

**MARK SCHEME for the October/November 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</b> | <b>(a) (i)</b> 14.62 final answer  | <b>3</b>                            | <b>M2</b> for $0.85 \times 20 \times 0.86$ oe soi by 14.6(0)<br>or <b>M1</b> for $0.85 \times 20$ soi by 17<br>or $0.85 \times 0.86$ soi by 0.731   |
|          | <b>(ii)</b> 20 www   | <b>3</b>                            | <b>M2</b> for $16.40 / 0.82$ oe<br>or <b>M1</b> for 16.40 associated with 82%   |
|          | <b>(iii)</b> 135 www   | <b>2</b>                            | <b>M1</b> for $(108 \times 5) / 4$  |
|          | <b>(b)</b> $c + 4d = 27.10$ oe<br>$c + 7d = 34.30$ oe<br>Elimination of one variable | <b>B1</b><br><b>B1</b><br><b>M1</b> | Could use other variables but must be consistent  |
|          | $(c =) 17.5(0)$ and $(d =) 2.4(0)$   | <b>A1</b>                           | Correct answers from no working scores <b>SC1</b> only  |
|          | <b>(c)</b> 36 cao  | <b>3</b>                            | <b>B1</b> for 7h 30 min or 7.5 or 450 (mins) seen<br>and <b>M1</b> for $270/t$ where $7 \leq t \leq 9$  |
|          | <b>(d)</b> 606.744 or 606.74 or 606.7(0) or 607                                      | <b>2</b>                            | <b>M1</b> for $540 \times (1.06)^2$ oe but not $(1 + 6\%)^2$ unless recovers<br>For step by step method, must see 572.4(0) and a correct method for the second year<br><b>M0</b> if any further addition or subtraction |

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| <p><b>2</b></p> | <p>(a) (i) 39</p> <p>(ii) <math>\frac{8}{x} + 2</math> or <math>\frac{8+2x}{x}</math> or <math>\frac{2(4+x)}{x}</math><br/>or <math>8x^{-1} + 2</math> final answer</p> <p>(b) -2.5 oe</p> <p>(c) 2.2 oe</p> <p>(d) (i) <math>4x - 2 = \frac{2}{x} + 1</math></p> <p>At least 1 intermediate step and<br/><math>4x^2 - 3x - 2 = 0</math></p> <p>(ii) <math>\frac{-(-3) \pm \sqrt{(-3)^2 - 4(4)(-2)}}{2(4)}</math></p> <p>1.18 and -0.43 cao</p>                           | <p><b>2</b></p> <p><b>2</b></p> <p><b>2</b></p> <p><b>2</b></p> <p><b>E1</b></p> <p><b>B1</b></p> <p><b>B1</b></p> <p><b>B1B1</b></p>                                    | <p><b>B1</b> for <math>(f(2) =) 6</math> or <math>6^2</math> seen or <math>(4x - 2)^2 + 3</math> seen</p> <p><b>M1</b> for <math>4\left(\frac{2}{x} + 1\right) - 2</math></p> <p><b>M1</b> for <math>2 + x = 0.2x</math> oe or <math>\frac{2}{x} = 0.2 - 1</math> or better</p> <p><b>M1</b> for <math>\frac{2}{5/3} + 1</math> allow 1.66 to 1.67 for 5/3<br/>or <math>\frac{2}{2/x} + 1</math></p> <p>oe with these four terms</p> <p>No errors</p> <p><b>B1</b> for <math>\sqrt{(-3)^2 - 4(4)(-2)}</math> or better (41)<br/><b>B1</b><br/>and in form <math>\frac{p + \sqrt{q}}{r}</math> or <math>\frac{p - \sqrt{q}}{r}</math></p> <p><b>B1</b> for <math>-(-3)</math> and <math>2(4)</math> or better</p> <p><b>SC1</b> for 1.18 and -0.43 seen or 1.2 <u>and</u> -0.4 or 1.17... <u>and</u> -0.425...</p> |
| <p><b>3</b></p> | <p>(a) Reflection only<br/><math>x = -1</math> oe only</p> <p>(b) (i) Triangle <math>(-1, 2) (-1, 6) (-3, 6)</math></p> <p>(ii) Triangle <math>(-1, -2) (-1, -6) (-3, -6)</math></p> <p>(iii) Triangle <math>(1, -1) (7, -1) (7, 2)</math></p> <p>(c) (i) Triangle drawn at <math>(2, 3) (6, 7) (6, 9)</math></p> <p>(ii) Shear (only)<br/><math>y</math> axis invariant<br/>(factor) 1</p> <p>(d) <math>\begin{pmatrix} 0 &amp; 1 \\ -1 &amp; 0 \end{pmatrix}</math></p> | <p><b>B1</b></p> <p><b>B1</b></p> <p><b>B2</b></p> <p><b>B2</b></p> <p><b>B2</b></p> <p><b>3</b></p> <p><b>B1</b></p> <p><b>B1</b></p> <p><b>B1</b></p> <p><b>B2</b></p> | <p>Two transformations scores 0</p> <p><b>B1</b> for vertices plotted only<br/>or for clockwise rotation about <math>(0,0)</math></p> <p><b>B1</b> for vertices plotted only<br/>or for reflection in <math>x = y</math></p> <p><b>B1</b> for vertices plotted only<br/>or for enlargement by 1.5 with correct orientation</p> <p><b>B2</b> for 2 correct vertices plotted<br/>or <b>SC2</b> for 3 correct coordinates shown in working or <b>SC1</b> for any 2 correct coordinates<br/>or <b>M1</b> for <math>\begin{pmatrix} 1 &amp; 0 \\ 1 &amp; 1 \end{pmatrix} \begin{pmatrix} 2 &amp; 6 &amp; 6 \\ 1 &amp; 1 &amp; 3 \end{pmatrix}</math></p> <p>Two transformations scores 0<br/>or <math>x = 0</math> invariant</p> <p><b>B1</b> for either column or row correct</p>                                     |

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| <p><b>4</b></p> | <p>(a) (i) 28 cao</p> <p>(ii) 420</p> <p>(b) <math>(r^3 =) \frac{3 \times 1080}{4\pi}</math> oe</p> <p><math>(r =) \sqrt[3]{\frac{3 \times 1080}{4\pi}}</math> oe</p> <p>6.36 or 6.37 www</p> <p>(c) (i) 24</p> <p>(ii) 232 (231.6 to 232.2)</p>  | <p><b>2</b></p> <p><b>2ft</b></p> <p><b>M1</b></p> <p><b>M1dep</b></p> <p><b>A1</b></p> <p><b>B1</b></p> <p><b>3</b></p>                                       | <p><b>M1</b> for <math>\frac{350 \times 16}{200}</math> oe<br/>or <math>350 \div 12.5</math> oe or <math>1.75 \times 16</math> oe</p> <p>ft for <i>their</i> <math>28 \times 15</math></p> <p><b>M1</b> for <i>their</i> <math>28 \times \frac{240}{16}</math> or <math>\frac{350 \times 240}{200}</math> oe<br/>or <math>1.75 \times 240</math> oe</p> <p>Correct rearrangement soi by 257 to 258</p> <p>Dependent on previous <b>M1</b></p> <p>6.364 to 6.366</p> <p><b>M1</b> for <math>\pi \times 2.5^2 \times 1.8</math> (soi by 35.3 to 35.4)<br/>or area = <math>20 \times 30 - \text{their } 24 \times \pi \times 2.5^2</math><br/>(soi by 128.7 to 129)<br/>and <b>M1dep</b> for <math>1080 - (\pi \times 2.5^2 \times 1.8) \times \text{their } 24</math><br/>or their area <math>\times 1.8</math></p> |
| <p><b>5</b></p> | <p>(a) 63.45 or 63.5 cso</p> <p>(b) (i) 75 117 195 200</p> <p>(ii) 8 correct points plotted</p> <p>Curve (or polygon) correct through 8 points</p> <p>(c) (i) 65 to 67</p> <p>(ii) 52 to 55</p> <p>(iii) 21 to 24</p> <p>(iv) 44 to 52</p> <p>(v) Integer value of 200 – reading at 45 secs</p> | <p><b>4</b></p> <p><b>B2</b></p> <p><b>P3ft</b></p> <p><b>C1ft</b></p> <p><b>B1ft</b></p> <p><b>B1</b></p> <p><b>B1</b></p> <p><b>B1</b></p> <p><b>2ft</b></p> | <p><b>M1</b> for 10, 30, 45, 55, 65, 75, 85, 95<br/>At least 6 correct mid-values soi<br/>and <b>M1</b> for <math>\sum fx</math><br/>(<math>6 \times 10 + 12 \times 30 + 20 \times 45 + \dots + 5 \times 95</math>) (12690)<br/>where <math>x</math> is in the correct interval allow one further slip<br/>and <b>M1</b> for their <math>\sum fx \div 200</math> dep on second <b>M1</b></p> <p><b>B1</b> for 2 or 3 correct</p> <p><b>P2ft</b> for 6 or 7<br/><b>P1ft</b> for 4 or 5</p> <p>ft their increasing curve only if at least <b>B1</b> in (b)(i). Ignore <math>t = 0</math> to 20</p> <p>Or ft their curve at cf = 100</p> <p>Must be integer</p> <p><b>B1ft</b> for integer value of reading at 45 secs</p>   |

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| 6 | <p>(a) (i) 141 (141.3 to 141.4)</p> <p>(ii) 8.93 (8.93...)</p> <p>(b) (i) 2.98 or 2.976 to 2.977</p> <p>(ii) Answer rounds to 15.7</p> <p>(c) 535 or 536 (534.9 to 535.8)</p>   | <p>2</p> <p>3</p> <p>2ft</p> <p>2ft</p> <p>5</p>  | <p>M1 for <math>\pi \times 4.5 \times 10</math></p> <p>M2 for <math>\sqrt{10^2 - 4.5^2}</math><br/>or M1 for <math>h^2 + 4.5^2 = 10^2</math> implied by 79.75</p> <p>ft their (a)(ii) <math>\div 3</math> www correct to 3sf or better<br/>M1 for their (a)(ii) <math>\div 3</math></p> <p>ft their (a)(i) <math>\div 9</math> correct to 3 sf or better<br/>or <math>\pi \times 1.5 \times \sqrt{\text{their } 2.98^2 + 1.5^2}</math></p> <p>M1 for their (a)(i) <math>\div 9</math> or <math>\pi \times 1.5 \times 10 \div 3</math> oe<br/>or <math>\pi \times 1.5 \times \sqrt{\text{their } 2.98^2 + 1.5^2}</math></p> <p>M1 for area of one circle <math>\pi \times 1.5^2</math> or <math>\pi \times 4.5^2</math><br/>(7.0685 or 63.617)<br/>and M1 for their (a)(i) – their (b)(ii)<br/>(large cone SA – small cone SA)<br/>(141 – 15.7) (= 125.3 to 125.7)<br/>and M1 for <math>12 \times \pi \times 9</math> (curved area of cylinder)<br/>(339.292..)<br/>and M1 for correct collection of 4 areas</p> |
| 7 | <p>(a) 8.7, –3.2, –10</p> <p>(b) 6 correct points plotted<br/>Smooth curve through 6 points and correct shape</p> <p>(c) Ruled tangent drawn at <math>x = 2</math><br/>Rise/run (using correct scales)<br/>3.4 to 4</p> <p>(d) <math>k &gt; 1.85</math> or <math>k &gt;</math> any value greater than 1.85</p> <p>(e) (i) Correct ruled line for <math>-3 \leq x \leq 3</math></p> <p>(ii) –1.75 to –1.9</p> <p>(f) (i) <math>x^2 + \frac{1}{x} = x + 2</math></p> <p>(ii) <math>(y =) x + 2</math></p> | <p>B3</p> <p>P2ft</p> <p>C1ft</p> <p>T1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>B2</p> <p>B1</p> <p>B2</p> <p>B1ft</p> | <p>8.66(..) or 8.67, –3.24, –9.99 if given to 2 dp<br/>B1 for each correct value</p> <p>P1ft for 5 or 4 correct</p> <p>C0 if curve crosses y-axis</p> <p>Not chord, allow slight daylight</p> <p>Dep T1</p> <p>Accept <math>\geq</math> Ignore <math>k &lt;</math> any value greater than 1.85</p> <p>SC1 for short ruled line or good freehand complete line<br/>or any ruled line grad –1<br/>or ruled with y intercept of 1 (not <math>y = 1</math>)</p> <p>B1</p> <p>B1 for <math>x^2 - x - 2 + \frac{1}{x} = 0</math> oe seen<br/>or <math>1 + x^3 = x^2 + 2x</math> seen</p> <p>or their <math>ax + b</math> numerical <math>a \neq 0</math> and <math>b \neq 0</math></p>  |

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| <b>8</b>                           | <b>(a) (i)</b> $3^2 + 5^2 - 2 \times 3 \times 5 \cos 45$<br>3.575... or 3.576 cao | <b>M2</b> | <b>M1</b> for correct implicit version   |
|                                    | <b>(ii)</b> 36.3 to 36.4  | <b>E2</b> | <b>A1</b> for 12.78 to 12.8  |
|                                    |   | <b>3</b>  | <b>M2</b> for $(\sin BCA =) \frac{3 \times \sin 45}{\text{their } 3.58}$<br>or <b>M1</b> for $\frac{\sin BCA}{3} = \frac{\sin 45}{\text{their } 3.58}$ oe  |
| <b>(b) (i)</b> 76                  |   | <b>B1</b> |  |
| <b>(ii)</b> 17.4 or 17.42 to 17.44 |   | <b>3</b>  | <b>M2</b> for<br>$0.5 \times 3 \times 5 \times \sin 45 + 0.5 \times 5 \times 5 \sin$ their <b>(b)(i)</b><br>5.3033... + 12.1286...<br>or <b>M1</b> for<br>$0.5 \times 3 \times 5 \times \sin 45$ or $0.5 \times 5 \times 5 \sin$ their <b>(b)(i)</b> |
| <b>(c)</b> 48.2 (48.18 to 48.19)   |   | <b>2</b>  | <b>M1</b> for $\cos PAB = \frac{2}{3}$ oe  |

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| <b>9</b> | <p><b>(a) (i)</b> <math>\frac{120}{336}</math> oe <math>\frac{5}{14}</math> 0.357(1...)</p>  | <b>3</b>  | <p>Accept fraction, %, dec equivalents (3sf or better) throughout but not ratio or words<br/>isw incorrect cancelling/conversion to other forms<br/>Pen –1 once for 2sf answers</p> <p><b>M2</b> for <math>\frac{6}{8} \times \frac{5}{7} \times \frac{4}{6}</math></p> <p>or <b>M1</b> for <math>\frac{5}{7}</math> seen</p>   |
|          | <p><b>(ii)</b> <math>\frac{180}{336}</math> oe <math>\frac{15}{28}</math> 0.536 or 0.5357...</p>   | <b>3</b>  | <p><b>M2</b> for <math>\frac{2}{8} \times \frac{6}{7} \times \frac{5}{6} + \frac{6}{8} \times \frac{2}{7} \times \frac{5}{6} + \frac{6}{8} \times \frac{5}{7} \times \frac{2}{6}</math></p> <p>Accept <math>3 \times \frac{2 \times 5 \times 6}{6 \times 7 \times 8}</math></p> <p>or <b>M1</b> for <math>\frac{2 \times 5 \times 6}{6 \times 7 \times 8}</math> oe seen (<math>\frac{60}{336}</math> oe <math>\frac{5}{28}</math>)</p>                   |
|          | <p><b>(b) (i)</b> <math>\frac{x}{25} \times \frac{x-1}{24} = \frac{7}{100}</math></p> <p><math>\frac{x^2 - x}{600} = \frac{7}{100}</math></p> <p>or <math>x(x-1) = \frac{7}{100} \times 25 \times 24</math></p> <p><math>x^2 - x - 42 = 0</math></p> | <b>M2</b>   | <p><b>M1</b> for <math>\frac{x}{25}</math> or <math>\frac{x-1}{24}</math> seen</p>  |
|          | <p><b>(ii)</b> <math>(x+6)(x-7)</math></p> <p><b>(iii)</b> –6, 7</p> <p><b>(iv)</b> 18</p>   | <b>M1</b><br><b>E1</b><br><b>B2</b><br><b>B1ft</b><br><b>B1ft</b> | <p>Or better, min requirement is <math>x^2 - x = 7 \times 6</math></p> <p>With no errors or omissions</p> <p><b>SC1</b> any other <math>(x+a)(x+b)</math> where <math>a \times b = -42</math> or <math>a + b = -1</math></p> <p>Correct or follow through dep on at least <b>SC1</b> in <b>(b)(ii)</b></p> <p>Correct or ft 25 – their positive integer solution<br/>Dep on pos and neg answer to <b>(b)(iii)</b><br/>Answer must be positive integer</p> |