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**CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
International General Certificate of Secondary Education

## **MARK SCHEME for the May/June 2014 series**

### **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.

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

Cambridge will not enter into discussions about these mark schemes.

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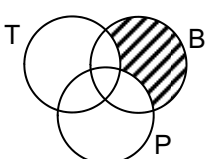
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## Abbreviations

|     |                            |
|-----|----------------------------|
| cao | correct answer only        |
| dep | dependent                  |
| FT  | follow through after error |
| isw | ignore subsequent working  |
| oe  | or equivalent              |
| SC  | Special Case               |
| nfw | not from wrong working     |
| soi | seen or implied            |

| Qu |         | Answers                                                                          | Mark                   | Part Marks                                                                                                                                                                                             |
|----|---------|----------------------------------------------------------------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | (a) (i) | $\begin{pmatrix} 6 & 4 \\ -2 & 2 \end{pmatrix}$                                  | 1                      |                                                                                                                                                                                                        |
|    | (ii)    | Not possible                                                                     | 1                      |                                                                                                                                                                                                        |
|    | (iii)   | $\begin{pmatrix} 6 & 4 \\ -2 & 2 \end{pmatrix}$                                  | 2                      | <b>B1</b> for one row or column correct                                                                                                                                                                |
|    | (iv)    | $\frac{1}{5}\begin{pmatrix} 1 & -2 \\ 1 & 3 \end{pmatrix}$ oe isw                | 2                      | <b>B1</b> for $\frac{1}{5}\begin{pmatrix} a & c \\ b & d \end{pmatrix}$ seen or $k\begin{pmatrix} 1 & -2 \\ 1 & 3 \end{pmatrix}$ seen                                                                  |
|    | (b)     | 1 column in <b>C</b> and 2 rows in <b>D</b>                                      | 1                      | Any clear indication                                                                                                                                                                                   |
|    | (c)     | Enlargement<br>[Factor] 2<br>[Centre] (0, 0) oe                                  | 1<br>1<br>1            |                                                                                                                                                                                                        |
| 2  | (a)     | 8                                                                                | 2                      | <b>M1</b> for $12 \div 1.5$ oe                                                                                                                                                                         |
|    | (b)     | [Distance =] 36<br><i>their</i> $36 \div 3 [= 12]$ oe                            | <b>B1</b><br><b>M1</b> |                                                                                                                                                                                                        |
|    | (c)     | 200                                                                              | 2                      | <b>M1</b> for $12 \times 1000 \div 60$ oe<br>e.g. $36000 \div 180$                                                                                                                                     |
|    | (d)     | Horizontal line at 36 to 13 45<br>( <i>their</i> 13 45, 36) joined to (16 42, 0) | 1<br><b>1FT</b>        |                                                                                                                                                                                                        |
| 3  | (a)     | 62 705                                                                           | 2                      | <b>M1</b> for $75246 \div 6$ soi by 12 541<br>or $75246 \times 5$                                                                                                                                      |
|    | (b)     | 10.9 or 10.88...                                                                 | 3                      | <b>M2</b> for $\frac{(150\,675 - 135\,890)}{135\,890} \times 100$ oe<br><br><b>or</b><br><b>M1</b> for correct fraction soi by 0.1088...<br>or $\frac{150\,675}{135\,890} \times 100$ soi by 110.88... |

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| Qu |          | Answers                                                                                                       | Mark                                        | Part Marks                                                                                                                                                                                                                                                                                                                           |
|----|----------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | (c)      | 127 000                                                                                                       | 3                                           | <b>M2</b> for $135\,890 \div 1.07$ oe<br><b>or</b><br><b>M1</b> for 135 890 associated with 107%                                                                                                                                                                                                                                     |
|    | (d) (i)  | 59 112 to 59 113 or 59 100 or 59 110<br>or 59 119 to 59 120 or 59 100<br>nfw                                  | 3                                           | <b>M2</b> for $\pi \times 21 \times (30^2 - 2^2)$ oe<br><b>Or</b><br><b>M1</b> for $\pi \times 21 \times 30^2$ or $\pi \times 21 \times 2^2$                                                                                                                                                                                         |
|    | (ii) (a) | 0.0125                                                                                                        | 1                                           |                                                                                                                                                                                                                                                                                                                                      |
|    | (b)      | 7580 or 7582 or 7581 or 7583 nfw                                                                              | 4                                           | <b>M1</b> for $21 \times 29.7 \times \text{their } 0.0125$<br>[=7.796 or 7.8[0]]<br><b>and</b><br><b>M1</b> for<br>$\text{their (d)(i)} \div (21 \times 29.7 \times \text{their } 0.0125)$<br><b>A1</b> for 7580 to 7583.2 (non integer)<br><br>If 0 then <b>SC1</b> for<br>$\text{their (d)(i)} \div (21 \times 29.7 \times 0.125)$ |
| 4  | (a)      | 4 – x correctly placed<br>5 – x correctly placed<br>7 correctly placed                                        | 1<br>1<br>1                                 | <b>SC3</b> for 1, 2 and 7 all correctly placed<br>instead of expressions in x                                                                                                                                                                                                                                                        |
|    | (b)      | $4 + 11 + (6 - x) + x + 9 + (4 - x) + (5 - x) + 7 = 40$ oe<br><br>$46 - 2x = 40$ nfw<br><br>$x = 3$           | <b>M1</b><br><br><b>A1</b><br><br><b>B1</b> | FT from their Venn diagram, condone omission of one subset<br><br>Must be in the form $a + bx = c$ , ie each side simplified, or better                                                                                                                                                                                              |
|    | (c) (i)  | $\frac{9}{40}$ or 0.225 or 22.5%                                                                              | 1                                           | ISW cancelling or conversion after correct answer seen                                                                                                                                                                                                                                                                               |
|    | (ii)     | 2                                                                                                             | 1FT                                         | FT from their Venn diagram and their x provided $n(B \cap P \cap T') \neq 5$                                                                                                                                                                                                                                                         |
|    | (iii)    | 15                                                                                                            | 1FT                                         | FT from their Venn diagram                                                                                                                                                                                                                                                                                                           |
|    | (iv)     | 25                                                                                                            | 1FT                                         | FT from their Venn diagram                                                                                                                                                                                                                                                                                                           |
|    | (v)      | 4                                                                                                             | 1                                           |                                                                                                                                                                                                                                                                                                                                      |
|    | (d)      | Correct region shaded.<br> | 1                                           |                                                                                                                                                                                                                                                                                                                                      |

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| Qu |         | Answers                                              | Mark | Part Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----|---------|------------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5  | (a)     | [0]44 to [0]48                                       | 1    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|    | (b)     | 12.6 to 13.2                                         | 2    | <b>B1</b> for 8.4 to 8.8 seen                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|    | (c)     | 340                                                  | 1    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|    | (d)     | 1 : 150 000                                          | 2    | <b>M1</b> for $\times 100\,000$ soi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|    | (e)     | Arcs for perp bisector of <i>SL</i>                  | 1    | Two pairs of correct arcs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|    |         | Ruled perp bisector of <i>SL</i>                     | 1    | Within tolerance of overlay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|    |         | Arcs for bisector of angle <i>PSL</i>                | 1    | Marks on <i>PS</i> and <i>SL</i> plus one pair of correct arcs                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|    |         | Ruled bisector of angle <i>PSL</i>                   | 1    | Within tolerance of overlay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|    |         | B marked within accuracy                             | 1    | Within tolerance of overlay<br>Dep on two correct bisectors drawn                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|    | (f)     | 3.375                                                | 2    | <b>M1</b> for $1.5 \times 1.5^2$ or $(2/3)^2$ seen                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 6  | (a) (i) | 0.6 oe                                               | 2    | <b>M1</b> for $0.2 + 0.4$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|    | (ii)    | 1500                                                 | 1    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|    | (iii)   | 0.03 oe                                              | 2    | <b>M1</b> for $0.1 \times 0.3$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|    | (b)     | $\frac{112}{132}$ oe $\frac{28}{33} = 0.848[4\dots]$ | 3    | <b>M2</b> for $1 - \frac{5}{12} \times \frac{4}{11}$<br>or $\frac{7}{12} \times \frac{5}{11} + \frac{5}{12} \times \frac{7}{11} + \frac{7}{12} \times \frac{6}{11}$<br>or $\frac{7}{12} + \frac{5}{12} \times \frac{7}{11}$<br><b>or</b><br><b>M1</b> for addition of any two of<br>$\frac{7}{12} \times \frac{5}{11}$ , $\frac{5}{12} \times \frac{7}{11}$ , $\frac{7}{12} \times \frac{6}{11}$<br>or sum of 3 products with an error in the numerator of one product<br>or for $\frac{5}{12} \times \frac{4}{11}$ identified |

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| Qu |         | Answers                                           | Mark        | Part Marks                                                                                                                                                                                                                                                                                              |
|----|---------|---------------------------------------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7  | (a) (i) | Image: $(-4, -3), (-4, -1), (-3, -1)$             | 2           | SC1 for translation $\begin{pmatrix} -5 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -4 \end{pmatrix}$                                                                                                                                                                                                  |
|    | (ii)    | Image: $(1, -1), (3, -1), (3, -2)$                | 2           | SC1 for rotation about the origin but $90^\circ$ anticlockwise                                                                                                                                                                                                                                          |
|    | (b) (i) | Image: $(2, 1), (2, 3), (4, 3)$                   | 3           | B2 for 2 correct vertices plotted<br>or<br>SC2 for 3 vertices shown in working<br>or<br>SC1 for 2 vertices shown in working<br>or<br>M1 $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix} \times \begin{pmatrix} 1 & 1 & 2 \\ 1 & 3 & 3 \end{pmatrix}$                                                      |
|    | (ii)    | Stretch<br>[factor] 2<br>Invariant line y-axis oe | 1<br>1<br>1 | Accept $x = 0$ , stays the same                                                                                                                                                                                                                                                                         |
|    |         |                                                   |             |                                                                                                                                                                                                                                                                                                         |
| 8  | (a)     | 2.125 and 2.375                                   | 2           | B1 for one correct value                                                                                                                                                                                                                                                                                |
|    | (b)     | Correct curve                                     | B4          | B3FT for 11 correct plots<br>or<br>B2FT for 9 or 10 correct plots<br>or<br>B1FT for 7 or 8 correct plots                                                                                                                                                                                                |
|    | (c)     | Ruled tangent at $x = 2$                          | B1          | No daylight at $x = 2$ . Consider point of contact as midpoint between two vertices of daylight, this must be between $x = 1.8$ and $2.2$                                                                                                                                                               |
|    |         | Gradient from 7.8 to 10.2                         | 2           | Dep on B1 awarded<br>Allow integer/integer or a mixed number if within range<br>or<br>M1 dep for $(\text{change in } y) \div (\text{change in } x)$<br>Dependent on any tangent drawn or close attempt at a tangent at <u>any</u> point<br>Must see correct or implied calculation from a drawn tangent |
|    |         |                                                   |             |                                                                                                                                                                                                                                                                                                         |
|    | (d)     | 0 and $-1.75$ to $-1.65$ and $1.65$ to $1.75$     | 2           | B1 for two correct values                                                                                                                                                                                                                                                                               |
|    | (e)     | $-1.2$ to $-0.8 < k < 2.8$ to $3.2$               | 2           | B1 for each correct<br>or SC1 for reversed answers                                                                                                                                                                                                                                                      |

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| Qu |         | Answers                                             | Mark      | Part Marks                                                                                                                                                                                                                                                                                              |
|----|---------|-----------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9  | (a) (i) | 37.5 to 38.5                                        | 1         |                                                                                                                                                                                                                                                                                                         |
|    | (ii)    | 19.5 to 20.5 nfw                                    | 2         | <b>B1</b> for [LQ =] 23.5 to 24<br>or [UQ =] 43.5 to 44                                                                                                                                                                                                                                                 |
|    | (iii)   | 43                                                  | 2         | <b>B1</b> for 56 seen or horizontal line drawn at<br>cf = 56                                                                                                                                                                                                                                            |
|    | (b) (i) | 31.8[4...] nfw                                      | 4         | <b>M1</b> for midpoints soi (condone 1 error<br>or omission)<br>and<br><b>M1</b> for use of $\sum ft$ with $t$ in correct<br>interval including both boundaries<br>(condone 1 further error or<br>omission)<br>and<br><b>M1</b> (dep on 2 <sup>nd</sup> M1) for $\sum ft \div 80$<br>(2547.5 $\div$ 80) |
|    | (ii)    | Correct histogram                                   | 4         | <b>B1</b> for each correct block with correct<br>width and height<br>If <b>B0</b> then <b>SC1</b> for four correct f.d.s<br>or four correct widths                                                                                                                                                      |
| 10 | (a) (i) | 5                                                   | 1         |                                                                                                                                                                                                                                                                                                         |
|    | (ii)    | $-2\frac{1}{3}$ oe                                  | 2         | <b>B1</b> for $[h(-1) =] \frac{1}{3}$ soi<br>or<br><b>M1</b> for $2(3^x) - 3$                                                                                                                                                                                                                           |
|    | (iii)   | $\frac{x+3}{2}$ or $\frac{x}{2} + 1.5$ as final ans | 2         | <b>M1</b> for $y + 3 = 2x$ or $x = 2y - 3$<br>or $\frac{y}{2} = x - 1.5$ or better or correct reverse<br>flowchart                                                                                                                                                                                      |
|    | (iv)    | $4x - 9$ as final answer nfw                        | 2         | <b>M1</b> for $2(2x - 3) - 3$                                                                                                                                                                                                                                                                           |
|    | (v)     | $(2x - 3)(x + 1) = 1 + 2(x + 1)$                    | <b>M1</b> | $(2x - 5)(x + 1) = 1$ (eliminate fractions)                                                                                                                                                                                                                                                             |
|    |         | $2x^2 - 3x + 2x - 3$ or better seen                 | <b>B1</b> | $2x^2 - 5x + 2x - 5$ or better seen                                                                                                                                                                                                                                                                     |
|    |         | $2x^2 - 3x - 6 = 0$                                 | <b>A1</b> | No errors or omissions seen                                                                                                                                                                                                                                                                             |

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| Qu        |         | Answers                                                                                                         | Mark                       | Part Marks                                                                                                                                                                                                        |
|-----------|---------|-----------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | (vi)    | $\frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 2 \times -6}}{2 \times 2}$                                             | <b>B2</b>                  | <b>B1</b> for $\sqrt{(-3)^2 - 4 \times 2 \times -6}$ or better [ $\sqrt{57}$ ]<br>and if in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$<br><b>B1</b> for $p = -(-3)$ and $r = 2 \times 2$ or better |
|           |         | 2.64 and $-1.14$ cao                                                                                            | <b>B1B1</b>                | <b>SC1</b> for 2.64 <b>and</b> $-1.14$ seen in working<br>or 2.6 <b>and</b> $-1.1$ as final ans<br>or 2.637. <b>and</b> $-1.137..$ as final ans<br>or $-2.64$ <b>and</b> 1.14 as final ans                        |
|           | (b)     | $\frac{x-1}{x+5}$ as final answer nfw                                                                           | <b>4</b>                   | <b>B3</b> for $(x-1)(x-2)$ and $(x+5)(x-2)$<br><b>or B2</b> for $(x-1)(x-2)$ or $(x+5)(x-2)$<br><b>or SC1</b> for $(x+a)(x+b)$ where<br>$a+b=3$ or $-3$ or $ab=2$ or $-10$                                        |
| <b>11</b> | (a) (i) | $(-5, 7)$                                                                                                       | <b>1</b>                   |                                                                                                                                                                                                                   |
|           | (ii)    | 5                                                                                                               | <b>2</b>                   | <b>M1</b> for $\sqrt{(-3)^2 + 4^2}$ or better                                                                                                                                                                     |
|           | (b) (i) | (a) $\frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$ or $\frac{1}{5}(3\mathbf{a} + 2\mathbf{b})$<br>final answer | <b>2</b>                   | <b>M1</b> for any correct vector path for $\overrightarrow{ON}$                                                                                                                                                   |
|           |         | (b) $\frac{2}{5}\mathbf{a}$                                                                                     | <b>2</b>                   | <b>M1</b> for any correct vector path for $\overrightarrow{NY}$                                                                                                                                                   |
|           | (ii)    | $NY = \frac{2}{5}BC$ oe<br>[NY] parallel to [BC]                                                                | <b>1dep</b><br><b>1dep</b> | <b>dep</b> on (b)(i)(b) correct<br><b>dep</b> on $\overrightarrow{NY} = k\mathbf{a}$ , $k \neq 1$                                                                                                                 |