

## **MARK SCHEME for the October/November 2012 series**

### **0581 MATHEMATICS**

**0581/41**

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.

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

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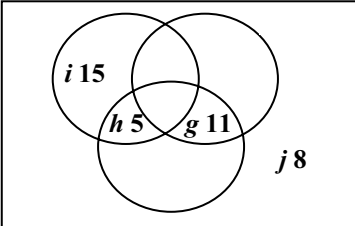
<b>Page 2</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>IGCSE – October/November 2012</b>	<b>0581</b>	<b>41</b>

### 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>	<p><b>(a) (i)</b> 126</p> <p><b>(ii)</b> 144</p> <p><b>(b)</b> 16.66 . . . to 16.67 or 16.7 oe</p> <p><b>(c) (i)</b> 22.18 to 22.19 or 22.2 oe</p> <p><b>(ii)</b> 58 www</p> <p><b>(d) (i)</b> 50, 70, 100, 135  <math>(5 \times 50 + 14 \times 70 + 29 \times 100 + 32 \times 135) [= 8450]</math>  <math>\div 80</math> or their <math>\sum f</math>  106 or 105.6 or 105.625 or 105.62 or 105.63 cao www</p> <p><b>(ii)</b> 1  2.9 oe  4.27 [4.266 to 4.267] oe</p>	<p><b>2</b></p> <p><b>1 ft</b></p> <p><b>2</b></p> <p><b>3</b></p> <p><b>2 ft</b></p> <p><b>M1</b></p> <p><b>M1</b></p> <p><b>M1</b></p> <p><b>A1</b></p> <p><b>4</b></p>	<p><b>M1</b> for <math>x + x + 18 + 90 = 360</math> or better</p> <p>ft their <math>x + 18</math></p> <p><b>M1</b> for <math>60/360 \times 100</math> oe (implied by answer 16.6)</p> <p><b>M2</b> for <math>(35 + 36)/320 \times 100</math> or <b>B1</b> for 36 or 35 or 71 seen</p> <p>For <b>2ft</b>, <math>114 -</math> their <b>(a)(ii)</b>/<math>360 \times 140</math> correctly evaluated (correct or to the nearest integer) or <b>M1</b> for <math>(360 - 60 - 72)/360 \times 180</math> [114] or 56ft (their <b>(a)(ii)</b>/<math>360 \times 140</math>) seen</p> <p>At least 3 correct mid-values seen</p> <p><math>\sum fx</math> where <math>x</math> is in the correct interval allow one further slip</p> <p>Depend on second method</p> <p>isw conversion to mins/secs &amp; reference to classes</p> <p><b>B3</b> for 2.9 and 4.27 or <b>B2</b> for 2.9 or 4.27 and <b>B1</b> for 1</p> <p><b>Or SC2</b> for 0.25 oe and 0.725 oe and 1.066 to 1.07 oe seen</p> <p><b>Or SC1</b> for any pair of the above seen</p>

Page 3	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2012	0581	41

2	<p>(a) (i) 14 -5.5 20</p> <p>(ii) 10 correct points plotted</p> <p>Smooth curve through all 10 points correct shape</p> <p>(b) -4.8 to -4.6, -0.4 to -0.2, 3 to 3.1 www</p> <p>(c) Tangent drawn at <math>x = -4</math> Attempts <math>y</math> step/<math>x</math> step with correct scales 6 to 11</p> <p>(d) (i) Ruled line through ( 1, 15) and (3, -5)</p> <p>(ii) 2.5 to 2.7</p>	<p>1+1+1</p> <p>P3 ft</p> <p>1+1+1</p> <p>T1</p> <p>M1</p> <p>A1</p> <p>3</p> <p>1</p>	<p>P2 ft for 8 or 9 correct</p> <p>P1 ft for 6 or 7 correct</p> <p>Centre of point must touch line if exact or be in correct square (including boundaries)</p> <p>C1 Within 1 mm radially of potted points. In absence of plot[s], allow curve to imply plot[s] No ruled sections</p> <p>After 0 scored, SC1 for <math>y = 2</math> soi</p> <p>Penalise first occurrence of co-ord answers in (b) and (d)(ii)</p> <p>Not chord or daylight</p> <p>Dep on T1 or close attempt at tangent at <math>x = -4</math></p> <p>Dep on M1 only</p> <p>L2 for short line but correct or freehand full length correct line.</p> <p>L1 for ruled or freehand line through (0, 10) (but not <math>y = 10</math>) or for ruled line with gradient -5</p> <p>isw for extra solns from wrong curve/line</p>
3	<p>(a)</p>  <p>(g = )11 (h = ) 5 (i = )15 (j = ) 8</p> <p>(b) (i) 5 (ii) 51</p> <p>(c) (i) 15 (ii) 10</p> <p>(d) (i) <math>\frac{13}{90}</math> oe [0.144] (ii) <math>\frac{15}{90}</math> oe [0.167]</p>	<p>1</p> <p>1ft</p> <p>1ft</p> <p>1ft</p> <p>1</p> <p>1ft</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>ft 16 – their 11</p> <p>ft 20 – their 5</p> <p>ft 39 – (their 11 + their 5 + their 15)</p> <p>ft for positive integers only</p> <p>ft 36 + their <math>i</math></p> <p>In (d) and (e) accept fraction, %, dec equivalents (3sf or better) throughout but not ratio or words isw incorrect cancelling/conversion</p>

Page 4	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2012	0581	41

	<p>(e) (i) <math>\frac{20}{8010}</math> oe [0.0025[0]]</p> <p>(ii) <math>\frac{598}{8010}</math> oe [0.0747]</p>	<p>2</p> <p><b>M1</b> for <math>\frac{5}{90} \times \frac{4}{89}</math> oe</p> <p>After <b>M0, SC1</b> for <math>\frac{5}{90} \times \frac{5}{90}</math> oe</p> <p>3</p> <p><b>M2</b> for <math>\left(\frac{23}{90} \times \frac{13}{89}\right) + \left(\frac{13}{90} \times \frac{23}{89}\right)</math> oe</p> <p>or <b>M1</b> for one product soi [0.0373..]</p> <p>After <b>M0, SC1</b> for <math>2 \left(\frac{23}{90} \times \frac{13}{90}\right)</math> oe</p>
4	<p>(a) (i) 2.5 or <math>\frac{5}{2}</math></p> <p>(ii) 13</p> <p>(b) (i) <math>27x^3y^{12}</math> final answer</p> <p>(ii) <math>4a^3b^{[1]}</math> final answer</p> <p>(iii) <math>\frac{x+1}{x+8}</math> www final answer</p>	<p>2</p> <p><b>M1</b> for one correct step collected i.e <math>6x = k</math> or <math>ax = 15</math> or for <math>4x + 2x = 8 + 7</math></p> <p>2</p> <p><b>M1</b> for <math>x - 7 = 2 \times 3</math> or better</p> <p>2</p> <p><b>B1</b> for 2 correct elements</p> <p>2</p> <p><b>B1</b> for 2 correct elements</p> <p>4</p> <p><b>M2</b> for <math>(x - 8)(x + 1)</math> seen or <b>SC1</b> for <math>(x + a)(x + b)</math> where <math>a + b = -7</math> or <math>ab = -8</math> <b>and B1</b> for <math>(x + 8)(x - 8)</math> seen</p>
5	<p>(a) 55.6 to 55.61 www</p> <p>(b) 90.6 or 90.57 to 90.58</p> <p>(c) 25.19 to 25.21, 30.23 to 30.246 or 30.2, 57.95 to 57.97 or 58[.0]</p> <p>(d) 16.8 to 16.842</p>	<p>3</p> <p><b>M2</b> for <math>\sqrt{46^2 + 24^2 + 20^2}</math> oe <math>\left[\sqrt{3092}\right]</math> or <b>M1</b> for <math>46^2 + 24^2</math> oe [soi by 2692 or art 51.9] or <math>46^2 + 20^2</math> oe [soi by 2516 or art 50.2] or <math>24^2 + 20^2</math> oe [soi by 976 or art 31.2]</p> <p>3</p> <p><b>M2</b> for <math>\frac{20000}{(20 \times 24 \times 46)} \times 100</math> oe or <b>M1</b> for <math>20 \times 24 \times 46</math> [22080]</p> <p>3</p> <p><b>M2</b> for <math>20 \times \sqrt[3]{2}</math> or <math>24 \times \sqrt[3]{2}</math> or <math>46 \times \sqrt[3]{2}</math> <b>M1</b> for <math>\sqrt[3]{2}</math> oe seen [1.259 to 1.261]</p> <p>3</p> <p><b>M2</b> for <math>\sqrt[3]{\frac{20000}{4/3\pi}}</math> oe or answer figs 168 to 16842 or <b>M1</b> for <math>\sqrt[3]{\frac{20000}{4/3\pi}}</math> [4770 – 4780] seen</p>

Page 5	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2012	0581	41

<p><b>6</b></p>	<p>(a) (i) <math>\begin{pmatrix} -2 \\ -1 \end{pmatrix}</math></p> <p>(ii) 7.28 [0] or <math>\pm\sqrt{53}</math> as final answer</p> <p>(iii) [m = ] 3.5 oe and [n = ] -1.5 oe</p> <p>(b) (i) <math>-p + q</math></p> <p>(ii) <math>-\frac{3}{5}p + \frac{3}{5}q</math> oe</p> <p>(iii) Parallel similar 9 : 25 oe</p>	<p>1</p> <p>2</p> <p>6</p> <p>1</p> <p>1 FT</p> <p>1</p> <p>1</p> <p>1</p>	<p>M1 for <math>\sqrt{2^2 + (-7)^2}</math> oe</p> <p>B1 for <math>-2m + 2n = -10</math> oe and B1 for <math>3m - 7n = 21</math> oe and M1 for correct attempt to equate one set of coefficients and M1dep for elimination allow 1 arithmetic error overall ft their sim eqns for both m's or M1 for correct rearrangement (allow 1 slip) and M1dep for correct substitution ft their sim eqns for both m's and A1 for 3.5 or -1.5</p> <p>Condone column vector used</p> <p>Correct or ft <math>\frac{3}{5}</math> (their (b)(i)) dep on <math>ap + bq</math>, [a ≠ 0, b ≠ 0] Condone column vector used</p> <p>Accept enlargement e.g 1 : 2.77 [7] or 0.36 : 1</p>
<p><b>7</b></p>	<p>(a) (i) <math>360 \div 5</math></p> <p>(ii) <math>(180 - 72) \div 2</math> <math>54 \times 2</math></p> <p>(iii) <math>180 - 90 - 72</math></p> <p>(b) <math>2 \times 7 \times \sin(72/2)</math> oe</p> <p>8.228 to 8.229</p>	<p>1</p> <p>M1</p> <p>E1</p> <p>1</p> <p>M2</p> <p>E1</p>	<p>Accept longer correct methods</p> <p>Accept <math>[(5 - 2) \times 180]</math> or <math>360 / 5</math> M1</p> <p>Then <math>\div 5</math> <span style="float: right;">180 - 72 E1</span></p> <p>Accept other methods provided they are fully explained</p> <p>M1 for <math>7 \times \sin(72/2)</math> oe <u>Alt methods</u> M2 for <math>[DC^2 =] 7^2 + 7^2 - 2.7.7 \cos 72</math> or M1 for implicit version or M2 for <math>(7 \sin 72)/\sin 54</math> or M1 for <math>DC/\sin 72 = 7/\sin 54</math> oe</p> <p>Dep on M2 and with no errors seen</p>

Page 6	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2012	0581	41

	<p>(c) (i) 23.3[0..]</p> <p>(ii) 116.5 to 116.52 or 117</p> <p>(iii) 30.78 to 30.8</p> <p>(iv) 12.66 to 12.67 or 12.7</p> <p>(d) 1.43 or 1.432 to 1.453 cao</p>	<p>2 M1 for <math>\frac{1}{2} \times 7 \times 7 \times \sin 72</math> oe</p> <p>1 ft ft their (c)(i) <math>\times 5</math></p> <p>2 M1 for <math>72/360 \times \pi 7^2</math></p> <p>2 M1 for <math>7 + 7 \cos 36</math> oe [7 + 5.66...] e.g. <math>8.23 \cos 54 + 8.23 \sin 72</math> oe [4.84 + 7.83]</p> <p>5 B4 for area of rectangle = 168.3 to 169.2 www or area of triangular corners = 51.6 to 52.5 www or B3 for 13.3 to 13.32 seen or M2 for [ZY =] <math>8.23 + 2(8.23 \sin 18)</math> oe or <math>2(8.23 \sin 54)</math> or <math>2 \times 7 \sin 72</math> oe or B1 for [CY =] 2.54[3] or 5.08 to 5.09 seen or [AX =] 6.65 to 6.66 seen</p>
8	<p>(a) <math>2x + 7</math> final answer <math>x + 9</math> final answer</p> <p>(b) <math>2(2x + 3)(x + 5)</math> at any stage <math>2x^2 + 3x + 10x + 15</math> or better <math>4x^2 + 26x + 30</math></p> <p>(c) (i) <math>4x^2 + 26x - 45 [= 0]</math> soi <math display="block">\frac{-26 \pm \sqrt{(26)^2 - 4(4)(-45)}}{2(4)}</math>  <math>-7.92, 1.42</math> final answers</p> <p>(ii) 6.42 [0...]</p>	<p>2 B1 for each, accept in either order After 0 scored allow SC1 mark for both correct but unsimplified</p> <p>M1 The <math>\times 2</math> could be embedded within one of the brackets e.g. <math>(4x + 6)(x + 5)</math></p> <p>B1 Expands brackets correctly</p> <p>E1 No errors seen and two previous stages shown</p> <p>B1</p> <p>B1 ft ft their <math>4x^2 + 26x \pm k</math> [<math>k \neq 0</math>] oe</p> <p>B1 ft In square root B1 ft for <math>(26)^2 - 4(4)(-45)</math> or better (1396)</p> <p>If in form <math>\frac{p + \sqrt{q}}{r}</math> or ; <math>\frac{p - \sqrt{q}}{r}</math></p> <p>B1 ft for <math>-26</math> and <math>2(4)</math> or better</p> <p>B1 B1 If B0, SC1 for <math>-7.9</math> and <math>1.4</math> or both answers <math>-7.920\dots, 1.420\dots</math> or for <math>-7.92, 1.42</math> seen</p> <p>1 ft ft their greatest positive root If their <math>x \leq 2</math> then ft <math>x + 5</math> If their <math>x &gt; 2</math> then ft <math>2x + 3</math></p>

Page 7	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2012	0581	41

<b>9</b>	<b>(a)</b> $5.79 \times 10^7$ oe 5.21 39.5	<b>1</b> <b>1</b> <b>1</b>	Accept ans in range 57890000 to 57900000 5.207 39.50.... or 39.51 Accept answers to greater than 3sf
	<b>(b) (i)</b> 498.6... to 499	<b>2</b>	<b>M1</b> for $1.496 \times 10^8 \div 300\ 000$
	<b>(ii)</b> 328 or 328.3...	<b>2</b>	<b>M1</b> for figs 197 or figs 328[3.. ] seen Or their $39.5 \times$ their <b>(b)(i)</b>
	<b>(c)</b> 9.46[0] to $9.461 \times 10^{12}$	<b>3</b>	<b>B2</b> for any correct equivalent or <b>M1</b> for $300\ 000 \times 3600 \times 24 \times 365$ oe or for answer figs 946 to 9461
<b>(d)</b> 63200 or 63235 to 63242 oe	<b>2</b>	<b>M1</b> for figs (their <b>(c)</b> $\div$ 1496). Implied by first 3 figs correct	