

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

**0580 MATHEMATICS**

**0580/42**

Paper 4 (Extended), maximum raw mark 130

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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### Abbreviations

|     |                            |
|-----|----------------------------|
| cao | correct answer only        |
| cso | correct solution only      |
| dep | dependent                  |
| ft  | follow through after error |
| isw | ignore subsequent working  |
| oe  | or equivalent              |
| SC  | Special Case               |
| www | without wrong working      |
| art | anything rounding to       |
| soi | seen or implied            |

| Qu.          | Answers                                                                   | Mark | Part Marks                                                                                                                                                                                                                                                 |
|--------------|---------------------------------------------------------------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1 (a)</b> | <b>(i)</b> 25                                                             | 1    |                                                                                                                                                                                                                                                            |
|              | <b>(ii)</b> 15.5 (15.46 to 15.47)                                         | 1    |                                                                                                                                                                                                                                                            |
|              | <b>(iii)</b> 0.05 oe                                                      | 2    | B1 for 1/100 or 0.01 seen                                                                                                                                                                                                                                  |
|              | <b>(b)</b> 8812.50 final answer      www 3                                | 3    | Condone 8812.5<br>M2 for $7500 \times 5 \times 0.035 + 7500$ oe (implied by final answers 8810, 8812, 8813 or 8812.5(0) seen)<br>or B2 for 1312.5 as final answer<br>or M1 for $7500 \times 5 \times 0.035$ oe (implied by final answers 1310, 1312, 1313) |
|              | <b>(c)</b> <b>(i)</b> $2^2 \times 3 \times 5$                             | 2    | Allow $2 \times 2 \times 3 \times 5$<br>M1 for any correct <u>product</u> of 3 factors = 60 seen or correct factor ladder or correct tree (condone 1's on tree/ladder)                                                                                     |
|              | <b>(ii)</b> 12                                                            | 2    | M1 for $2^2 \times 3$ or $2 \times 2 \times 3$ oe                                                                                                                                                                                                          |
|              | <b>(iii)</b> 240                                                          | 2    | M1 for $2^4 \times 3 \times 5$ or $2 \times 2 \times 2 \times 2 \times 3 \times 5$ oe<br>SC2 only for both correct answers <b>(ii)</b> <b>(iii)</b> reversed                                                                                               |
| <b>2 (a)</b> | 3.02 (3.023...)      www 4                                                | 4    | M3 for $\sqrt{2^2 + 1.5^2 + 1.7^2}$ oe may be in two steps or $\sqrt{9.11 \text{ to } 9.15...}$ (3.018 to 3.026..)<br>or M2 for $2^2 + 1.5^2 + 1.7^2$ oe implied by 9.11 to 9.15....<br>or M1 for any correct Pythag in 1 of the faces e.g. $2^2 + 1.5^2$  |
|              | <b>(b)</b> 34.1 to 34.3      cao      www 3                               | 3    | M2 for $\sin = 1.7/\text{their } EC$<br>or $\cos = \text{their } EG/\text{their } EC$ or $\tan = 1.7/\text{their } EG$<br>or complete long method<br>(M1 for $CEG$ as required angle – accept on diagram if clear)                                         |
|              | <b>(c)</b> <b>(i)</b> 2.95 cao                                            | 1    |                                                                                                                                                                                                                                                            |
|              | <b>(ii)</b> Yes <b>and</b> because their <b>(c)(i)</b> < their <b>(a)</b> | 1ft  | ft their <b>(a)</b> and their <b>(c)(i)</b> , must say <u>yes</u> or <u>no</u> oe and compare the two distances – numerically or by labels                                                                                                                 |

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|       |                                                                                                                               |      |                                                                                                                                                     |
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| 3 (a) | (i) 142 to 150                                                                                                                | 2    | B1 for 7.1 to 7.5 seen                                                                                                                              |
|       | (ii) (0)59 to (0)63                                                                                                           | 1    |                                                                                                                                                     |
|       | (iii) 148° to 152° drawn<br>Distance 6.8 to 7.2 cm drawn                                                                      | 1    | Both marks available from the position of <i>B</i> as lines don't need to be drawn.                                                                 |
| (b)   | (iv) 328 to 332°                                                                                                              | 1    |                                                                                                                                                     |
|       | (v) 60                                  www 2                                                                                 | 2    | M1 for 20 <sup>2</sup> or better seen                                                                                                               |
|       | 667 (666.6 to 666.7)    www 3                                                                                                 | 3    | B1 for 2.25 (h), 135 (mins), 8100 (sec) and M1 for 1500 ÷ their time in hours (time must be in range 2.09 to 3.25) (could be implied by 697 to 698) |
| (c)   | $(\cos =) \frac{1125^2 + 790^2 - 1450^2}{2 \times 1125 \times 790}$                                                           | M2   | M1 for $1450^2 = 1125^2 + 790^2 - 2 \times 1125 \times 790 \cos Q$                                                                                  |
|       | 96.9 (96.87 to 96.88)    www 4                                                                                                | A2   | A1 for (cos =) -0.1197...(which implies M2)                                                                                                         |
| 4 (a) | 4                                                                                                                             | 1    |                                                                                                                                                     |
|       | - 5.8 or - 5.75 or - 5.7                                                                                                      | 1    |                                                                                                                                                     |
|       | - 2                                                                                                                           | 1    |                                                                                                                                                     |
| (b)   | 10 correct plots ft                                                                                                           | P3ft | ft from their values in (a) generous with (- 0.25, 12.1)<br>P2 for 8 or 9 correct plots ft<br>or P1 for 6 or 7 correct plots ft                     |
|       | Correct shape curve through 10 points (condone 2 points slightly missed)<br>Two separate branches not crossing <i>y</i> -axis | C1ft | ft their points if shape correct – ignore anything between - 0.25 and 0.25                                                                          |
|       |                                                                                                                               | B1   | C1 and B1 are independent                                                                                                                           |
| (c)   | - 2.5 to - 2.3                                                                                                                | 1    |                                                                                                                                                     |
|       | - 0.5 to - 0.4                                                                                                                | 1    |                                                                                                                                                     |
|       | 2.75 to 2.9                                                                                                                   | 1    |                                                                                                                                                     |
| (d)   | Correct tangent drawn at $x = -2$                                                                                             | T1   | Allow slight daylight                                                                                                                               |
|       | - 4 to - 2.5                                                                                                                  | 2    | Dep on T1<br>M1 Rise/Tread attempt Dep on T1<br>or SC1 for answer in range 2.5 to 4 after T1                                                        |

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|              |                                                                                                                                                                                             |                      |                                                                                                                                                                                                                                                            |
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| <b>5 (a)</b> | 2, 3, 4, 5                                                                                                                                                                                  | 3                    | M2 for $1 < n \leq 5$ seen (M1 for $1 < n$ or $n \leq 5$ )<br>Allow $2 \leq n < 6$ in M2 or M1 case<br>If 0, B2 for 3 correct with no extras or 4 correct with 1 extra.                                                                                    |
|              | <b>(b)</b> <b>(i)</b> $2x(x + 5y)$<br><b>(ii)</b> $3(a - 2b)(a + 2b)$                                                                                                                       | 2<br>3               | B1 for $x(2x + 10y)$ or $2(x^2 + 5xy)$<br>B2 for $(3a - 6b)(a + 2b)$ or $(a - 2b)(3a + 6b)$<br>or correct answer seen in working<br>or B1 for $3(a^2 - 4b^2)$<br>If B0, SC1 for $a^2 - b^2 = (a - 2b)(a + 2b)$                                             |
|              | <b>(c)</b> <b>(i)</b> $\frac{1}{2}x(x + 17) = 84$ or<br>$x(x + 17) = 2 \times 84$<br>Correct proof of $x^2 + 17x - 168 = 0$<br><b>(ii)</b> $(x - 7)(x + 24)$<br><b>(iii)</b> 7 and $-24$ ft | M1<br>E1<br>2<br>1ft | Condone $\frac{1}{2}x \times x + 17 = 84$ but only for M mark<br>No errors or omission of brackets anywhere<br>SC1 for $(x + a)(x + b)$ where $a$ and $b$ are integers<br>and $a + b = 17$ or $ab = -168$<br>Correct or ft from their factors if quadratic |
|              | <b>(d)</b> $-3$ www 3                                                                                                                                                                       | 3                    | B2 for $15 - 6 = x - 4x$ oe or better<br>M1 for $15 - x = 2(3 - 2x)$ or better<br>or $7\frac{1}{2} - x/2 = 3 - 2x$                                                                                                                                         |
|              | <b>(e)</b> $\sqrt{(-5)^2 - 4 \times 2 \times -6}$<br>$p = -5$ and $r = 2 \times 2$                                                                                                          | B1<br>B1             | $(\sqrt{73})$<br>Dependent on $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$<br>or $(x - \frac{5}{4})^2$ B1<br>$\sqrt{3 + \frac{25}{16}}$ B1                                                                                                         |
|              | 3.39, $-0.89$ final answers                                                                                                                                                                 | B1B1                 | SC1 for 3.4 or 3.386... or 3.39 seen and $-0.9$ or $-0.886...$ or $-0.89$ seen                                                                                                                                                                             |

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|       |       |                                                                                            |            |                                                                                                                                                                                                 |
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| 6 (a) | (i)   | $45 < t \leq 55$                                                                           | 1          | Allow any indication e.g. 4 <sup>th</sup> interval                                                                                                                                              |
|       | (ii)  | 52.6 (52.63.....)      www 3                                                               | 3          | M1 for $6 \times 10 + 15 \times 27.5 + 19 \times 40 + 37 \times 50 + 53 \times 62.5 + 20 \times 75 (= 7895)$<br>Allow 1 error/omission<br>and M1 dep for $\div 150$                             |
|       | (b)   | (i) 40, 77, 130, 150                                                                       | 2          | B1 for 2 or 3 correct values                                                                                                                                                                    |
|       | (ii)  | Correct scales<br>6 correct plots ft                                                       | S1<br>P3ft | ft from (i) if increasing values.<br>(35, 21) must be inside square 20 – 22<br>but (55, 77) may be inside or edge of square<br>P2 for 4 or 5 correct plots ft<br>P1 for 2 or 3 correct plots ft |
|       |       | Curve or ruled lines through the 6 points                                                  | C1ft       | ft their points if increasing<br>condone graph starting at (20, 6)                                                                                                                              |
|       | (c)   | (i) 54 to 55                                                                               | 1          |                                                                                                                                                                                                 |
|       | (ii)  | 18.5 – 22.5                                                                                | 2          | B1 for UQ = 62.5 to 65 or LQ = 42.5 to 44 seen                                                                                                                                                  |
|       | (iii) | Their reading at 60 – their reading at 50                                                  | 1          |                                                                                                                                                                                                 |
|       | (iv)  | $\frac{150 - \text{their reading at } 50 (\pm 2)}{150}$ oe                                 | 2          | SC1 for $\frac{\text{their reading at } 50 (\pm 2)}{150}$ oe                                                                                                                                    |
|       | (v)   | If their (iv) is $\frac{k}{150}$ , then ft their<br>$\frac{k}{150} \times \frac{k-1}{149}$ | 2ft        | In (iv) and (v), condone answers as decimals to 3 sf<br>Penalise first occurrence only of 2sf decimals<br>isw cancelling/conversion<br>M1 for $\frac{k}{150} \times \frac{k-1}{149}$            |

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|   |     |                                                        |             |                                                                                                                                                                                                                                                                                                                                                         |
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| 7 | (a) | 87.5 (87.45 to 87.52)      www 4                       | 4           | M1 for $\frac{1}{2} \times 2.5 \times 9.5$ soi by 11.875 or 71.25 and M2 for $\frac{1}{2} \times 2.5^2 \times \sin 60 \times 6$ oe (16.23 to 16.24)<br>or M1 for $\frac{1}{2} \times 2.5^2 \times \sin 60$ (2.706..) or 1 trapezium (8.1189..)                                                                                                          |
|   | (b) | 107.9 ..... to 108.0.....www3                          | 3           | Must see at least 4 figures<br>M2 for $\frac{55}{360} \times \pi \times 15^2$ or M1 for $\frac{55}{360}$ seen                                                                                                                                                                                                                                           |
|   | (c) | (i) 2.29 (2.291 to 2.293)      www 2                   | 2           | M1 for $108 = 15\pi r$ oe allow 107.9 to 108.0... for their 108                                                                                                                                                                                                                                                                                         |
|   |     | (ii) 14.8 (14.82 to 14.83)      cao      www 3         | 3           | M2 for $\sqrt{15^2 - \text{their } 2.29^2}$<br>(M1 for $h^2 + \text{their } 2.29^2 = 15^2$ )                                                                                                                                                                                                                                                            |
|   | (d) | 70.9 to 71.5 cao      www 3                            | 3           | M2 for $\frac{\pi}{3}$ (their $2.29^2 \times \text{their } 14.8 - \text{their } 1.145^2 \times \text{their } 7.4$ ) (not 15 or 7.5)<br>or $\frac{7}{8} \times \frac{\pi}{3} \times \text{their } 2.29^2 \times \text{their } 14.8$<br>or M1 for 1/8 oe e.g. $\frac{7.5^3}{15^3}$ or 7/8 or ( $\frac{1}{2}$ their $R$ and $\frac{1}{2}$ their $h$ ) seen |
| 8 | (a) | Correct enlargement                                    | 2           | B1 for any enlargement of 2 in correct orientation                                                                                                                                                                                                                                                                                                      |
|   | (b) | (i) Stretch only<br>y- axis oe invariant<br>(factor) 4 | 1<br>1<br>1 |                                                                                                                                                                                                                                                                                                                                                         |
|   |     | (ii) $\begin{pmatrix} 4 & 0 \\ 0 & 1 \end{pmatrix}$    | 2ft         | Ft their factor 4<br>SC1 for $\begin{pmatrix} k & 0 \\ 0 & 1 \end{pmatrix} k \neq 0, \neq 1$ or $\begin{pmatrix} 1 & 0 \\ 0 & 4 \end{pmatrix}$ ft their factor 4                                                                                                                                                                                        |
|   | (c) | Shear only<br>x-axis oe invariant<br>(factor) 2        | 1<br>1<br>1 |                                                                                                                                                                                                                                                                                                                                                         |

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|       |                                         |   |                                                                                                                                                                                                                                                                                                                              |
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| 9 (a) | (i) 3, 8, 15 in correct positions       | 2 | B1 for 2 correct values in correct positions                                                                                                                                                                                                                                                                                 |
|       | (ii) 12                                 | 3 | M2 for $12 \times (12 + 2)$ (= 168) or $12, (12 + 2)$ or M1 for $n^2 + 2n = 168$ then<br>M1 for $(n + a)(n + b)$ where $a$ and $b$ are integers and $ab = -168$ or $a + b = 2$ oe                                                                                                                                            |
|       | (b) (i) $2 + 3n$ oe                     | 2 | Allow unsimplified e.g. $5 + 3(n - 1)$<br>B1 for $3n$ oe seen                                                                                                                                                                                                                                                                |
|       | (ii) $2^{n-1}$ oe                       | 2 | B1 for $2^k$ seen                                                                                                                                                                                                                                                                                                            |
| (c)   | $a = \frac{1}{2}, b = 1\frac{1}{2}$ cao | 6 | B1 for 12 or 30 seen but if 30 clearly only from Diagram 4 then B0.<br>M1 for any 1 of $a + b + 1 = 3$ oe<br>$8a + 4b + 2 = 12$ oe<br>$27a + 9b + 3 = 30$ oe<br>M1 for a 2 <sup>nd</sup> of the above equations<br>M1 (indep) for correctly eliminating $a$ or $b$ from pair of linear equations<br>B1 for one correct value |