

**MARK SCHEME for the May/June 2013 series**

**0580 MATHEMATICS**

**0580/42**

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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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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
<b>1</b>	<b>(a) (i)</b> $\frac{6}{5+6+3} \times 560$ [= 240]	<b>2</b>	Accept 'of' used instead of $\times$ <b>M1</b> for $560 \div (5 + 6 + 3)$
	<b>(ii)</b> 120	<b>1</b>	
	<b>(b)</b> 90	<b>2</b>	<b>M1</b> for $\frac{3}{8} \times 240$ oe
	<b>(c) (i)</b> 96120 final answer	<b>2</b>	<b>M1</b> for <i>their(a)(ii)</i> $\times 75 + (560 - \textit{their (a)(ii)}) \times 198$ oe
	<b>(ii)</b> 187.5[0] final answer	<b>3</b>	<b>M2</b> for $\frac{198}{1+0.056}$ oe or <b>M1</b> for $(100 + 5.6)[\%] = 198$ oe seen
	<b>(d)</b> 184[.2....]	<b>3</b>	<b>M2</b> for $\frac{36 \times 0.75 - 9.5}{9.5} \times 100$ oe or <b>M1</b> for $\frac{36 \times 0.75}{9.5} \times 100$ or $36 \times 0.75 - 9.5$ [17.5] used implied by answer 84.2 or <b>SC1</b> for final answer 284[.2..]
	<b>(e)</b> 69.4 and 69[.0]      cao	<b>3</b>	<b>SC2</b> for one correct or both correct but reversed <b>M1</b> for two of 10.85, 10.95, 23.65 or 23.75 seen or $2(23.7 + 10.9) + 4(0.05)$ or $2(23.7 + 10.9) - 4(0.05)$

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2	(a) (i)	Translation, $\begin{pmatrix} -5 \\ 8 \end{pmatrix}$ oe	1,1	Brackets needed for vector Not $(-5, 8)$ , $(-5 \ 8)$
	(ii)	correct trapezium at $(2, 2)$ $(4, 3)$ $(4, 5)$ $(2, 5)$	2	SC1 for reflection in $x = -1$ or vertices only
	(iii)	correct trapezium at $(4, 2)$ $(5, 4)$ $(7, 4)$ $(7, 2)$	3	M2 for 4 correct vertices on grid or in working or M1 for $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 2 & 2 & 4 & 4 \\ -4 & -7 & -7 & -5 \end{pmatrix}$  or SC1 for 3 vertices correct or complete shape in correct orientation but wrong position
	(b) (i)	Shear  $x$ -axis (oe) invariant  2	1  1  1	
	(ii)	rectangle at $(-3, 2)$ $(1, 2)$ $(1, 8)$ $(-3, 8)$	2	SC1 for all vertices only or correct orientation and size, wrong position
3	(a)	0, 2, 0, -3	3	B2 for 3 correct or B1 for 2 correct
	(b)	Correct curve	B4	B3FT for 8 points B2FT for 7 or 6 points B1FT for 5 or 4 points
	(c)	$y = -1$ indicated  $x = 1.3$ to $1.4$ and $4.1$ to $4.2$	B1  B1	e.g. Could be mark[s] on curve isw other lines if not clearly used
	(d) (i)	line drawn from $(0, 2)$ to touch curve  $(2.5$ to $2.75, 3$ to $3.4)$	M1  A1	No daylight at point of contact If short, must cross at $(0, 2)$ within $\frac{1}{2}$ small square when extended
	(ii)	rise/run e.g. $(\text{their } y - 2)/\text{their } x$  $0.4$ to $0.48$	M1  A1	dep on attempt at a tangent from $(0, 2)$ in (d)(i) and uses scales correctly Can be implied from answer– check on tangent for their rise for a run of 1 ( $\frac{1}{2}$ small square)  ww2 dep on attempt at a tangent from $(0, 2)$ in (d)(i)

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4	(a)	227 or 226.95 to 227.01	2	M1 for $\pi \times 8.5^2$
	(b)	5.35	1	
	(c)	39.0[0] to 39.0[1]	2	M1 for $\sin [MOB] = \frac{\text{their } b}{8.5}$ oe Dep on their $b < 8.5$
	(d)	30.2 or 30.3 or 30.24 to 30.27	3	M2 for $\frac{360 - 4 \times 39}{360} \times 2 \times \pi \times 8.5$ oe or M1 for $\frac{a}{360} \times 2 \times \pi \times 8.5$ oe where $0 < a < 360$  Implied by 5.78 to 5.79 or 11.5 to 11.6 or 23.14 to 23.15 or 23.1 or 23.2 or 41.83 to 41.84 or 41.8
	(e)	$AB = BC$ $TA = TC$ $TB = TB$	1 1 1	isw comments or reasons  If 0 scored SC1 for “all <u>three sides</u> the same” oe [SSS] and no mention of angles
5	(a)	$\frac{27}{x}$ final answer	1	
	(b)	$\frac{25}{x-2}$ final answer	1	
	(c)	$\frac{25}{x-2} - 4 = \frac{27}{x}$ oe  $25x - 4x(x-2) = 27(x-2)$ oe  $4x^2 + 27x - 25x - 8x - 54 [= 0]$ oe  $2x^2 - 3x - 27 = 0$ without error seen	M1  M1  M1dep  A1	FT $\text{their } (b) - 4 = \text{their } (a)$ oe must be eqn in $x$  FT $\frac{25}{x-2} + 4 = \frac{27}{x}$ oe <u>only</u> for 2 <sup>nd</sup> and 3 <sup>rd</sup> M mark If all on one side then condone omission of ‘= 0’  Dep on 2 <sup>nd</sup> M1 Must see brackets expanded before this award and terms on one side of eqn  Must see $4x^2 - 6x - 54 = 0$ first
	(d)	-3, 4.5	3	B2 for $(2x-9)(x+3)$ or SC1 for $(2x+a)(x+b)$ where $a$ and $b$ are integers and $a + 2b = -3$ or $ab = -27$
	(e)	6 cao	1	

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<p>6 (a) (i)</p>	$\frac{12^2 + 21^2 - 15^2}{2 \times 12 \times 21}$ <p>44.41 to 44.42</p> <p>(ii) 88.2 or 88.15 to 88.19</p> <p>(b) 7.74 or 7.736 to 7.737.... www</p>	<p>M2</p> <p>A2</p> <p>2</p> <p>4</p>	<p>M1 for <math>15^2 = 12^2 + 21^2 - 2.12.21\cos M</math></p> <p>A1 for [cos =] 0.714 or 0.7142 to 0.7143 or <math>\frac{360}{504}</math> oe</p> <p>M1 for <math>0.5 \times 12 \times 21 \times \sin(44.4)</math> oe</p> <p>B1 for 55 soi</p> <p>M2 <math>\frac{6.4}{\sin(\text{their } R)} \times \sin 82</math> oe</p> <p>or M1 for <math>\frac{6.4}{\sin(\text{their } R)} = \frac{PR}{\sin 82}</math> oe</p>
<p>7 (a) (i)</p> <p>(ii)</p> <p>(iii)</p> <p>(iv)</p> <p>(v)</p> <p>(b)</p>	<p><math>\begin{pmatrix} 15 \\ 21 \end{pmatrix}</math></p> <p>not possible oe</p> <p>(2) final answer</p> <p><math>\begin{pmatrix} 4 &amp; 13 \\ 0 &amp; 0 \end{pmatrix}</math></p> <p><math>\begin{pmatrix} -5 &amp; -9 \\ 1 &amp; 0 \end{pmatrix}</math></p> <p><math>\frac{1}{2} \begin{pmatrix} 3 &amp; -4 \\ -1 &amp; 2 \end{pmatrix}</math> or better isw</p>	<p>1</p> <p>1</p> <p>2</p> <p>1</p> <p>2</p> <p>2</p>	<p>M1 for 30 – 28</p> <p>B1 for one correct row or column</p> <p>B1 for <math>k \begin{pmatrix} 3 &amp; -4 \\ -1 &amp; 2 \end{pmatrix}</math> seen or implied</p> <p>or <math>\frac{1}{2} \begin{pmatrix} a &amp; b \\ c &amp; d \end{pmatrix}</math> seen</p>
<p>8 (a)</p> <p>(b) (i)</p> <p>(ii)</p>	<p>hat <math>\frac{5}{8}, \frac{3}{8}</math></p> <p>scarf <math>\frac{2}{3}, \frac{1}{3}</math></p> <p><math>\frac{1}{6}, \frac{5}{6}</math></p> <p><math>\frac{15}{48}</math> oe <math>\left[ \frac{5}{16} \right]</math></p> <p><math>\frac{5}{24}</math></p>	<p>1</p> <p>1</p> <p>1</p> <p>2FT</p> <p>2FT</p>	<p>1 mark per pair in correct place</p> <p>FT their <math>\frac{3}{8} \times \frac{5}{6}</math> correctly evaluated</p> <p>M1 <math>\frac{3}{8} \times \frac{5}{6}</math> FT from their tree</p> <p>FT their <math>\frac{5}{8} \times \frac{1}{3}</math> correctly evaluated</p> <p>M1 <math>\frac{5}{8} \times \frac{1}{3}</math> FT from their tree</p>

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(iii)	$\frac{13}{48}$ cao	2	<b>M1</b> for <i>their</i> $\frac{3}{8} \times \frac{1}{6} + \text{their (b)(ii) soi}$
(c)	$\frac{170}{240}$ or $\frac{85}{120}$ or $\frac{34}{48}$ or $\frac{17}{24}$ cao	3	<b>M2</b> for $1 - \frac{5}{8} \times \frac{2}{3} \times \frac{7}{10}$ FT <i>their tree</i> or $\frac{3}{8} + \frac{5}{8} \times \frac{1}{3} + \frac{5}{8} \times \frac{2}{3} \times \frac{3}{10}$ oe <b>or M1</b> for ["wears all" = ] $\frac{5}{8} \times \frac{2}{3} \times \frac{7}{10}$ FT <i>their tree</i> seen
9 (a)	371 or 371.1...	4	<b>M3</b> for $(6 \times 4 \times 12) + (2 \times 6 \times 0.5 \times 4 \times 4 \times \sin 60)$ oe <b>or M2</b> for area of 1 or 2 hexagons <b>or M1</b> for area of one relevant triangle or trapezium or rectangle within hexagon If 0 scored <b>SC1</b> for 288 shown
(b) (i)	1740 or 1743.6 to 1744.2	4	<b>M3</b> for $\frac{12000}{4} \div (\pi \times 0.74^2)$ oe <b>or SC2</b> for figs 174[3..] or 174[4..] <b>or B1</b> for $\pi \times 0.74^2$ seen [1.72..] <b>or B1</b> for 12000 / 4 soi by 3000
(ii)	87 cao                  www 5	5	<b>B4</b> for 87.39 to 87.43 <b>or M3</b> for $[r=] \sqrt{\frac{\text{figs } 12}{\pi \times \text{figs } 5}}$ oe <b>or M2</b> for $[r^2 =] = \frac{\text{figs } 12}{\pi \text{ figs } 5}$ oe <b>or M1</b> for $\text{figs } 12 = \pi r^2 \times \text{figs } 5$
10 (a) (i)	final answer $\frac{25-8x}{20}$	2	<b>M1</b> for $\frac{5 \times 5 - 4 \times 2x}{5 \times 4}$ or better seen
(ii)	final answer $\frac{2x^2 + 5x + 9}{3(x+3)}$	3	<b>B1</b> for $2x^2 + 6x - x - 3$ soi <b>and B1</b> for denom $3(x+3)$ or $3x+9$ seen
(b)	$x = \frac{2}{3}$ oe or 0.667 or 0.6666 to 0.6667 $y = -3$	3	<b>M1</b> for correct method to eliminate one variable <b>A1</b> for $x = \frac{2}{3}$ oe or 0.667 or 0.6666 to 0.6667 <b>or</b> $y = -3$

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(c)	final answer $\frac{7}{2x+3}$ www	4	<p><b>B1</b> for <math>7(x+3)</math> in numerator and <b>B2</b> for <math>(2x+3)(x+3)</math> in denominator or <b>SC1</b> for <math>(2x+a)(x+b)</math> where <math>a</math> and <math>b</math> are integers and <math>a+2b=9</math> or <math>ab=9</math></p> <p>After <b>B1</b> scored, <b>SC1</b> for final answer <math>\frac{7}{2(x+1.5)}</math> or <math>\frac{3.5}{x+1.5}</math></p>
<b>11 (a)</b>	$3^2 + 1^2$	1	Ignore attempt to evaluate $\sqrt{10}$
(b) (i)	$\frac{\sqrt{10}}{3}$ final answer	1	
(ii)	$\frac{10}{3}$ final answer	2	<p><b>M1</b> for <i>their</i> <math>\frac{\sqrt{10}}{3} \times \sqrt{10}</math> or <i>their</i> <math>\left(\frac{\sqrt{10}}{3}\right)^2 + (\sqrt{10})^2</math> implied by 3.33 seen</p>
(c)	$\frac{100}{27}$ or $3\frac{19}{27}$ isw conversion or 3.7[03] to 3.7[04]	2	<p><b>M1</b> for <math>3 \times \left(\frac{\sqrt{10}}{3}\right)^n</math> oe where <math>n</math> is 3 or 4 or for <math>[OP_4 =] \sqrt{\frac{1000}{81}}</math> or for <i>their</i> (b)(ii) <math>\times \left(\frac{\sqrt{10}}{3}\right)^n</math> where <math>n</math> is 1 or 2</p>
(d) (i)	18.43...	2	<b>M1</b> for $\tan [P_1OP_2] = \frac{1}{3}$ oe
(ii)	18.4[3...]	1	
(iii)	20	3	<p><b>SC2</b> for 19 or <b>M1</b> for <math>\frac{360}{18.4[3...]}</math></p>