



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**MATHEMATICS**

**0580/41**

Paper 4 (Extended)

**May/June 2016**

MARK SCHEME

Maximum Mark: 130

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**Published**

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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               |
| nfwf | not from wrong working     |
| soi  | seen or implied            |

| Question   | Answer   | Mark     | Part marks   |
|--|--|----------|--|
| <b>1</b>   | <b>(a) (i)</b> 48  | <b>2</b> | <b>M1</b> for $\frac{72}{3}$   |
|  | <b>(ii)</b> 32.4[0]  | <b>1</b> |  |
|  | <b>(iii)</b> $\frac{13}{30}$   | <b>2</b> | <b>M1</b> for $\frac{72 - \text{their(ii)} - 8.4}{72}$ oe  |
|  | <b>(iv)</b> 24   | <b>3</b> | <b>M2</b> for $\frac{19.2}{0.8}$ oe<br>or <b>M1</b> for recognising 19.2 is 80%  |
|  | <b>(b)</b> 660   | <b>3</b> | <b>M2</b> for $\frac{550 \times 2 \times 10}{100} + 550$ oe<br>or <b>M1</b> for $\frac{550 \times 2 \times 10}{100}$ oe                      |
|  | <b>(c)</b> 663.9[0]  | <b>2</b> | <b>M1</b> for $550 \times 1.019^{10}$ oe   |
|  | <b>(d)</b> 1.5[0]  | <b>3</b> | <b>M2</b> for $\sqrt[10]{\frac{638.3[0]}{550}}$ oe<br>or <b>M1</b> for $550 \times m^{10} = 638.3[0]$  |
| <b>2</b>   | <b>(a) (i)</b> Triangle drawn,<br>vertices (2, -4), (2, -5), (4, -4) | <b>2</b> | <b>SC1</b> for translation $\begin{pmatrix} 5 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -2 \end{pmatrix}$<br>or correct points not joined |
|  | <b>(ii)</b> Triangle drawn,<br>vertices (-3, 4), (-3, 5), (-1, 4)    | <b>2</b> | <b>SC1</b> for reflection in line $y = k$<br>or line $x = 1$<br>or correct points not joined   |
|  | <b>(iii)</b> Enlargement   | <b>1</b> |  |
|  | [factor] 3   | <b>1</b> |  |
|  | [centre] (-6, -5)  | <b>1</b> |  |
| <b>(b) (i)</b> $\begin{pmatrix} 2 & 5 \\ 3 & 10 \end{pmatrix}$ | <b>1</b>   |          |  |

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| Question  | Answer   | Mark    | Part marks   |
|-----------|--|---------|--|
| (ii)      | $\begin{pmatrix} 10 & 14 \\ 18 & 24 \end{pmatrix}$ final answer  | 2       | SC1 for one row or one column correct  |
| (iii)     | $\frac{1}{4}$ oe   | 3       | M2 for $1 \times 4 - 2 \times 3 = 4 \times k - 3 \times 1$ or better or B1 for $1 \times 4 - 2 \times 3$ or $4 \times k - 3 \times 1$ seen                     |
| (c) (i)   | Rotation   | 1       |  |
|           | 90° [anti-clockwise] oe  | 1       |  |
|           | (0, 0) oe  | 1       |  |
| (ii)      | $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$   | 2       | SC1 for one correct row or column  |
| 3 (a) (i) | 400  | 1       |  |
| (ii)      | 350  | 1       |  |
| (iii)     | 70   | 1       |  |
| (iv)      | 170  | 2       | B1 for 30 seen   |
| (b) (i)   | Mid-values 40, 80, 125, 200 soi  | M1      |  |
|           | $\Sigma fx$ with correct frequencies and $x$ 's in correct intervals or on boundaries of correct intervals | M1      |  |
|           | $\div 200$   | M1(dep) | Dependent on second M1   |
|           | 106 nfw  | A1      | SC2 for correct answer without working   |
| (ii)      | Correct histogram  | 4       | B1 for correct widths<br>and B1 for each rectangle of correct height at 0.8, 1.6, 1.6 (up to B3)<br>After 0 scored, SC1 for 3 correct frequency densities seen |
| (iii)     | $\frac{10712}{39800}$ oe isw   | 2       | M1 for $\frac{104}{200} \times \frac{103}{199}$ oe   |
| 4 (a)     | 14 137 to 14 137.2 or 14 139   | 2       | M1 for $\frac{4}{3} \times \pi \times 15^3$  |
| (b) (i)   | 104 000 or 103 600 to 103 700  | 3       | M2 for $\pi \times 25^2 \times 60 - 14140$<br>or M1 for $\pi \times 25^2 \times 60$  |

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| <b>Question</b> | <b>Answer</b>                            | <b>Mark</b>          | <b>Part marks</b>  |
|-----------------|--|----------------------|--|
| <b>(ii)</b>     | 52.8 or 52.75 to 52.81...                | <b>2</b>             | <b>M1</b> for <i>their</i> (b)(i) $\div (\pi \times 25^2)$<br>or $14\,140 \div (\pi \times 25^2)$  |
| <b>(c) (i)</b>  | 15.8 or 15.81.....                       | <b>3</b>             | <b>M2</b> for $[r^2 = ] \frac{14140}{\frac{1}{3} \times \pi \times 54}$<br>or <b>M1</b> for $\frac{1}{3} \times \pi \times r^2 \times 54 = 14\,140$ oe   |
| <b>(ii)</b>     | 3580 or 3576 to 3581 nfw                 | <b>4</b>             | <b>M1</b> for $(\textit{their} (c)(i))^2 + 54^2$<br><br><b>M1</b> for $\pi \times (\textit{their} (c)(i)) \times \sqrt{\{(\textit{their} (c)(i))^2 + 54^2\}}$<br><br><b>M1</b> for $\pi \times (\textit{their} (c)(i))^2$  |
| <b>5 (a)</b>    | 9<br>10.5                                | <b>1</b><br><b>1</b> |  |
| <b>(b)</b>      | Fully correct curve                      | <b>5</b>             | <b>SC4</b> for correct curve, but branches joined<br><br><b>B3 FT</b> for 9 or 10 points plotted<br>or <b>B2 FT</b> for 7 or 8 points plotted<br>or <b>B1 FT</b> for 5 or 6 points plotted<br><br>and <b>B1</b> for two separate branches not touching or cutting y-axis |
| <b>(c)</b>      | 2.1 to 2.6                               | <b>1</b>             |  |
|                 | 8.5 to 9                                 | <b>1</b>             |  |
| <b>(d)</b>      | 2, 3, 5, 7                               | <b>2</b>             | <b>SC1</b> for correct 4 values and no more than one extra positive integer or $\pm 2, \pm 3, \pm 5, \pm 7$<br>or 3 correct values and no extras   |
| <b>(e)</b>      | (-2, -12)                                | <b>1</b>             |  |
| <b>(f) (i)</b>  | $20 + x^2 = x^3$                         | <b>M1</b>            | Multiplication by $x$  |
|                 | $x^3 - x^2 - 20 = 0$                     | <b>A1</b>            | No errors or omissions   |
| <b>(ii)</b>     | Fully correct curve $y = x^2$            | <b>2</b>             | <b>SC1</b> for U – shaped parabola, vertex at origin   |
| <b>(iii)</b>    | 2.5 to 3.5                               | <b>1</b>             |  |
| <b>(iv)</b>     | 3.[0] to 3.1 or FT their answer to (iii) | <b>1FT</b>           | <b>FT</b> dep on (iii) $> 0$   |

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| Question | Answer  | Mark  | Part marks   |   |
|----------|---------|---|--------------|---|
| 6        | (a) (i) | [y = ] $\frac{1}{2}(80 - 2x)$   | M1           | 40 - x is enough  |
|          |         | $A = \text{their } \frac{1}{2}(80 - 2x) \times x$ oe  | M1           |   |
|          |         | $A = 40x - x^2$ and $x^2 - 40x + A = 0$   | A1           | No errors or omissions  |
|          | (ii)    | $(x - 30)(x - 10)$  | B2           | B1 for $x(x - 30) - 10(x - 30) [= 0]$<br>or $x(x - 10) - 30(x - 10) [= 0]$<br>or<br>SC1 for $(x + a)(x + b)$<br>where $ab = 300$ or $a + b = -40$   |
|          |         | 30, 10  | B1           |   |
|          | (iii)   | $\sqrt{(-40)^2 - 4(1)(200)}$ or better  | B1           | or for $(x - 20)^2$   |
|          |         | $p = -40$ and $r = 2(1)$  | B1           | Must see $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ or both<br>or for $20 \pm \sqrt{200}$   |
|          |         | 5.86<br>34.14   | B1<br>B1     | If B0, SC1 for 5.9 or 5.857 to 5.858<br>and 34.1 or 34.14...<br><br>or 5.86 and 34.14 seen in working<br><br>or -5.86 and -34.14 as final answers   |
|          | (b) (i) | $\frac{200}{x} - \frac{200}{x + 10}$<br><br>$\frac{200(x + 10) - 200x}{x(x + 10)} = \frac{2000}{x(x + 10)}$ | M2<br><br>A1 | or M1 for $\frac{200}{x}$ or $\frac{200}{x + 10}$ soi<br><br>No errors or omissions   |
|          | (ii)    | 16 [min] 40 [s]   | 3            | B2 for $0.2\dot{7}$ or 0.278 or 0.2777 to 0.2778<br>or $\frac{5}{18}$ [h] oe<br><br>or $16.\dot{6}$ or 16.7 or 16.66 to 16.67 or $\frac{50}{3}$<br>[min]<br><br>or M1 for<br>$2000 \div 80(80 + 10)$ or $\frac{200}{80} - \frac{200}{90}$ |

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| <b>Question</b> | <b>Answer</b>  | <b>Mark</b>   | <b>Part marks</b>        |   |
|-----------------|----------------|---|--------------------------|---|
| <b>7</b>        | <b>(a) (i)</b> | $\frac{1}{2}\mathbf{p}$   | <b>1</b>                 |   |
|                 | <b>(ii)</b>    | $\frac{1}{2}\mathbf{p} - \frac{1}{3}\mathbf{r}$   | <b>1</b>                 |   |
|                 | <b>(iii)</b>   | $\mathbf{p} + \frac{2}{3}\mathbf{r}$  | <b>1</b>                 |   |
|                 | <b>(b)</b>     | $\mathbf{r} + \frac{3}{2}\mathbf{p}$  | <b>2</b>                 | <b>M1</b> for correct unsimplified answer<br>or for correct route<br>or for recognising $\overline{\text{OU}}$ as position vector   |
|                 | <b>(c)</b>     | 6 nfww  | <b>3</b>                 | <b>B2</b> for $(2k)^2 + ([-]k)^2 = 180$ oe<br>or <b>M1</b> for $(2k)^2 + ([-]k)^2$ oe   |
| <b>8</b>        | <b>(a)</b>     | 2   | <b>2</b>                 | <b>M1</b> for $2x + 1 = 1 + 4$  |
|                 | <b>(b)</b>     | 17  | <b>2</b>                 | <b>B1</b> for $[\text{h}(3) =] 8 \text{ soi}$ or $2 \times 2^x + 1$ oe  |
|                 | <b>(c)</b>     | $\frac{x-1}{2}$ oe final answer   | <b>2</b>                 | <b>M1</b> for $y-1 = 2x$ or $\frac{y}{2} = x + \frac{1}{2}$<br>or $x = 2y + 1$  |
|                 | <b>(d)</b>     | $4x^2 + 4x + 5$ final answer  | <b>3</b>                 | <b>M1</b> for $(2x+1)^2 + 4$<br>and <b>B1</b> for $[(2x+1)^2 =] 4x^2 + 2x + 2x + 1$<br>or better  |
|                 | <b>(e)</b>     | $\sqrt{2}$ or 1.41 or 1.414....   | <b>1</b>                 |   |
|                 | <b>(f)</b>     | -1  | <b>1</b>                 |   |
| <b>9</b>        | <b>(a) (i)</b> | $-\frac{1}{2}x + 2$ oe  | <b>3</b>                 | <b>SC2</b> for $y = -\frac{1}{2}x + c$ oe<br>or <b>SC1</b> for $y = kx + 2$ oe, $k \neq 0$<br>or<br><b>M1</b> for [gradient =] $-\frac{2}{4}$<br>and <b>M1</b> for substituting (4, 0) or (0, 2)<br>into $y = (\text{their } m)x + c$ |
|                 | <b>(ii)</b>    | $\frac{16}{a^2} \left[ + \frac{0^{[2]}}{b^2} \right] = 1$ or $\frac{4^2}{a^2} \left[ + \frac{0^{[2]}}{b^2} \right] = 1$<br>and $a^{[2]} = 4^{[2]}$<br><br>$\left[ \frac{0^{[2]}}{a^2} \right] + \frac{4}{b^2} = 1$ or $\left[ \frac{0^{[2]}}{a^2} \right] + \frac{2^2}{b^2} = 1$<br>and $b^{[2]} = 2^{[2]}$ | <b>1</b><br><br><b>1</b> |   |

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| Question | Answer                        | Mark | Part marks  |
|----------|-------------------------------|------|---|
| (b) (i)  | 1.73 or 1.732.. or $\sqrt{3}$ | 3    | M2 for $\frac{k^2}{4} = \frac{3}{4}$ or better<br>or M1 for $\frac{2^2}{16} + \frac{k^2}{4} = 1$ oe                               |
| (ii)     | 81.8 or 81.78 to 81.79        | 3    | M2 for $2 \times \tan^{-1}\left(\frac{\text{their}\sqrt{3}}{2}\right)$ oe<br>or M1 for $\tan = \frac{\text{their}\sqrt{3}}{2}$ oe |
| (c) (i)  | $8\pi$ final answer           | 1    |   |
| (ii)     | $72\pi$ final answer          | 2FT  | FT <i>their</i> (c)(i) $\times 9$ in terms of $\pi$<br>M1 for area factor of $3^2$ or 9<br>or [new $a$ ] = 12, [new $b$ ] = 6     |