

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International General Certificate of Secondary Education

## **MARK SCHEME for the October/November 2014 series**

### **0580 MATHEMATICS**

**0580/41**

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

Qu	Answers	Mark	Part Marks
<b>1</b>	<b>(a) (i)</b>	<b>2</b>	<b>M1</b> for $72 \div (7 + 2 + 3)$
	<b>(ii)</b>	<b>2</b>	<b>M1</b> for $13.5 \div 3 \times (7 + 2 + 3)$ oe
	<b>(iii)</b>	<b>3</b>	<b>M2</b> for $8.4[0] \div 1.12$ oe or <b>M1</b> for $112[\%]$ associated with $[\$]8.4[0]$ oe
	<b>(b) (i)</b>	<b>M2</b>	<b>M1</b> for a correct relevant area inside the hexagon e.g. $0.5 \times 2 \times 2 \sin 60$ oe
		<b>A1</b>	Must see 10.38 to 10.39[...]
	<b>(ii)</b>	<b>2</b>	<b>M1</b> for $10.4 \times$ figs 45 [figs 467 to 468]
	<b>(iii)</b>	<b>4</b>	<b>M1</b> for <i>their</i> <b>(b)(ii)</b> $\times 1250 \div 1000$ <b>A1 FT</b> for <i>their</i> <b>(b)(ii)</b> $\times 1250 \div 1000$ evaluated to at least 3 sf  <b>M1dep</b> on previous <b>M1</b> for <i>their</i> mass in tonnes (rounded up) $\times 45.5[0]$ if between 6 and 10 or for <i>their</i> mass in tonnes (rounded up) $\times 47[.00]$ if between 1 and 5 or for <i>their</i> mass in tonnes (rounded up) $\times 44[.00]$ if over 10

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Qu	Answers	Mark	Part Marks
2 (a)	$[\pm]\sqrt{v^2 + 2as}$ final answer	2	<b>M1</b> for correct first step, i.e. $u^2 = v^2 + 2as$
(b) (i)	$\frac{60}{x} + \frac{45}{x+4} = 6$ oe	<b>M2</b>	<b>B1</b> for either $\frac{60}{x}$ or $\frac{45}{x+4}$ seen
	$60(x+4) + 45x = 6x(x+4)$ or better	<b>M1</b>	<b>Dep on M2</b>
	$60x + 240 + 45x = 6x^2 + 24x$ oe $0 = 2x^2 - 27x - 80$	<b>A1</b>	$[6x^2 - 81x - 240 = 0]$ <b>Dep on M3</b> and brackets expanded and with no errors or omissions throughout
(ii)	16 final answer	3	<b>M2</b> for $(x-16)(2x+5) [= 0]$ or <b>M1</b> for partial factorisation e.g. $x(2x+5) - 16(2x+5)$ or <b>SC1</b> for $(x+a)(2x+b) [= 0]$ where $ab = -80$ or $2a+b = -27$
			or <b>B2</b> for $\frac{-27 + \text{or} - \sqrt{(-27)^2 - 4 \cdot 2 \cdot -80}}{2 \cdot 2}$ or
			$[-]\sqrt{40 + \left(\frac{27}{4}\right)^2} + \frac{27}{4}$
			or <b>B1</b> for $\frac{-27 + \text{or} - \sqrt{q}}{2.2}$ or $\sqrt{(-27)^2 - 4 \cdot 2 \cdot -80}$ or
			$\left(x - \frac{27}{4}\right)^2$
(c) (i)	$0.75 \times 20 [=15]$	1	
(ii)	150 cao	4	<b>M3</b> for $90 + T = 1800 \times 2 \div 15$ oe or $T - 110 = (1800 - (90 \times 15) - (20 \times 15 \div 2)) \times 2 \div 15$ oe or $t = (1800 - (90 \times 15) - (20 \times 15 \div 2)) \times 2 \div 15$ oe [ $t = 40$ ]
			or <b>M2</b> for $\frac{1}{2}(90 + T) \times 15 = 1800$ oe or $\frac{1}{2}(T - 110) \times 15 + 90 \times 15 + \frac{1}{2}(20 \times 15) = 1800$ oe or $1800 - \frac{1}{2} \times 20 \times 15 - 90 \times 15$ oe [300 for area of 'end' triangle]
			or <b>M1</b> for method for area of triangle or rectangle or trapezium soi

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Qu	Answers	Mark	Part Marks
(d)	10 cao nfw	3	<b>M2</b> for $22.5 \div 2.25$ or <b>M1</b> for $21.5$ to $22.5 \div 2.25$ to $2.75$ or <b>B1</b> for $22.5$ or $2.25$ seen
3 (a)	Correct reflection (0, 1) (3, 1) (3, 3)	1	
(b)	Correct rotation (-5, 1) (-7, 1) (-5, 4)	2	<b>SC1</b> for rotation of $90^\circ$ anticlockwise about the wrong centre or $90^\circ$ clockwise about $(-4, 0)$ or for 3 correct points plotted but not joined
(c) (i)	Enlargement [scale factor] 2 [centre] $(-7, 7)$	3	<b>B1</b> for each
(ii)	1 : 4 or 3 : 12 or $\frac{1}{4} : 1$	2	<b>M1</b> for $1 : 2^2$ oe, e.g. $(3 \times 2)/2 : (6 \times 4)/2$ or <b>SC1</b> for 4 : 1 or 12 : 3 or $1 : \frac{1}{4}$
(d)	$\begin{pmatrix} 4 & 0 \\ 0 & 1 \end{pmatrix}$	2	<b>B1</b> for $\begin{pmatrix} k & 0 \\ 0 & 1 \end{pmatrix}$ , $k$ may be algebraic or numeric but $\neq 0$ or 1 or <b>SC1</b> for $\begin{pmatrix} 1 & 0 \\ 0 & 4 \end{pmatrix}$
(e) (i)	Correct shear drawn (0, 1) $(-3, -5)$ $(-3, -3)$	3	<b>B2</b> for two correct points plotted or if not plotted correctly shown in working or <b>B1</b> for $\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix} \begin{pmatrix} -3 \\ 3 \end{pmatrix}$ or $\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix} \begin{pmatrix} -3 \\ 1 \end{pmatrix}$ or $\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix} \begin{pmatrix} 0 \\ 1 \end{pmatrix}$ or better
(ii)	Shear $y$ -axis or $x = 0$ invariant [factor] 2	3	<b>B1</b> for each
(iii)	$\begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$ oe	2	<b>B1</b> for [determinant =] 1 shown or stated or $k \begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$ so $k \neq 0$

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Qu	Answers	Mark	Part Marks
4	(a) (i) $11 - x$ final answer	2	<b>M1</b> for $8x - 4 - 9x + 15$ or <b>B1</b> for final answer $11 - kx$ or $k - x$
	(ii) $6x^2 - xy - 12y^2$ final answer	3	<b>M2</b> for $6x^2 + 8xy - 9xy - 12y^2 [= 0]$ or for final answer with <b>one</b> error in a <b>coefficient</b> (includes sign) but otherwise correct  or <b>M1</b> for any two of $6x^2, 8xy, -9xy, -12y^2$
	(b) $x(x^2 - 5)$ final answer	1	Condone $x(x - \sqrt{5})(x + \sqrt{5})$ as final answer
	(c) $x \geq 4$ or $4 \leq x$ final answer nfw	3	<b>B2</b> for 4 with no/incorrect inequality or equals sign as answer or <b>M2</b> for $8x + 4 \leq 15x - 24$ or better  or <b>M1</b> for $4(2x + 1) \leq 3(5x - 8)$
	(d) (i) $p = 4.5$ oe $q = 8.25$ oe	3	<b>B2</b> for one correct answer or for $(x - 4.5)^2 - 8.25$ oe seen or <b>M1</b> for $(x - 4.5)^2$ oe seen or $x^2 - px - px + p^2$ seen and <b>M1</b> for $p^2 - q = 12$ or $2p = 9$
	(ii) $-8.25$ oe	1FT	FT – <i>their q</i>
(iii) $x = 4.5$ oe	1FT	FT $x =$ <i>their p</i>	
5	(a) $-2, 5.5$	2	<b>B1</b> for each value
	(b) Correct curve 	5	<b>B5</b> for correct curve over full domain or <b>B3FT</b> for 9 or 10 points or <b>B2FT</b> for 7 or 8 points or <b>B1FT</b> for 5 or 6 points Point must touch line if exact or be in correct square if not exact (including boundaries) <b>and</b> <b>B1</b> independent for one branch on each side of the $y$ -axis and <b>not touching</b> or crossing the $y$ -axis  <b>SC4</b> for correct curve with branches joined
	(c) $-2.6 \leq x \leq -2.4$ $0.6 \leq x \leq 0.7$ $1.8 \leq x \leq 1.9$	3	<b>B1</b> for each value  If <b>B0</b> then <b>SC1</b> for $y = 5$ used

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Qu	Answers	Mark	Part Marks
(d)	$y = x + 5$ ruled correctly and $-2.2 \leq x \leq -2.0$ $0.5 \leq x \leq 0.6$ $2.4 \leq x \leq 2.6$	4	<b>B1</b> for $y = x + 5$ ruled correctly  <b>B1indep</b> for each value
6 (a)	2000 or 1998.75 or 1998.8 or 1999 nfw	4	<b>M1</b> for midpoints <b>soi</b> (condone 1 error or omission) (500, 1250, 1750, 2250, 3000) and <b>M1</b> for use of $\sum fx$ with $x$ in correct interval including both boundaries (condone 1 further error or omission) (5000, 37500, 96250, 162000, 99000) and <b>M1</b> (dep on 2nd <b>M1</b> ) for $\sum fx \div 200$
(b) (i)	10, 40, 95, 167, 200	2	<b>B1</b> for 2 correct
(b) (ii)	Correct curve or ruled polygon	3	<b>B1FT</b> <i>their</i> <b>(b)(i)</b> for 5 correct heights within 1mm vertically and <b>B1</b> for 5 points at upper ends of intervals on correct vertical line and <b>B1FT</b> (dep on at least <b>B1</b> ) for increasing curve or polygon through 5 points  After 0 scored, <b>SC1FT</b> for 4 correct points plotted
(b) (iii)	68 to 80	2	<b>M1</b> for 120 to 132 seen
(c)	$\frac{21}{50}$ oe	4	<b>M3</b> for $\frac{9}{10} \times \frac{2}{5} + \frac{1}{10} \times \frac{3}{5}$ oe or better or <b>M2</b> for $\frac{9}{10} \times \frac{2}{5}$ or $\frac{1}{10} \times \frac{3}{5}$ or $\frac{18}{50}$ oe or $\frac{3}{50}$ oe or <b>M1</b> for sight of $\frac{1}{10}$ and $\frac{2}{5}$

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Qu	Answers	Mark	Part Marks
7 (a) (i)	<p><b><u>Any two of with conclusion</u></b>            Angle <math>ACD</math> = angle <math>ABD</math>            Angle <math>CAB</math> = angle <math>CDB</math>            Angle <math>AXC</math> = angle <math>DXB</math>  <b>AND</b>            ‘triangles have equal angles’ oe  <b>OR</b>  <b><u>All three of without conclusion</u></b>            Angle <math>ACD</math> = angle <math>ABD</math>            Angle <math>CAB</math> = angle <math>CDB</math>            Angle <math>AXC</math> = angle <math>DXB</math></p>	2	<p><b>B1</b> for two pairs without a conclusion</p> <p>e.g. similar and AA or AAA</p>
(ii) (a)	10	2	<p><b>M1</b> for <math>\frac{DX}{12.5} = \frac{3.2}{4}</math> oe</p>
(b)	$4^2 + 3.2^2 - 2 \times 4 \times 3.2 \cos 110$  34.9 to 35  5.92 or 5.915 to 5.916	<p><b>M2</b></p> <p><b>A1</b></p> <p><b>B1</b></p>	<p>or <b>M1</b> for implicit version</p> <p>Implied by answer 5.92 or 5.915 to 5.916 after <b>M2</b></p>
(c)	58.7 or 58.73[...]	2FT	<p><b>FT</b> for <math>\frac{1}{2} \times 12.5 \times \text{their } 10 \times \sin 110</math> oe correctly evaluated to 3 or more sig figs  <b>M1</b> for <math>\frac{1}{2} \times 12.5 \times \text{their } 10 \times \sin 110</math> oe            or <math>\frac{1}{2} \times 4 \times 3.2 \times \sin 110 \times (12.5/4)^2</math></p> <p>After <b>0</b> scored <b>and</b> 15.6... in (a)(ii)(a), allow <b>SC1</b> for <math>\frac{1}{2} \times 4 \times 3.2 \times \sin 110 \times (12.5/3.2)^2</math></p>
(b)	7.62 or 7.623 to 7.624	5	<p><b>B4</b> for 37.6[2...] or 37.63            or  <b>M2</b> for <math>[AB =] \frac{30}{\tan 31}</math> or <math>30 \times \tan 59</math> oe            or <b>M1</b> for <math>\tan 31 = \frac{30}{AB}</math> or <math>\tan 59 = \frac{AB}{30}</math> oe</p> <p><b>And</b>  <b>M2</b> for <math>[BD =] \text{their } AB \times \tan 37</math> oe            or  <b>M1</b> for <math>\tan 37 = \frac{BD}{\text{their } AB}</math> oe</p>

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Qu	Answers	Mark	Part Marks
8	(a) $2c + 3b$	2	M1 for $\overrightarrow{OQ}$ recognised as pos vector.
	(b) (i) $3c - 6a$ or $3(c - 2a)$	1	
	(ii) $2c - 4a$ or $2(c - 2a)$	2	M1 for any valid route from $P$ to $Q$ e.g. $-(3b - 2a) - 6a + \text{their } \overrightarrow{OQ}$ or $\overrightarrow{PQ} = \overrightarrow{PA} + \overrightarrow{AO} + \overrightarrow{OQ}$ or $\overrightarrow{PQ} = \overrightarrow{PB} + \overrightarrow{BQ}$
(c)	$PQ = \frac{2}{3}AC$ oe  and  $PQ$ is parallel to $AC$	2FT	STRICT FT dep on $\overrightarrow{PQ} = k\overrightarrow{AC}$ from (b)(i) and (b)(ii) B1FT for each statement  After 0 scored and $\overrightarrow{PQ} = k\overrightarrow{AC}$ in (b)(i) and (ii), allow SC1FT for correct statement, e.g. $PQ$ is not parallel to $AC$
9	(a) $36, 9, 45$	2	B1 for two correct values
	$8n + 4$ oe	2	M1 for $8n + k$ , for any $k$
	$(n - 1)^2$ oe	2	M1 for a quadratic expression of form $n^2 [+ an + b]$ oe
	(b) 19	2	M1 for $(n + 1)(n + 5) = 480$ or better or $20 \times 24$ seen
	(c) (i) $\frac{1}{3} + p + q = 12$ and no errors seen	1	Accept $p + q = 12 - \frac{1}{3}$ after $\frac{1}{3}[1^3] + p[1^2] + q[1]$ shown
	(ii) $\frac{1}{3} \times 8 + 4p + 2q = 12 + 21$	2	M1 for $12 + 21$ seen or 33 seen
(iii)	$[p =] \frac{7}{2}$ oe  $[q =] \frac{49}{6}$ oe	3	M1 for correct multiplication and subtraction or substitution using the correct given equations B1 for $[p =] \frac{7}{2}$ or $[q =] \frac{49}{6}$  After 0 scored, SC1 for 2 values satisfying one of the original correct given equations