

**MARK SCHEME for the May/June 2013 series**

|                         |                                          |
|-------------------------|------------------------------------------|
| <b>0580 MATHEMATICS</b> |                                          |
| <b>0580/42</b>          | 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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**Abbreviations**

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

| Qu         | Answers             | Mark                                 | Part Marks                                                                                                                                                                          |                                                                                                                                                                                                                                           |
|------------|---------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b>   | <b>(a) (i)</b>      | $\frac{6}{5+6+3} \times 560$ [= 240] | <b>2</b>                                                                                                                                                                            | Accept 'of' used instead of $\times$<br><b>M1</b> for $560 \div (5 + 6 + 3)$                                                                                                                                                              |
|            | <b>(ii)</b>         | 120                                  | <b>1</b>                                                                                                                                                                            |                                                                                                                                                                                                                                           |
|            | <b>(b)</b>          | 90                                   | <b>2</b>                                                                                                                                                                            | <b>M1</b> for $\frac{3}{8} \times 240$ oe                                                                                                                                                                                                 |
|            | <b>(c) (i)</b>      | 96120 final answer                   | <b>2</b>                                                                                                                                                                            | <b>M1</b> for <i>their(a)(ii)</i> $\times 75 + (560 - \textit{their (a)(ii)}) \times 198$ oe                                                                                                                                              |
|            | <b>(ii)</b>         | 187.5[0] final answer                | <b>3</b>                                                                                                                                                                            | <b>M2</b> for $\frac{198}{1+0.056}$ oe<br>or <b>M1</b> for $(100 + 5.6)[\%] = 198$ oe seen                                                                                                                                                |
|            | <b>(d)</b>          | 184[.2....]                          | <b>3</b>                                                                                                                                                                            | <b>M2</b> for $\frac{36 \times 0.75 - 9.5}{9.5} \times 100$ oe<br>or <b>M1</b> for $\frac{36 \times 0.75}{9.5} \times 100$ or $36 \times 0.75 - 9.5$ [17.5]<br>used<br>implied by answer 84.2<br>or <b>SC1</b> for final answer 284[.2..] |
| <b>(e)</b> | 69.4 and 69[.0] cao | <b>3</b>                             | <b>SC2</b> for one correct or both correct but reversed<br><b>M1</b> for two of 10.85, 10.95, 23.65 or 23.75 seen<br>or $2(23.7 + 10.9) + 4(0.05)$<br>or $2(23.7 + 10.9) - 4(0.05)$ |                                                                                                                                                                                                                                           |

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|   |         |                                                                      |                     |                                                                                                                                                                                                                                                                                |
|---|---------|----------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | (a) (i) | Translation, $\begin{pmatrix} -5 \\ 8 \end{pmatrix}$ oe              | 1,1                 | Brackets needed for vector<br>Not $(-5, 8)$ , $(-5 \ 8)$                                                                                                                                                                                                                       |
|   | (ii)    | correct trapezium at (2, 2)<br>(4, 3) (4, 5) (2, 5)                  | 2                   | SC1 for reflection in $x = -1$ or vertices only                                                                                                                                                                                                                                |
|   | (iii)   | correct trapezium at<br>(4, 2) (5, 4) (7, 4) (7, 2)                  | 3                   | M2 for 4 correct vertices on grid or in working<br>or M1 for $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 2 & 2 & 4 & 4 \\ -4 & -7 & -7 & -5 \end{pmatrix}$<br><br>or SC1 for 3 vertices correct or complete shape in correct orientation but wrong position |
|   | (b) (i) | Shear<br><br>$x$ -axis (oe) invariant<br><br>2                       | 1<br><br>1<br><br>1 |                                                                                                                                                                                                                                                                                |
|   | (ii)    | rectangle at $(-3, 2)$<br>(1, 2) (1, 8) $(-3, 8)$                    | 2                   | SC1 for all vertices only<br>or correct orientation and size, wrong position                                                                                                                                                                                                   |
| 3 | (a)     | 0, 2, 0, -3                                                          | 3                   | B2 for 3 correct or B1 for 2 correct                                                                                                                                                                                                                                           |
|   | (b)     | Correct curve                                                        | B4                  | B3FT for 8 points<br>B2FT for 7 or 6 points<br>B1FT for 5 or 4 points                                                                                                                                                                                                          |
|   | (c)     | $y = -1$ indicated<br><br>$x = 1.3$ to 1.4 and 4.1 to 4.2            | B1<br><br>B1        | e.g. Could be mark[s] on curve<br>isw other lines if not clearly used                                                                                                                                                                                                          |
|   | (d) (i) | line drawn from (0, 2) to touch curve<br><br>(2.5 to 2.75, 3 to 3.4) | M1<br><br>A1        | No daylight at point of contact<br>If short, must cross at (0, 2) within $\frac{1}{2}$ small square when extended                                                                                                                                                              |
|   | (ii)    | rise/run e.g. (their $y - 2$ )/their $x$<br><br>0.4 to 0.48          | M1<br><br>A1        | dep on attempt at a tangent from (0, 2) in (d)(i) and uses scales correctly<br>Can be implied from answer– check on tangent for their rise for a run of 1 ( $\frac{1}{2}$ small square)<br><br>ww2 dep on attempt at a tangent from (0, 2) in (d)(i)                           |

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| 4 | (a) | 227 or 226.95 to 227.01                                                                                                                                              | 2                                   | M1 for $\pi \times 8.5^2$                                                                                                                                                                                                                                                                                                                                                     |
|   | (b) | 5.35                                                                                                                                                                 | 1                                   |                                                                                                                                                                                                                                                                                                                                                                               |
|   | (c) | 39.0[0] to 39.0[1]                                                                                                                                                   | 2                                   | M1 for $\sin [MOB] = \frac{\text{their } b}{8.5}$ oe<br>Dep on their $b < 8.5$                                                                                                                                                                                                                                                                                                |
|   | (d) | 30.2 or 30.3 or 30.24 to 30.27                                                                                                                                       | 3                                   | M2 for $\frac{360 - 4 \times 39}{360} \times 2 \times \pi \times 8.5$ oe<br>or M1 for $\frac{a}{360} \times 2 \times \pi \times 8.5$ oe<br>where $0 < a < 360$<br><br>Implied by 5.78 to 5.79 or 11.5 to 11.6 or 23.14 to 23.15 or 23.1 or 23.2 or 41.83 to 41.84 or 41.8                                                                                                     |
|   | (e) | $AB = BC$<br>$TA = TC$<br>$TB = TB$                                                                                                                                  | 1<br>1<br>1                         | isw comments or reasons<br><br>If 0 scored SC1 for “all three sides the same” oe [SSS] and no mention of angles                                                                                                                                                                                                                                                               |
| 5 | (a) | $\frac{27}{x}$ final answer                                                                                                                                          | 1                                   |                                                                                                                                                                                                                                                                                                                                                                               |
|   | (b) | $\frac{25}{x-2}$ final answer                                                                                                                                        | 1                                   |                                                                                                                                                                                                                                                                                                                                                                               |
|   | (c) | $\frac{25}{x-2} - 4 = \frac{27}{x}$ oe<br><br>$25x - 4x(x-2) = 27(x-2)$ oe<br><br>$4x^2 + 27x - 25x - 8x - 54 = 0$ oe<br><br>$2x^2 - 3x - 27 = 0$ without error seen | M1<br><br>M1<br><br>M1dep<br><br>A1 | FT their (b) - 4 = their (a) oe must be eqn in x<br><br>FT $\frac{25}{x-2} + 4 = \frac{27}{x}$ oe <u>only</u> for 2 <sup>nd</sup> and 3 <sup>rd</sup><br>M mark<br>If all on one side then condone omission of ‘= 0’<br><br>Dep on 2 <sup>nd</sup> M1<br>Must see brackets expanded before this award and terms on one side of eqn<br><br>Must see $4x^2 - 6x - 54 = 0$ first |
|   | (d) | -3, 4.5                                                                                                                                                              | 3                                   | B2 for $(2x-9)(x+3)$<br>or SC1 for $(2x+a)(x+b)$ where $a$ and $b$ are integers and $a + 2b = -3$<br>or $ab = -27$                                                                                                                                                                                                                                                            |
|   | (e) | 6 cao                                                                                                                                                                | 1                                   |                                                                                                                                                                                                                                                                                                                                                                               |

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| 6   | (a) (i)                                                                    | $\frac{12^2 + 21^2 - 15^2}{2 \times 12 \times 21}$<br>44.41 to 44.42                             | M2                                                                                                                                              | M1 for $15^2 = 12^2 + 21^2 - 2 \cdot 12 \cdot 21 \cos M$                                                                                           |
|     | (ii)                                                                       | 88.2 or 88.15 to 88.19                                                                           | A2                                                                                                                                              | A1 for [cos =] 0.714 or 0.7142 to 0.7143 or $\frac{360}{504}$ oe                                                                                   |
|     | (b)                                                                        | 7.74 or 7.736 to 7.737.... www                                                                   | 2                                                                                                                                               | M1 for $0.5 \times 12 \times 21 \times \sin(44.4)$ oe                                                                                              |
|     |                                                                            |                                                                                                  | 4                                                                                                                                               | B1 for 55 soi<br>M2 $\frac{6.4}{\sin(\text{their } R)} \times \sin 82$ oe<br>or M1 for $\frac{6.4}{\sin(\text{their } R)} = \frac{PR}{\sin 82}$ oe |
| 7   | (a) (i)                                                                    | $\begin{pmatrix} 15 \\ 21 \end{pmatrix}$                                                         | 1                                                                                                                                               |                                                                                                                                                    |
|     | (ii)                                                                       | not possible oe                                                                                  | 1                                                                                                                                               |                                                                                                                                                    |
|     | (iii)                                                                      | (2) final answer                                                                                 | 2                                                                                                                                               | M1 for 30 – 28                                                                                                                                     |
|     | (iv)                                                                       | $\begin{pmatrix} 4 & 13 \\ 0 & 0 \end{pmatrix}$                                                  | 1                                                                                                                                               |                                                                                                                                                    |
|     | (v)                                                                        | $\begin{pmatrix} -5 & -9 \\ 1 & 0 \end{pmatrix}$                                                 | 2                                                                                                                                               | B1 for one correct row or column                                                                                                                   |
| (b) | $\frac{1}{2} \begin{pmatrix} 3 & -4 \\ -1 & 2 \end{pmatrix}$ or better isw | 2                                                                                                | B1 for $k \begin{pmatrix} 3 & -4 \\ -1 & 2 \end{pmatrix}$ seen or implied<br>or $\frac{1}{2} \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ seen |                                                                                                                                                    |
| 8   | (a)                                                                        | hat $\frac{5}{8}, \frac{3}{8}$<br>scarf $\frac{2}{3}, \frac{1}{3}$<br>$\frac{1}{6}, \frac{5}{6}$ | 1<br>1<br>1                                                                                                                                     | 1 mark per pair in correct place                                                                                                                   |
|     | (b) (i)                                                                    | $\frac{15}{48}$ oe $\left[ \frac{5}{16} \right]$                                                 | 2FT                                                                                                                                             | FT their $\frac{3}{8} \times \frac{5}{6}$ correctly evaluated<br>M1 $\frac{3}{8} \times \frac{5}{6}$ FT from their tree                            |
|     | (ii)                                                                       | $\frac{5}{24}$                                                                                   | 2FT                                                                                                                                             | FT their $\frac{5}{8} \times \frac{1}{3}$ correctly evaluated<br>M1 $\frac{5}{8} \times \frac{1}{3}$ FT from their tree                            |
|     |                                                                            |                                                                                                  |                                                                                                                                                 |                                                                                                                                                    |

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| (iii)      | $\frac{13}{48}$ cao                                                             | 2 | <b>M1</b> for <i>their</i> $\frac{3}{8} \times \frac{1}{6}$ + <i>their</i> (b)(ii) soi                                                                                                                                                                                                                                          |
| (c)        | $\frac{170}{240}$ or $\frac{85}{120}$ or $\frac{34}{48}$ or $\frac{17}{24}$ cao | 3 | <b>M2</b> for $1 - \frac{5}{8} \times \frac{2}{3} \times \frac{7}{10}$ FT <i>their</i> tree or<br>$\frac{3}{8} + \frac{5}{8} \times \frac{1}{3} + \frac{5}{8} \times \frac{2}{3} \times \frac{3}{10}$ oe<br><b>or M1</b> for<br>[“wears all” = ] $\frac{5}{8} \times \frac{2}{3} \times \frac{7}{10}$ FT <i>their</i> tree seen |
| 9 (a)      | 371 or 371.1...                                                                 | 4 | <b>M3</b> for $(6 \times 4 \times 12) + (2 \times 6 \times 0.5 \times 4 \times 4 \times \sin 60)$ oe<br><b>or M2</b> for area of 1 or 2 hexagons<br><b>or M1</b> for area of one relevant triangle or trapezium or rectangle within hexagon<br>If 0 scored <b>SC1</b> for 288 shown                                             |
| (b) (i)    | 1740 or 1743.6 to 1744.2                                                        | 4 | <b>M3</b> for $\frac{12000}{4} \div (\pi \times 0.74^2)$ oe<br>or <b>SC2</b> for figs 174[3..] or 174[4..]<br>or <b>B1</b> for $\pi \times 0.74^2$ seen [1.72..]<br>or <b>B1</b> for 12000 / 4 soi by 3000                                                                                                                      |
| (ii)       | 87 cao          www 5                                                           | 5 | <b>B4</b> for 87.39 to 87.43<br>or <b>M3</b> for [r=] $\sqrt{\frac{\text{figs } 12}{\pi \times \text{figs } 5}}$ oe<br>or <b>M2</b> for [r <sup>2</sup> =] = $\frac{\text{figs } 12}{\pi \text{ figs } 5}$ oe<br>or <b>M1</b> for figs 12 = $\pi r^2 \times \text{figs } 5$                                                     |
| 10 (a) (i) | final answer $\frac{25-8x}{20}$                                                 | 2 | <b>M1</b> for $\frac{5 \times 5 - 4 \times 2x}{5 \times 4}$ or better seen                                                                                                                                                                                                                                                      |
| (ii)       | final answer $\frac{2x^2 + 5x + 9}{3(x+3)}$                                     | 3 | <b>B1</b> for $2x^2 + 6x - x - 3$ soi<br><b>and B1</b> for denom $3(x+3)$ or $3x+9$ seen                                                                                                                                                                                                                                        |
| (b)        | $x = \frac{2}{3}$ oe or 0.667 or 0.6666 to 0.6667<br>$y = -3$                   | 3 | <b>M1</b> for correct method to eliminate one variable<br><b>A1</b> for $x = \frac{2}{3}$ oe or 0.667 or 0.6666 to 0.6667<br>or $y = -3$                                                                                                                                                                                        |

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| (c)     | final answer $\frac{7}{2x+3}$ www                                            | 4 | <p><b>B1</b> for <math>7(x+3)</math> in numerator<br/>and <b>B2</b> for <math>(2x+3)(x+3)</math> in denominator<br/>or <b>SC1</b> for <math>(2x+a)(x+b)</math> where <math>a</math> and <math>b</math> are integers and <math>a+2b=9</math> or <math>ab=9</math></p> <p>After <b>B1</b> scored, <b>SC1</b> for final answer<br/><math>\frac{7}{2(x+1.5)}</math> or <math>\frac{3.5}{x+1.5}</math></p> |
| 11 (a)  | $3^2 + 1^2$                                                                  | 1 | Ignore attempt to evaluate $\sqrt{10}$                                                                                                                                                                                                                                                                                                                                                                |
| (b) (i) | $\frac{\sqrt{10}}{3}$ final answer                                           | 1 |                                                                                                                                                                                                                                                                                                                                                                                                       |
| (ii)    | $\frac{10}{3}$ final answer                                                  | 2 | <p><b>M1</b> for <i>their</i> <math>\frac{\sqrt{10}}{3} \times \sqrt{10}</math> or<br/><i>their</i> <math>\left(\frac{\sqrt{10}}{3}\right)^2 + (\sqrt{10})^2</math><br/>implied by 3.33 seen</p>                                                                                                                                                                                                      |
| (c)     | $\frac{100}{27}$ or $3\frac{19}{27}$ isw conversion<br>or 3.7[03] to 3.7[04] | 2 | <p><b>M1</b> for <math>3 \times \left(\frac{\sqrt{10}}{3}\right)^n</math> oe where <math>n</math> is 3 or 4<br/>or for <math>[OP_4 =] \sqrt{\frac{1000}{81}}</math><br/>or for <i>their</i> (b)(ii) <math>\times \left(\frac{\sqrt{10}}{3}\right)^n</math> where <math>n</math> is 1 or 2</p>                                                                                                         |
| (d) (i) | 18.43...                                                                     | 2 | <b>M1</b> for $\tan [P_1OP_2] = \frac{1}{3}$ oe                                                                                                                                                                                                                                                                                                                                                       |
| (ii)    | 18.4[3...]                                                                   | 1 |                                                                                                                                                                                                                                                                                                                                                                                                       |
| (iii)   | 20                                                                           | 3 | <p><b>SC2</b> for 19<br/>or <b>M1</b> for <math>\frac{360}{18.4[3...]}</math></p>                                                                                                                                                                                                                                                                                                                     |