

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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|---------------|---------------------------------------|-----------------|--------------|
| Page 2 | Mark Scheme: Teachers' version | Syllabus | Paper |
| | IGCSE – May/June 2012 | 0580 | 41 |

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 |
|--------------|------------------------|------------|--|
| 1 (a) | 1134 | 3 | M2 for $\frac{504}{12} \times (12 + 7 + 8)$ soi by answer of 1130 or B1 for 27 or 42 or 294 or 336 seen |
| | (b) (i) | 3 | M2 for $\frac{93}{100} \times 504$ oe soi by 468.7 or 469 or M1 for $\frac{7}{100} \times 504$ (implied by 35.28) |
| | | | M2 for $\frac{64.68}{77} \times 100$ or M1 for $(100 - 23)\% = 64.68$ |
| | (c) | 262.19 cao | 3 |
| (d) | 12.5% | 3 | M2 for $\frac{324 - 288}{288} \times 100$ or M1 for $\frac{324}{288} \times 100$ (112.5) or $\frac{36}{288}$ (0.125) |
| 2 (a) | 10.9 or 10.92... www 4 | 4 | M2 for $4^2 + 9^2 - 2 \times 4 \times 9 \times \cos 108$ If M0 , M1 for correct implicit statement A1 for 119.249...(which can be 3 www) |
| | (b) (i) | 3 | M2 for $9 \times \cos 55$ oe in correct triangle If M0 , B1 for 55 or 35 in correct position soi |
| | | | B2 SC1 for answer 233 |
| (ii) | (0)53 | | |

| Page 3 | Mark Scheme: Teachers' version | Syllabus | Paper |
|--------|--------------------------------|----------|-------|
| | IGCSE – May/June 2012 | 0580 | 41 |

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|--|---|---|--|
| <p>3 (a)</p> <p>(b)</p> <p>(c) (i)</p> <p>(ii)</p> <p>(d)</p> | <p>1 0.98(4) 0 – 0.98(4) – 1</p> <p>9 points plotted</p> <p>smooth curve</p> <p>$y = 0.8$ drawn</p> <p>–1.1 to –1.2, –0.4 to –0.5, 1.55 to 1.65</p> <p>correct tangent drawn at $x = -1.5$ 4 to 5.5</p> | <p>B3</p> <p>P3ft</p> <p>C1</p> <p>B1</p> <p>1, 1, 1</p> <p>T1</p> <p>B2</p> | <p>B2 for 4 correct, B1 for 3 correct</p> <p>B2 for 7 or 8 points correct B1 for 5 or 6 points correct</p> <p>correct cubic 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 M1 for evidence rise/run with correct scales dep on T1</p> |
| <p>4 (a)</p> <p>(b)</p> <p>(c)</p> <p>(d) (i)</p> <p>(ii)</p> <p>(e)</p> | <p>90</p> <p>$\tan(\angle ACB) = 7 \div 10$ oe 34.9(9...)</p> <p>same segment</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>B1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>3</p> <p>2</p> <p>3</p> | <p>Any longer method must reach equivalent stage</p> <p>Allow same arc oe</p> <p>M2 for $\frac{7 \times \sin 77}{\sin 35}$</p> <p>or M1 for implicit form</p> <p>M1 for $0.5 \times 7 \times \text{their (d)(i)} \times \sin(180 - 77 - 35)$ oe</p> <p>Allow 68.00 to 68.01 for 68</p> <p>M2 for $12.3 \times \left(\frac{10}{\text{their } 11.9}\right)^2$</p> <p>or M1 for $\left(\frac{10}{\text{their } 11.9}\right)^2$ or reciprocal seen</p> |
| <p>5 (a) (i)</p> <p>(ii)</p> <p>(iii)</p> <p>(b)</p> <p>(c) (i)</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>1</p> <p>1</p> <p>1ft</p> <p>1</p> <p>2</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>B1 for 2 correct</p> |

| Page 4 | Mark Scheme: Teachers' version | Syllabus | Paper |
|--------|--------------------------------|----------|-------|
| | IGCSE – May/June 2012 | 0580 | 41 |

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

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|---------|--|-------------|--|
| 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° | 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 | |

| Page 6 | Mark Scheme: Teachers' version | Syllabus | Paper |
|--------|--------------------------------|----------|-------|
| | IGCSE – May/June 2012 | 0580 | 41 |

| | | | |
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| 9 (a) (i) | 14 | 1 | |
| (ii) | $13 - 2x$ | 2 | M1 for $7 - 2(x - 3)$ |
| (iii) | $25x^2 - 8$ final answer | 1 | |
| (b) | $\frac{7-x}{2}$ oe | 2 | M1 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 | M1 for $(3x + 5)^2 - 8$ seen B1 for $9x^2 + 30x + 25$ |
| (d) | 7 cao | 3 | M2 for $3(3x + 5) + 5 = 83$ or better or B1 for $3(3x + 5) + 5$ oe |
| (e) | $x < -\frac{3}{8}$ oe cao | 3 | M1 for $2(3x + 5) < 7 - 2x$ oe B1 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 648π 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 | B1 | accept $9 \times \frac{8}{24}$ oe |
| | 1958 to 1964.(...) | M1 | (= 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 | M1 dep | [alternate method M1 for ratio sides 1:3 M1 ratio vols 1 : 27 M1 <i>their</i> (a) $\times 26 \div 27$] 624 π implies B1 M2 or M3 |
| | | E1 | must see a figure after decimal point if 1960 |
| | | M1 | |
| | | M1 | implied by 8.318... |
| | | M1 | dep on M1 M1 |
| | | E1 | SC2 for $5 \times \pi \times 2.9^2 \times 15 = 1980$ to 1982 |