <) –4 to –3.7	**1ft**	Correct or ft their graph for y values at max and min
	(k >) 1.7 to 2	**1ft**	After 0 scored **SC1** for both correct but reversed
	(d) **(i)** Ruled line gradient 3 and y-intercept –2 over the range –1 to 3.5	**3**	**B2** for correct but freehand or short or **M1** for a ruled line of gradient 3 or passes through (0, –2) (but not $y = -2$)
	(ii) (a =) –12, (b =) 2	**1,1**	After 0, **M1** for $x^3 - 6x - 6x - 2 + 4$ (=0) or better
	(iii) 0.1 to 0.2 and 3.3 to 3.4 cao	**1,1**	
6	**(a)** $120^2 + 95^2 - 2 \times 120 \times 95 \times \cos 77$	**M2**	**M1** for implicit version
	135.26 … or 135.3	**E2**	**A1** for 18295 to 18297
	(b) $(\sin B) = \dfrac{\text{their } 135 \times \sin 26}{79}$	**M2**	**M1** for $\dfrac{\sin B}{\text{their } 135} = \dfrac{\sin 26}{79}$ oe
	48.5 to 48.7 isw	**A1**	
	131 or 131.3 to 131.5 www4	**B1ft**	ft for 180 – their 48.5 to 48.7 dep on sine rule or sine used
	(c) (Angle A =) 22.5 to 22.7	**B1ft**	ft 154 – their **(b)**, also accept angle B = 67.3 to 67.5 (ft their **(b)** – 64)
	'Path'/79 = sin (their A) oe	**M1**	Dep on **B1** and their $A < 90$ eg 79 cos 67.4
	30.2 to 30.5 www3	**A1**	
	(d) $\frac{1}{2} \times 120 \times 95 \times \sin 77$ oe	**M1**	(5554)
	Their area ÷ 180	**M1**	Dep on area attempt
	30.8 to 30.9	**A1**	
	30	**B1ft**	ft their 30.8 to 30.9 truncated dep on at least **M1** earned After **M2** answer 30 www scores **A1B1** Answer 30 ww scores 0

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7 (a)	**(a) (i)** Reflection only	**B1**	Spoilt if extras
	$y = -2$	**B1**	
	(ii) Enlargement only	**B1**	Spoilt if extras
	$\frac{1}{2}$	**B1**	
	(1, 4)	**B1**	
	(iii) Rotation only	**B1**	Spoilt if extras
	90° clockwise oe	**B1**	Accept –90° or (+)270°
	Around (1, –3)	**B1**	
	(b) (i) Triangle at (–4, 4), (–1, 4), (–1, 5)	**2**	**B1** for translation of $\begin{pmatrix} -5 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 2 \end{pmatrix}$ After **B0**, **SC1** for translation of 5 small squares to the left and 2 small squares up
	(ii) Triangle at (4, 4), (1, 4), (4, 6)	**3**	**B1** for each of (4, 4) or (4, 6) plotted If no/wrong plots allow **SC2** for 3 correct coordinates shown in working or **SC1** for any 2 correct coordinates shown or **M1** for $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}\begin{pmatrix} 1 & 4 & 4 \\ 2 & 2 & 3 \end{pmatrix}$ shown
	(c) Stretch only	**B1**	Spoilt if extras
	(Factor) 2	**B1**	
	x-axis oe invariant	**B1**	

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8	**(a)** **(i)** There are up to 5 large coaches oe	**1**	E.g. can't hire more than 5 large coaches The maximum is 5 large coaches The large coaches are less than or equal to 5
	(ii) $50x + 30y \geq 300$ oe	**E2**	No errors Allow in words provided clear e.g. 50 in large coaches and 30 in small coaches must equal 300 seats or more **M1** for associating 50 with x or large coaches and 30 with y or small coaches
	(b)		Freehand lines –1 pen once. All lines must be long enough to make full boundary of their region accept dashed or solid lines
	$x = 5$ ruled	**L1**	
	$x + y = 10$ ruled	**L1**	
	$5x + 3y = 30$ ruled	**L2**	**L1** for ruled line with intercepts at (0, 10) or (6, 0) within 2mm by eye at intercepts (extend if line is short)
	Correct region indicated cao	**R1**	Allow if slight inaccuracy(s) in diagonal lines Allow any clear indication of region
	(c) **(i)** 5 2	**1** **1**	After 5 and 2 in working ignore attempts to calculate costs
	(ii) 2950	**1ft**	ft their 5 × 450 + their 2 × 350 provided positive integers
9	**(a)** **(i)** 2 × 3 × 3 × 7 oe	**2**	**M1** for prime factors of 2,3,3,7 shown condone 1('s) shown as well for method only
	(ii) 18	**1**	
	(iii) 504	**2**	**M1** for other multiples of 504 or 2 × 2 × 2 × 3 × 3 × 7 oe shown If **(ii)** and **(iii)** both correct but reversed allow **SC1**
	(b) 3.028 or 3.029 cao	**4**	**B3** for 3.0289(85…) or **M1** for their 105/their 34 (their 105 in range 104 to 106 and their 34 in range 33 to 35) and **B1** for 104.5 or 34.5 or 34.499.. selected
	(c) πr^2 their h = their V	**M1**	Where V is in range 540 to 560 and h is in range 11 to 13
	$(r^2 =) \dfrac{\text{their } V}{\pi \times \text{their } h}$	**M1**	Implies previous method (15.36 implies **M2**) If using 545 and 12.5 then 13.88 (leading to 3.73) If using 550 and 12 then 14.59 (leading to 3.82)
	Sq root	**M1**	Dep on **M2**, can be implied from answers
	Selects 555 or 554.99.. and 11.5	**B1**	Indep
	3.919 cao	**A1**	If trials then 5 or 0

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