

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

**0581 MATHEMATICS**

**0581/43**

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
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)</b> 1 min 36 s www	<b>3</b>	<b>M1</b> for $1.2 \times 0.8 \times 0.5 (= 0.48)$ <b>A1</b> 1.6 or 96 If <b>A0</b> , <b>B1</b> for correctly converting to min and sec Dep on <b>M1</b>
	<b>(b)</b> 0.954 to 0.956 www	<b>3</b>	<b>M2</b> for $\frac{\text{their } 0.48}{\pi \times 0.4^2}$ or <b>M1</b> for $\pi \times 0.4^2 \times d = '0.48'$
	<b>(c)</b> 8.09 to 8.10 www	<b>4</b>	<b>M1</b> for $\pi \times 0.4^2 (0.503)$ condone $\times 2$ and <b>M1</b> for $\pi \times 0.8 \times 1.2 (3.02)$ <b>M1</b> for their area $\times 2.3$ (dep <b>M1 M1</b> )
<b>2</b>	<b>(a)</b> 0.5, 4	<b>1+1</b>	
	<b>(b)</b> 6 points plotted ft Correct shaped curve through 6 points (exponential)	<b>P2</b> <b>C1</b>	<b>P1</b> for 5 points Ignore to left of $x = -2$
	<b>(c) (i)</b> Correct ruled line reaching both points	<b>L1</b>	
	<b>(ii)</b> $6 \div 3$ oe	<b>1</b>	Allow 'test' with a coordinate on the line (not 0, 2)
	<b>(iii)</b> $-0.8$ to $-0.6$	<b>1</b>	Dep on <b>L1</b>
	<b>(d)</b> Tangent drawn at (1, 2) Rise/run attempt using correct scales 1.2 to 1.6 cao	<b>T1</b> <b>M1</b> <b>A1</b>	Not chord, allow up to 1 mm daylight Dep on <b>T1</b>
<b>3</b>	<b>(a) (i)</b> 50 www3	<b>3</b>	<b>B1</b> for angle $ADB$ or $ABD = 70$ <b>B1</b> for angle $DBC = 80$
	<b>(ii)</b> Angle $DCB \neq$ angle $CBE$ oe	<b>1</b>	Accept angle $CDB \neq$ angle $ABD$
	<b>(b)</b> 12	<b>B3</b>	<b>M2</b> for $\frac{5n}{2} = \frac{360}{n}$ oe or <b>M1</b> for 360 soi
<b>(c)</b> 65 www	<b>3</b>	$OAC = 25, CAB = 25, OBA = 50, BOC = 50,$ $AOB = 80, AOC = 130$ <b>B1</b> each, max 2	

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4	(a) Image (1, -1), (1, -2), (4, -2), (3, -1)	2	B1 if vertices plotted only or reflects in $y = -x$
	(b) Image (-3, 2), (-4, 2), (-4, 5), (-3, 4)	2	B1 for translation by $\begin{pmatrix} -2 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 1 \end{pmatrix}$
	(c) (i) Rotation only, 90 clockwise oe, (Centre) (0, 0) oe	1 1 1	Spoilt if extras
	(ii) $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	2	B1 for one row or one column correct
5	(d) Stretch only, (Factor) 2, $x$ -axis oe invariant	1 1 1	Spoilt if extras
	(a) 55 www	B4	M3 for $3w + 6(w + 5) = 525$ oe in \$ or $(3j - 5) + 6j = 525$ oe in \$ or M2 for $j = w + \text{figs}5$ oe and $3w + 6j = \text{figs}525$ or M1 for $w$ and $w + \text{figs}5$ or $j$ and $j - \text{figs}5$
	(b) (i) $\frac{72}{x} - \frac{72}{x+3} = 2$ oe $72(x+3) - 72x = 2x(x+3)$ oe	M2 M1	M1 for $\frac{72}{x}$ or $\frac{72}{x+3}$ Dep on 3 terms above Fractions removed, isw
(ii) -12, 9 www	3	M2 for $(x+12)(x-9)$ or $\frac{-3 \pm \sqrt{441}}{2}$ or SC1 for $(x+a)(x+b)$ where $ab = -108$ or $a+b = 3$ or $\frac{-3 \pm \sqrt{3^2 - 4 \times 1 \times -108}}{2}$	
(iii) 30	1	ft $3 \times$ a positive root + 3	
6	(a) (i) 13 or 13.0 www	3	M1 for $3^2 + 4^2$ oe Equiv if find AC first and M1 for $\sqrt{12^2 + \text{their}(3^2 + 4^2)}$
	(ii) 13.32 to 13.35 or 13.3	2	M1 for $\sin = \frac{3}{\text{their } AP}$ or $\tan = \frac{3}{\text{their } AC}$ oe
	(b) (i) 36.86 to 36.87 or 36.9	2	M1 for $\tan(PBC) = \frac{3}{4}$ oe
	(ii) 2.770 to 2.774 or 2.77	3	M2 for $\frac{4 \sin \text{their (b)(i)}}{\sin 120}$ or M1 for correct implicit eqn

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7	<p>(a) <math>3 &lt; t \leq 4</math></p> <p>(b) 1 2.5 3.5 6  <math>\sum fx</math> with <math>x</math> in correct interval  <math>662 \div 200</math>  3.31 cso</p> <p>(c) (i) 92, 164  (ii) (2, 24), (3, 92), (4, 164), (8, 200)  ft  Curve/polygon through the 4 points  (iii) <math>3 \leq \text{med} \leq 3.2</math>  <math>2.4 \leq \text{lq} \leq 2.7</math>  <math>0.9 \leq \text{iqr} \leq 1.5</math></p>	<p>1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>1</p> <p>P2ft</p> <p>1ft</p> <p>B1</p> <p>B1</p> <p>B1</p>	<p>Condone alt. notation used for class</p> <p>Mid-interval values soi</p> <p>Allow 1 slip (24 170 252 216)</p> <p>M1 dep on second M1</p> <p>P1ft for 3 points</p> <p>ft increasing curve/polygon</p>
8	<p>(a) 243</p> <p>(b) <math>\frac{1-x}{2}</math> or <math>\frac{x-1}{-2}</math> final ans</p> <p>(c) <math>\frac{-1 \pm \sqrt{1^2 - 4(1)(-1)}}{2(1)}</math>   -1.62, 0.62</p> <p>(d) <math>4x^2 - 6x + 1</math> final ans www3</p> <p>(e) 9</p>	<p>2</p> <p>2</p> <p>B2</p> <p>B1B1</p> <p>3</p> <p>1</p>	<p>B1 for <math>(g(-2) =) 5</math> seen or <math>3^{(1-2x)}</math></p> <p>M1 for <math>x = 1 - 2y</math> or <math>x = (1 - y)/2</math></p> <p>B1 for <math>\sqrt{1^2 - 4(1)(-1)}</math> or better (<math>\sqrt{5}</math>) seen anywhere</p> <p>If in form <math>\frac{p + \sqrt{q}}{r}</math> or <math>\frac{p - \sqrt{q}}{r}</math></p> <p>B1 for <math>p = -1</math> and <math>r = 2(1)</math></p> <p>SC1 for -1.62 and 0.62 seen or -1.6 or -1.618.. and 0.6 or 0.618...</p> <p>M1 for <math>(1 - 2x)^2 + (1 - 2x) - 1</math> or better and B1 for <math>(1 - 2x)^2 = 1 - 2x - 2x + 4x^2</math> or better</p>

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9	<p>(a) (i) <math>\frac{1}{4}</math> oe</p> <p>(ii) 25 cao</p> <p>(b) <math>\frac{2}{12}</math> oe cao</p> <p>(c) <math>\frac{7}{20}</math> oe cao</p> <p>(d) <math>\frac{6}{60}</math> oe cao</p>	<p>1</p> <p>1ft</p> <p>2</p> <p>3</p> <p>2</p>	<p>Accept fraction, %, dec equivalents (3sf or better when not exact) throughout but not ratio or words isw incorrect cancelling/conversion to other forms</p> <p>ft their <math>\frac{1}{4} \times 100</math> to 3sf or better or rounding or truncating to integer Not 25/100</p> <p>M1 for <math>\frac{2}{4} \times \frac{1}{3}</math> 0.167, 16.7%</p> <p>M2 for <math>\frac{1}{4} \times \frac{4}{5} + \frac{3}{4} \times \frac{1}{5}</math> or M1 for <math>\frac{1}{4} \times \frac{4}{5}</math> or <math>\frac{3}{4} \times \frac{1}{5}</math> After 0, SC1 for 7 correct in list (condone UU in addition)</p> <p>M1 for <math>\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3} \times \left(\frac{2}{2}\right)</math></p>
10	<p>(a) <math>20x + 10y \geq 200</math></p> <p>(b) <math>x + y \leq 15, y \geq 3, y \leq x</math></p> <p>(c)</p> <p><math>2x + y = 20</math> ruled</p> <p><math>x + y = 15</math> ruled</p> <p><math>y = x</math> ruled</p> <p><math>y = 3</math> ruled</p> <p>Quadrilateral identified</p> <p>(d) (i) 47 cao</p> <p>(ii) 7, 6 cao</p>	<p>1</p> <p>3</p> <p>B2</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>R1</p> <p>1</p> <p>2</p>	<p>In (a), (b) -1 once for wrong symbol</p> <p>B1 for each</p> <p>All lines long enough to make full boundary of region, accept dashed or solid lines, 2 mm acc at intercepts</p> <p>B1 for ruled line through (10, 0) or (0, 20)</p> <p>-1 once, freehand</p> <p>Allow if slight inaccuracy(s) in diagonal lines Allow any clear indication of region</p> <p>M1 for any <math>5x + 2y</math> in their region evaluated to equal their 47</p>

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11	(a) (i) $\begin{pmatrix} 8 \\ 1 \end{pmatrix}$	1	
	(ii) Point (3, 4) indicated	1	
	(iii) $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$	1	
	(b) (i) $-\frac{5}{12}\mathbf{u} + \frac{2}{3}\mathbf{v}$ oe 2 terms	4	
	(ii) $\frac{13}{24}\mathbf{u} + \frac{1}{3}\mathbf{v}$ oe 2 terms	2	<b>M1</b> for any correct route $L$ to $K$ e.g. $LU + UK$ and <b>B1</b> for $LU = \mathbf{u}/4$ oe or $OL = \frac{3}{4}\mathbf{u}$ oe and <b>B1</b> for $UK = \frac{2}{3}(\mathbf{v} - \mathbf{u})$ oe or $VK = \frac{1}{3}(\mathbf{u} - \mathbf{v})$ oe all <b>Bs</b> are soi
12	(a) (i) 12, ..., 30	2	<b>B1</b> each isw if expand incorrectly
	(ii) $(n + 1)(n + 2)$ oe	1	
	(iii) $p = 2$	1	
	$q = 2$	1	
	(iv) 69(th), 70(th)	2	
	(b) (i) $2 \times 3 + 7$	1	
	(ii) 27	1	
(iii) 1707, ..., 13 653	1,1	<b>M1</b> for their $2n + 2 = 140$ soi Accept $2 \times 3 + 2 \times 2 + 3$	