

**MARK SCHEME for the May/June 2012 question paper**  
**for the guidance of teachers**

**0580 MATHEMATICS**

**0580/41**

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
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 (a)</b>	1134	<b>3</b>	<b>M2</b> for $\frac{504}{12} \times (12 + 7 + 8)$ soi by answer of 1130 or <b>B1</b> for 27 or 42 or 294 or 336 seen
	<b>(b) (i)</b>	<b>3</b>	<b>M2</b> for $\frac{93}{100} \times 504$ oe soi by 468.7 or 469 or <b>M1</b> for $\frac{7}{100} \times 504$ (implied by 35.28)
			<b>M2</b> for $\frac{64.68}{77} \times 100$ or <b>M1</b> for $(100 - 23)\% = 64.68$
	<b>(c)</b>	262.19 cao	<b>3</b>
<b>(d)</b>	12.5%	<b>3</b>	<b>M2</b> for $\frac{324 - 288}{288} \times 100$ or <b>M1</b> for $\frac{324}{288} \times 100$ (112.5) or $\frac{36}{288}$ (0.125)
<b>2 (a)</b>	10.9 or 10.92... www 4	<b>4</b>	<b>M2</b> for $4^2 + 9^2 - 2 \times 4 \times 9 \times \cos 108$ If <b>M0</b> , <b>M1</b> for correct implicit statement <b>A1</b> for 119.249...(which can be 3 www)
	<b>(b) (i)</b>	<b>3</b>	<b>M2</b> for $9 \times \cos 55$ oe in correct triangle If <b>M0</b> , <b>B1</b> for 55 or 35 in correct position soi
			<b>B2</b> <b>SC1</b> for answer 233
<b>(ii)</b>	(0)53		

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<p><b>3 (a)</b></p> <p><b>(b)</b></p> <p><b>(c) (i)</b></p> <p><b>(ii)</b></p> <p><b>(d)</b></p>	<p>1 0.98(4) 0 – 0.98(4) – 1</p> <p>9 points plotted</p> <p>smooth curve</p> <p><math>y = 0.8</math> drawn</p> <p>–1.1 to –1.2, –0.4 to –0.5, 1.55 to 1.65</p> <p>correct tangent drawn at <math>x = -1.5</math> 4 to 5.5</p>	<p><b>B3</b></p> <p><b>P3ft</b></p> <p><b>C1</b></p> <p><b>B1</b></p> <p><b>1, 1, 1</b></p> <p><b>T1</b></p> <p><b>B2</b></p>	<p><b>B2</b> for 4 correct, <b>B1</b> for 3 correct</p> <p><b>B2</b> for 7 or 8 points correct <b>B1</b> for 5 or 6 points correct</p> <p>correct <b>cubic</b> shape through 8 or more points from – 2 to 2</p> <p>Accept good freehand To make the three possible intersections (otherwise the line must be from – 2 to 2)</p> <p>Allow slight daylight dep on T1 <b>M1</b> for evidence rise/run with correct scales dep on T1</p>
<p><b>4 (a)</b></p> <p><b>(b)</b></p> <p><b>(c)</b></p> <p><b>(d) (i)</b></p> <p><b>(ii)</b></p> <p><b>(e)</b></p>	<p>90</p> <p><math>\tan(\angle ACB) = 7 \div 10</math> oe 34.9(9...)</p> <p><b>same segment</b></p> <p>11.9 or 11.8(9....) www 3</p> <p>38.6 (38.58 to 38.62) www 2</p> <p>8.69 or 8.7(0) or 8.685 to 8.700.... cao www 3</p>	<p><b>B1</b></p> <p><b>M1</b></p> <p><b>A1</b></p> <p><b>B1</b></p> <p><b>3</b></p> <p><b>2</b></p> <p><b>3</b></p>	<p>Any longer method must reach equivalent stage</p> <p>Allow <b>same arc</b> oe</p> <p><b>M2</b> for <math>\frac{7 \times \sin 77}{\sin 35}</math></p> <p>or <b>M1</b> for implicit form</p> <p><b>M1</b> for <math>0.5 \times 7 \times \text{their (d)(i)} \times \sin(180 - 77 - 35)</math> oe</p> <p>Allow 68.00 to 68.01 for 68</p> <p><b>M2</b> for <math>12.3 \times \left(\frac{10}{\text{their } 11.9}\right)^2</math></p> <p>or <b>M1</b> for <math>\left(\frac{10}{\text{their } 11.9}\right)^2</math> or reciprocal seen</p>
<p><b>5 (a) (i)</b></p> <p><b>(ii)</b></p> <p><b>(iii)</b></p> <p><b>(b)</b></p> <p><b>(c) (i)</b></p>	<p>2.8 cao</p> <p>3.8 cao</p> <p>1.8 cao</p> <p>6</p> <p>9, 4, 4</p>	<p><b>1</b></p> <p><b>1</b></p> <p><b>1ft</b></p> <p><b>1</b></p> <p><b>2</b></p>	<p>accept 2 (h) 48, not 2.48</p> <p>accept 3 (h) 48 not 3.48</p> <p>ft their (a)(ii) – 2 accept 1 (h) 48 and 1.48</p> <p><b>B1</b> for 2 correct</p>

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<p>(ii) 1 2.5 3.5 4.5 5.5 7</p> <p><math>20 \times 1 + 25 \times 2.5 + 18 \times 3.5 +</math> <i>their</i> <math>9 \times 4.5 +</math> <i>their</i> <math>4 \times 5.5 +</math> <i>their</i> <math>4 \times 7</math> (= 236)</p> <p><math>\div 80</math></p> <p>2.95 cao</p> <p>(d) Axes suitably numbered <b>or</b> horizontal axis suitably numbered <b>and</b> area scale stated</p> <p>6 columns with correct relative widths</p> <p>heights:                    10                                   25, 18, <i>their</i> 9, <i>their</i> 4                                   <i>their</i> <math>4 \div 2</math></p>		<p><b>M1</b></p> <p><b>M1</b></p> <p><b>M1</b></p> <p><b>A1</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p>	<p>At least 5 correct mid-values seen</p> <p><math>\sum fx</math> where <math>x</math> is in the correct interval (20 + 62.5 + 63 + 40.5 + 22 + 28)</p> <p>Dependent on second method mark</p> <p>Allow www 4</p> <p>e.g. <math>4\text{cm}^2 = 10</math></p> <p>no gaps, but condone reasonable freehand</p> <p>if vertical axis not labelled use correct relative heights</p>
<p><b>6 (a) (i)</b></p> <p><math>(4x - 7)(2x - 1) = 1</math> <math>8x^2 - 14x - 4x + 7</math> <math>4x^2 - 9x + 3 = 0</math></p> <p>(ii)</p> <p><math>(x =) \frac{-(-9) \pm \sqrt{(-9)^2 - 4(4)(3)}}{2 \times 4}</math></p> <p><math>(x =) 0.41, 1.84</math> cao</p> <p>(iii) 0.36 or 0.3720 to 0.3724 or 0.37</p> <p>(b) (i)</p> <p><math>(x - 4)(x + 4)</math></p> <p>(ii)</p> <p><math>(2x + 3)(x + 4) + (x + 40) = 2(x^2 - 16)</math> oe</p> <p><math>2x^2 + 8x + 3x + 12</math> or <math>2x^3 + 3x^2 - 32x - 48</math></p> <p><math>x = -7</math> www 4</p>		<p><b>M1</b></p> <p><b>B1</b></p> <p><b>E1</b></p> <p><b>B2</b></p> <p><b>B1,B1</b></p> <p><b>B1ft</b></p> <p><b>B1</b></p> <p><b>M2</b></p> <p><b>B1</b></p> <p><b>A1</b></p>	<p>or <math>(4x - 7)(2x - 1) - 1 = 0</math> only</p> <p>allow <math>-18x</math> and/or <math>+6 = 0</math> or <math>= -6</math></p> <p>at least one more line e.g. <math>8x^2 - 18x + 6 = 0</math> with no errors or omissions seen</p> <p><b>B1</b> for <math>\sqrt{(-9)^2 - 4(4)(3)}</math> or better seen <math>(\sqrt{33})</math> <b>B1</b> for <math>p = -(-9)</math> and <math>r = 2 \times 4</math> or better as long as in the form <math>\frac{p + or - \sqrt{q}}{r}</math></p> <p>After B0B0, <b>SC1</b> for 0.4 or 0.406(929...) and 1.8 or 1.843(070...)</p> <p>ft their value to give positive <math>(4x - 7)</math></p> <p>fractions cleared or could all still be over <math>(x^2 - 16)</math> or <math>(2x + 3)(x^2 - 16) + (x + 40)(x - 4) = 2(x - 4)(x^2 - 16)</math></p> <p>Condone sign slips</p>

7	In any part of part (a) all marks are independent but mention of a second transformation scores 0 out of 3		
(a) (i)	Rotation (centre/about) origin ( $O$ ) (0,0) $180^\circ$	1 1 1	accept R SC3 for all of enlargement, sf $-1$ , (0, 0)
(ii)	Enlargement (centre/about) (0, $-3$ ) SF $-3$	1 1 1	accept E
(iii)	Enlargement (centre/about) (0, 6) SF $\frac{1}{3}$	1 1 1	accept E
(b) (i)	image at $(-4, -2)$ $(-2, -2)$ and $(-1, 0)$	2	SC1 for translation by $\begin{pmatrix} -4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -5 \end{pmatrix}$ , $k \neq 0$
(ii)	image at $(-2, 3)$ $(-4, 3)$ and $(-5, 5)$	2	SC1 for reflection in $y = -1$
(c) (i)	image at $(0, 3)$ $(4, 3)$ and $(6, 5)$	2	SC1 for stretch sf 2 with $x$ -axis invariant ie at $(0,6)$ $(2,6)$ $(3,10)$
(ii)	$\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$ ft	2 ft	ft their stretch factor only SC1 for correct left hand column ft or $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$ ft
8 (a)	2 4 6 8	1	
(b)	3	1	
(c) (i)	$(x - 4)(x - 9)$	2	SC1 any other $(x + a)(x + b)$ where $a \times b = 36$ or $a + b = -13$
(ii)	4 9	B1 ft	ft or can recover
(d)		2	Must have all 9 numbers on diagram and no extras SC1 for 5 or more correct elements
(e) (i)	$\emptyset$ or $\{ \}$ cao	1	
(ii)	$\neq$ cao	1	
(iii)	$\cup$ cao	1	

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9 (a) (i)	14	1	
(ii)	$13 - 2x$	2	<b>M1</b> for $7 - 2(x - 3)$
(iii)	$25x^2 - 8$ final answer	1	
(b)	$\frac{7-x}{2}$ oe	2	<b>M1</b> for $2x = 7 - y$ , $x = \frac{7-y}{2}$ oe or $x = 7 - 2y$ , $2y = 7 - x$ oe i.e one step from answer
(c)	$9x^2 + 30x + 17$	3	<b>M1</b> for $(3x + 5)^2 - 8$ seen <b>B1</b> for $9x^2 + 30x + 25$
(d)	7 cao	3	<b>M2</b> for $3(3x + 5) + 5 = 83$ or better or <b>B1</b> for $3(3x + 5) + 5$ oe
(e)	$x < -\frac{3}{8}$ oe cao	3	<b>M1</b> for $2(3x + 5) < 7 - 2x$ oe <b>B1</b> for $8x * -3$ or $-8x * 3$ Do not accept $\frac{3}{-8}$
10 (a)	2030 or 2040 or 2034 to 2036. (...)	2	$(V =) \frac{1}{3} \times \pi \times 9^2 \times 24$  Accept $648\pi$ for 2 marks if final answer
(b)	(upper radius =) 3  (vol cut off =) $\frac{1}{3} \times \pi \times \text{their } 3^2 \times 8$  <i>their</i> (a) – <i>their</i> 75.39	<b>B1</b>	accept $9 \times \frac{8}{24}$ oe
	1958 to 1964.(...)	<b>M1</b>	(= 75.36 to 75.41) <i>their</i> $r$ must be less than 9
(c)	$1960 = 5 \times \pi \times r^2 \times 15$ soi  $r^2 = 1960 \div \pi \div 15 \div 5$  $\sqrt{\text{their } 8.318}$  2.88 to 2.89	<b>M1 dep</b>	[ alternate method <b>M1</b> for ratio sides 1:3 <b>M1</b> ratio vols 1 : 27 <b>M1</b> <i>their</i> (a) $\times 26 \div 27$ ] 624 $\pi$ implies <b>B1 M2</b> or <b>M3</b>
		<b>E1</b>	must see a figure after decimal point if 1960
		<b>M1</b>	
		<b>M1</b>	implied by 8.318...
		<b>M1</b>	dep on <b>M1 M1</b>
		<b>E1</b>	<b>SC2</b> for $5 \times \pi \times 2.9^2 \times 15 = 1980$ to 1982