

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International General Certificate of Secondary Education

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

**0580 MATHEMATICS**

**0580/43**

Paper 4 (Extended), maximum raw mark 130

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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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
nfw	not from wrong working
soi	seen or implied

Qu.	Answers	Mark	Part Marks
<b>1</b>	<p><b>(a) (i)</b> 5.37[1...]</p> <p><b>(ii)</b> 54.1 or 54.11 to 54.12</p> <p><b>(iii)</b> 65.8</p> <p><b>(b)</b> 263.2 or 263</p>	<p><b>2</b></p> <p><b>3</b></p> <p><b>2</b></p> <p><b>3FT</b></p>	<p><b>M1</b> for <math>[AD^2 = ] 2.6^2 + 4.7^2</math> oe or better</p> <p><b>M2</b> for <math>\tan [BCD =] \frac{4.7}{(17-11-2.6)}</math> oe</p> <p>or</p> <p><b>B1</b> for 3.4 seen</p> <p><b>M1</b> for <math>\frac{11+17}{2} \times 4.7</math> oe</p> <p><b>FT</b> <i>their</i> <b>(a)(iii)</b> <math>\times 4</math> correctly evaluated</p> <p><b>M2</b> for <i>their</i> <b>(a)(iii)</b> <math>\times \left(\frac{9.4}{4.7}\right)^2</math> oe</p> <p>or</p> <p><b>M1</b> for [scale factor =] <math>\left(\frac{9.4}{4.7}\right)^2</math> or <math>\left(\frac{4.7}{9.4}\right)^2</math> soi</p>
<b>2</b>	<p><b>(a) (i)</b> <math>\frac{920}{8} \times 7 [=805]</math> oe</p> <p><b>(ii)</b> 30.8 or 30.76 to 30.77</p> <p><b>(b)</b> 1211 final answer</p>	<p><b>1</b></p> <p><b>2</b></p> <p><b>5</b></p>	<p><math>\frac{2990}{26} \times 7 [= 805]</math></p> <p><b>M1</b> for <math>\frac{8}{(11+8+7)} [\times 100]</math></p> <p><b>B4</b> for 13 926.5[0] [area A total sales]</p> <p>or</p> <p><b>B3</b> for 11 040 [area B] <b>and</b> 10 867.50 [area C] or 21 907.5 [area B + area C]</p> <p>or</p> <p><b>B2</b> for 11 040 [area B] <b>or</b> 10 867.50 [area C]</p> <p>or</p> <p><b>M1</b> for 736 [B tickets] and <b>M1</b> for 483 [C tickets]</p> <p>After 0 scored</p> <p><b>SC2</b> for answer of 1196</p> <p>or</p> <p><b>SC1</b> for 13754 (A total sales)</p>

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(c)	37 720	3	M2 for $\frac{35834}{0.95}$ oe or M1 for 35834 associated with 95[%]
3 (a) (i)	52 Angles in <b>same segment</b>	1 1dep	Accept same arc, same side of same chord
(ii)	104 <b>Angle at centre</b> is <b>twice</b> angle at <b>circumference</b>	1 1	Accept double, $2 \times$ but not middle, edge
(iii)	34 Angle between <b>tangent</b> and <b>radius</b> = <b>90°</b>	1 1	Accept right angle, perpendicular
(b) (i)	7.65 to 7.651	4	M2 for $8.92 + 72 - 2 \times 8.9 \times 7 \times \cos 56$ 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 $[\sin BEC =] \frac{7 \sin 56}{\text{their (b)(i)}}$ oe or M1 for $\frac{\sin 56}{\text{their (b)(i)}} = \frac{\sin BEC}{7}$ 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)	$\frac{6}{15}$ oe	2	M1 for $\frac{3}{5} \times \frac{2}{3}$
(iii)	$\frac{7}{15}$ oe	3	M2 for $\frac{3}{5} \times \frac{1}{3} + \frac{2}{5} \times \frac{2}{3}$ oe $1 - \text{their (a)(ii)} - \frac{2}{5} \times \frac{1}{3}$ or M1 for $\frac{3}{5} \times \frac{1}{3}$ or $\frac{2}{5} \times \frac{2}{3}$ seen
(b) (i)	Completes tree diagram correctly	3	B2 for 5 values correct or B1 for 1 value correct
(ii)	$\frac{126}{350}$ oe $\left[ \frac{9}{25} \right]$	2	M1 for $\frac{3}{5} \times \frac{6}{7} \times \frac{7}{10}$

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

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	(b)	$\sqrt{([-7])^2 - 4.3 - 12}$ or better and $p = [- -]7$ and $r = 2(3)$ oe  3.48, -1.15 cao	<b>B1</b> or for $\left(x - \frac{7}{6}\right)^2$  <b>B1</b> Must see $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ or both  or for $\frac{7}{6} \pm \sqrt{4 + \left(\frac{7}{6}\right)^2}$  <b>B1B1</b> After <b>B0</b> , <b>SC1</b> 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)	$\frac{x+5}{x^2}$ or $\frac{1}{x} + \frac{5}{x^2}$ final answer nfw	<b>3</b> <b>B1</b> for $(x+5)(x-5)$ and <b>B1</b> for $x^2(x-5)$
7	(a)	$\frac{1}{2} \times 8 \times 8 \times \sin 56$ oe 26.52 to 26.53	<b>M1</b> or $[\frac{1}{2} \times 2] 8 \sin 28 \times 8 \cos 28$ or $[\frac{1}{2} \times 2] \times 7.06... \times 3.75...$ <b>A1</b>
	(b) (i)	72.[0] or 71.87 to 72.0	<b>3</b> <b>M2</b> for $26.5 / (\pi \times 6.5^2) \times 360$ oe or <b>M1</b> for $\frac{x}{360} \times \pi \times 6.5^2 = 26.5$ or better
	(ii)	21.1 or 21.2 or 21.14 to 21.17	<b>3</b> <b>M2</b> for $\frac{\text{their (b)(i)}}{360} \times \pi \times 2 \times 6.5 + 2 \times 6.5$ oe or <b>M1</b> for $\frac{\text{their (b)(i)}}{360} \times \pi \times 2 \times 6.5$ oe or $\frac{\text{their (a)}}{0.5 \times 6.5}$
	(c) (i)	$\frac{30}{360} \times \pi \times r^2 - \frac{1}{2} \times r^2 \times \sin 30$ oe $\frac{1}{12} \times \pi \times r^2 - \frac{1}{4} \times r^2$ $\frac{1}{4} r^2 \left( \frac{1}{3} \pi - 1 \right)$	<b>M2</b> <b>M1</b> for $\frac{30}{360} \times \pi \times r^2$ or $\frac{1}{2} \times r^2 \times \sin 30$ <b>A1</b> <b>A1</b> Dep on <b>M2 A1</b> and no errors seen
	(ii)	20.6 or 20.7 or 20.55 to 20.71	<b>3</b> <b>M2</b> for $[r^2 =] \frac{5}{\frac{1}{4} \left( \frac{1}{3} \pi - 1 \right)}$ or <b>M1</b> for one correct rearrangement step to $r$ from $\frac{1}{4} r^2 \left( \frac{1}{3} \pi - 1 \right) = 5$

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

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