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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

**MARK SCHEME for the May/June 2011 question paper  
for the guidance of teachers**

**0580 MATHEMATICS**

**0580/43**

Paper 4 (Extended), maximum raw mark 130

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| Page 2 | Mark Scheme: Teachers' version | Syllabus | Paper |
|--------|--------------------------------|----------|-------|
|        | IGCSE – May/June 2011          | 0580     | 43    |

### 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> | <b>(i)</b> 34.65                                                   | 1    |                                                                                                                                                            |
|              | <b>(ii)</b> 41.58                                                  | 2    | M1 for $0.15 \times 277.2$ implied by 41.6 or 41.58 seen and not spoiled                                                                                   |
|              | <b>(iii)</b> 264                                                   | 3    | M2 for $277.2 \div (1 + 0.05)$ o.e. or M1 for recognition that $105(\%) = 277.20$                                                                          |
|              | <b>(b)</b>                                                         |      |                                                                                                                                                            |
|              | <b>(i)</b> 1000                                                    | 2    | M1 for $2200 \div (2 + 4 + 5) \times 5$                                                                                                                    |
|              | <b>(ii)</b> 3650                                                   | 2    | M1 for $2200 \div 44 \times 73$                                                                                                                            |
| <b>2 (a)</b> | <b>(i)</b> Image at (4, -4), (6, -4), (6, -6), (2, -6)             | 2    | SC1 for reflection in y-axis                                                                                                                               |
|              | <b>(ii)</b> Image at (-4, -4), (-4, -6), (-6, -6), (-6, -2)        | 2 ft | SC1 ft if rotated $90^\circ$ anti-clockwise about (0, 0)                                                                                                   |
|              | <b>(iii)</b> Reflection<br>$y = -x$                                | 1 ft | ft their Z (name of transformation)                                                                                                                        |
|              |                                                                    | 1 ft | independent (full details)                                                                                                                                 |
|              | <b>(b)</b>                                                         |      |                                                                                                                                                            |
|              | <b>(i)</b> Image at (2, 2), (3, 2), (3, 3), (1, 3)                 | 2    | SC1 for enlargement s.f. 0.5 with correct orientation, different centre or sf - 0.5, centre (0, 0)                                                         |
|              | <b>(ii)</b> $\begin{pmatrix} 0.5 & 0 \\ 0 & 0.5 \end{pmatrix}$ cao | 2    | B1 B1 each column                                                                                                                                          |
|              | <b>(c)</b>                                                         |      |                                                                                                                                                            |
|              | <b>(i)</b> Image at (0, 4), (2, 4), (0, 6), (-4, 6)                | 2    | SC1 if 3 vertices correct                                                                                                                                  |
|              | <b>(ii)</b> $\begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}$        | 2    | SC1 for $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}$ , $k \neq 0$ but can be algebraic or numeric or for $\begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix}$ |

| Page 3 | Mark Scheme: Teachers' version | Syllabus | Paper |
|--------|--------------------------------|----------|-------|
|        | IGCSE – May/June 2011          | 0580     | 43    |

|          |                                                                              |    |                                                                                                                                                                                                                                                                                                                                                                     |
|----------|------------------------------------------------------------------------------|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 (a)    | $(x + 5)^2 - 2x^2 = 1$ oe                                                    | M1 | Equiv means equation in the three parts, allowing $(x + 5)^2$ expanded                                                                                                                                                                                                                                                                                              |
|          | $(x + 5)^2 = x^2 + 10x + 25$ or<br>$x^2 + 5x + 5x + 25$                      | B1 |                                                                                                                                                                                                                                                                                                                                                                     |
|          | $x^2 + 10x + 25 - 2x^2 = 1$<br>$0 = x^2 - 10x - 24$                          | E1 | For final line reached without any errors or omissions after any previous line with $(x + 5)^2$ expanded                                                                                                                                                                                                                                                            |
| (b)      | 12                                                                           | 3  | M2 for $(x - 12)(x + 2)$ or full correct expression from formula.<br>Allow SC1 for $(x + a)(x + b)$ and $ab = -24$ or $a + b = -10$<br>then SC1 <b>ft</b> (dependent on quadratic factors or two roots from formula) for correct selection of +ve root, if only one +ve.<br>Answer of 12 and -2 scores M2 only                                                      |
| (c)      | 53.1 to 53.2    www 3                                                        | 3  | M2 for $2 \times \tan^{-1}(\frac{1}{2})$ o.e. i.e. any <b>complete</b> method<br>or M1 for $\tan = \frac{1}{2}$ o.e. i.e. any correct method leading to any angle in diagram (expressions can be implicit and bod which angle is being worked out) (Implied by 26.56 to 26.57 or 26.6, 63.43 to 63.44 or 63.4, 126.8 to 126.9)<br>53 or 127 without working score 0 |
| 4 (a)    | $(\cos(A)) = \frac{6^2 + 8^2 - 9^2}{2 \cdot 6 \cdot 8}$<br>78.58...    www 4 | M2 | M1 for correct implicit equation with $\cos A$                                                                                                                                                                                                                                                                                                                      |
|          |                                                                              | A2 | A1 for 0.1979 to 0.198 (this implies M2)                                                                                                                                                                                                                                                                                                                            |
|          |                                                                              | 1  | Allow 78.58...                                                                                                                                                                                                                                                                                                                                                      |
| (b) (i)  | 78.6                                                                         |    |                                                                                                                                                                                                                                                                                                                                                                     |
| (b) (ii) | $r = \frac{4.5}{\sin(78.6)}$ oe                                              | M2 | (M1 for $\sin(78.6) = \frac{4.5}{r}$ )                                                                                                                                                                                                                                                                                                                              |
|          | 4.590 to 4.591    cao    www 3                                               | A1 | Allow 78.58... or their angle <i>BOM</i> for M2 or M1                                                                                                                                                                                                                                                                                                               |
| (c)      | 35.5 (35.48 to 35.57...) cao    www 4                                        | 4  | M1 Area triangle = $0.5 \times 6 \times 8 \times \sin(78.6)$ oe<br>Allow 78.58.. (23.52..)<br>M1 Circle = $\pi \times 4.59^2$ Allow 4.590 to 4.591 (66.15 to 66.22...)<br>M1 ( <b>dependent</b> ) % = triangle / circle $\times 100$<br>Dependent on first 2 M's                                                                                                    |

| Page 4 | Mark Scheme: Teachers' version | Syllabus | Paper |
|--------|--------------------------------|----------|-------|
|        | IGCSE – May/June 2011          | 0580     | 43    |

|       |                                                                                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------|------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5 (a) | 9.11, 4.25, 2, ..., 2, 4.25, 9.11                                                                                            | 3              | B2 for 4 or 5 correct and B1 for 2 or 3 correct                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|       | (b) 12 points plotted<br>Smooth curve through 12 points<br>Two branches, neither touching y-axis                             | 5              | P3, <b>ft</b> their (a), P2 for 10 or 11 points, P1 for 8 or 9.<br>C1 correct shape <b>ft</b> their points shape same.<br>Ignore anything between – 0.5 and 0.5.<br>B1 independent                                                                                                                                                                                                                                                                                                                                                                                                           |
|       | (c) (i) $x = 0$<br>(ii) tangent at –1.5<br>–3 to –1.8                                                                        | 1<br>T1<br>2   | <b>Dependent</b> on tangent<br>M1(also dep on T1) for attempt at rise/run or SC1 for 1.8 to 3<br>B1 for 1 or more correct                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|       | (iii) –1.7 to –1.55, –0.7 to –0.55,<br>0.55 to 0.7, 1.55 to 1.7                                                              | 2              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|       | (iv) $y = 2x$ drawn to meet graph twice<br>1<br>1.8 to 1.9                                                                   | B1<br>B1<br>B1 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 6 (a) | (i) 5.8                                                                                                                      | 1              | SC1 for 28 or 29                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|       | (ii) 4.6 to 4.65                                                                                                             | 1              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|       | (iii) 2.35 to 2.5                                                                                                            | 1              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|       | (iv) 172 or 171                                                                                                              | 2              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|       | (b) (i) 72 to 76, 38 to 42<br>(ii) Their correct $\Sigma fx \div 200$                                                        | 2<br>4         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|       | (iii) $p \div 2, q$ , where $p, q$ are from (b)(i)<br>Histogram with two new columns of correct width<br>Two correct heights | 2ft<br><br>2ft | Must be integers. B1 either.<br>M1 for 3 or 4 correct mid-values seen 2, 5, 6.5, 8.5<br>M1 for $\Sigma fx$ , <b>ft</b> their frequencies and $x$ anywhere in interval, including boundaries<br>$36 \times 2 + (72 \text{ to } 76) \times 5 + (38 \text{ to } 42) \times 6.5 + 50 \times 8.5$<br>M1 for $\div 200$ or their 200 (dependent on second M1)<br>(74, 40 give 1127 then 5.635 (or 5.64 or 5.63))<br>Other pairs of frequencies from (b)(i) must have a sum of 114 to gain the A mark.<br>B1 either <b>ft</b> (ft their table)<br><br>B1<br>B1 <b>ft</b> (ft their freq. densities) |

| Page 5 | Mark Scheme: Teachers' version | Syllabus | Paper |
|--------|--------------------------------|----------|-------|
|        | IGCSE – May/June 2011          | 0580     | 43    |

|       |                                                                          |     |                                                                                                                                                                                                                                                                                                                                                                        |
|-------|--------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7 (a) | Correct tree diagram.                                                    | 5   | B1 for labels flower and not flower<br>First pair B1 for $\frac{7}{10}$ and $\frac{3}{10}$<br>B1 for next three branches after flowers<br>B1 for clear labels for colours<br>B1 for $\frac{2}{3}$ , $\frac{1}{4}$ and $\frac{1}{12}$ in correct places<br>If three branches at ends of both branches of first pair, lose final B, unless probabilities of 0 indicated. |
|       | (b) $\frac{33}{40}$ o.e. (0.825) cao                                     | 3   | M2 for $1 - \frac{7}{10} \times \frac{1}{4}$ (M1 for $\frac{7}{10} \times \frac{1}{4}$ or $\frac{7}{10} \times (1 - \frac{1}{4})$ ) oe<br>or<br>M2 for $\frac{3}{10} + \frac{7}{10} \times \frac{2}{3} + \frac{7}{10} \times \text{their } \frac{1}{12}$<br>or $\frac{3}{10} + \frac{7}{10} \times \frac{3}{4}$ oe                                                     |
|       | (c) 7 cao                                                                | 2   | M1 for $120 \times \frac{7}{10} \times \text{their } \frac{1}{12}$                                                                                                                                                                                                                                                                                                     |
| 8 (a) | Arc centre $D$ , radius 6 cm                                             | 1   |                                                                                                                                                                                                                                                                                                                                                                        |
|       | (b) (i) Perp bisector of $AB$ , with two pairs of arcs                   | 2   | At least 3 cm from $AB$ . SC1 accurate without arcs or accurate arcs (but no choice)                                                                                                                                                                                                                                                                                   |
|       | (ii) Bisector of angle $B$ , with arcs                                   | 2   | At least 5 cm from $B$ . SC1 accurate without arcs or accurate arcs (but no choice)                                                                                                                                                                                                                                                                                    |
|       | (c) (i) $Q$ at intersection of loci                                      | 1   | Dependent on at least both SC1's                                                                                                                                                                                                                                                                                                                                       |
|       | (ii) 2.7 cm to 2.9 cm cao                                                | 1   | Dependent on (c)(i)                                                                                                                                                                                                                                                                                                                                                    |
| 9 (a) | (d) Region inside arc, to left of perp bisector and below angle bisector | 1   | Dependent on at least both SC1's in (b)                                                                                                                                                                                                                                                                                                                                |
|       | (i) 81                                                                   | 2   | B1 for $(f(2) =) 7$                                                                                                                                                                                                                                                                                                                                                    |
|       | (ii) 8.5                                                                 | 2   | B1 for $(f(0.5) =) 2.5$                                                                                                                                                                                                                                                                                                                                                |
|       | (b) $\frac{x-1}{3}$ oe                                                   | 2   | M1 for $(x =) \frac{y-1}{3}$ or $(x =) \frac{f(x)-1}{3}$<br>or $3y = x - 1$ or $3f(x) = x - 1$<br>or $-1$ then $\div 3$ in flowchart (must be clear)                                                                                                                                                                                                                   |
|       | (c) $3x^2 + 12x + 13$ final answer                                       | 2   | M1 for $3(x+2)^2 + 1$ or better                                                                                                                                                                                                                                                                                                                                        |
| (d)   | $(x =) \frac{-3 \pm \sqrt{3^2 - 4(1)(1)}}{2(1)}$                         | 2   | B1 for $\sqrt{3^2 - 4(1)(1)}$ or better Seen anywhere<br>If in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ oe,<br>B1 for $p = -3$ and $r = 2(1)$<br>or $(x + \frac{3}{2})^2$ B1 then $\sqrt{\frac{9}{4} - 1}$ B1                                                                                                                                         |
|       | -2.62, -0.38 final answer                                                | 1,1 | If 0, SC1 for -2.6 or -2.62 or -2.618...<br>and -0.4(0) or -0.38 or -0.382 to -0.381 seen<br><b>Answers only B1 B1</b>                                                                                                                                                                                                                                                 |

| Page 6 | Mark Scheme: Teachers' version | Syllabus | Paper |
|--------|--------------------------------|----------|-------|
|        | IGCSE – May/June 2011          | 0580     | 43    |

|               |                                                                              |      |                                                                                                                                                                 |
|---------------|------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>10 (a)</b> | <b>(i) (a)</b> $\mathbf{p} + \mathbf{q}$                                     | 1    |                                                                                                                                                                 |
|               | <b>(b)</b> $\frac{1}{2}\mathbf{p} - \frac{1}{2}\mathbf{q}$ oe                | 2    | M1 for $\overrightarrow{LC} + \overrightarrow{CM}$ o.e. can be written in terms of $\mathbf{p}$ and/or $\mathbf{q}$                                             |
|               | <b>(c)</b> $\frac{3}{4}\mathbf{p} + \frac{3}{4}\mathbf{q}$ oe cao            | 2    | M1 for $\overrightarrow{AD} + \overrightarrow{DL} + \overrightarrow{LN}$ o.e can be written in terms of $\mathbf{p}$ and/or $\mathbf{q}$ ft their <b>(i)(b)</b> |
|               | <b>(ii)</b> $\overrightarrow{AN}$ is a multiple of $\overrightarrow{AC}$ o.e | 1    | Must be vectors (dependent on answers to <b>(a)</b> , <b>(c)</b> )                                                                                              |
| <b>(b)</b>    | <b>(i)</b> 30                                                                | 2    | M1 for $2x + x + 15 + 75 = 180$ or better                                                                                                                       |
|               | <b>(ii)</b> 135                                                              | 1ft  | ft 165 – their $x$ but only if final answer obtuse                                                                                                              |
| <b>11 (a)</b> | <b>(i)</b> 10                                                                | 1    |                                                                                                                                                                 |
|               | <b>(ii)</b> $\frac{3 \times 4}{2}$ or $\frac{3 \times (3+1)}{2}$ (= 6)       | 1    |                                                                                                                                                                 |
|               | <b>(iii)</b> 7260                                                            | 1    |                                                                                                                                                                 |
|               | <b>(iv)</b> 12 840                                                           | 2    | M1 for $S_{200} - S_{120}$ ( $20100 - 7260$ ) or $\frac{80}{2}(121 + 200)$ o.e.                                                                                 |
|               | <b>(v)</b> 160 400                                                           | 2    | M1 for $2(1 + 2 + 3 + \dots + 400)$ o.e.                                                                                                                        |
|               | <b>(b)</b> <b>(i)</b> 36, 100                                                | 1, 1 | Ignore right-hand column                                                                                                                                        |
|               |                                                                              | 1    |                                                                                                                                                                 |
|               | <b>(ii)</b> 11025                                                            | 1    |                                                                                                                                                                 |
|               | <b>(iii)</b> $\left[ \frac{n(n+1)}{2} \right]^2$ oe                          | 1    | isw                                                                                                                                                             |
|               | <b>(iv)</b> 3 348 900                                                        | 1    | M1 for square root then $\times 2$ (1056)                                                                                                                       |
|               | <b>(v)</b> 32                                                                | 2    | or SC1 for answer 33                                                                                                                                            |