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

**MATHEMATICS** **0580/41**

Paper 4 (Extended) **May/June 2016**

MARK SCHEME

Maximum Mark: 130

**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
nfww not from wrong working
soi seen or implied

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

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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 $1\times4-2\times3=4\times k-3\times1$ or better or **B1** for $1\times4-2\times3$ or $4\times k-3\times1$ 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 | |
| | ÷ 200 | M1(dep) | Dependent on second M1 |
| | 106 nfww | 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 $\frac{4}{3}\times\pi\times15^3$ |
| (b) (i) | 104 000 or 103 600 to 103 700 | 3 | **M2** for $\pi\times25^2\times60-14140$ or **M1** for $\pi\times25^2\times60$ |

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| Question | Answer | Mark | Part marks |
|---|---|---|---|
| (ii) | 52.8 or 52.75 to 52.81… | 2 | **M1** for *their* (b)(i) ÷ ($\pi \times 25^2$)<br>or $14\,140 \div (\pi \times 25^2)$ |
| (c) (i) | 15.8 or 15.81….. | 3 | **M2** for $[r^2 =]\ \frac{14140}{\frac{1}{3} \times \pi \times 54}$<br>or **M1** for $\frac{1}{3} \times \pi \times r^2 \times 54 = 14\,140$ oe |
| (ii) | 3580 or 3576 to 3581 nfww | 4 | **M1** for (*their* (c)(i))$^2$ + $54^2$<br>**M1** for $\pi \times$ (*their* (c)(i)) $\times \sqrt{\{}$(*their* (c)(i))$^2$ + $54^2\}$<br>**M1** for $\pi \times$ (*their* (c)(i))$^2$ |
| **5** (a) | 9<br>10.5 | 1<br>1 | |
| (b) | Fully correct curve | 5 | **SC4** for correct curve, but branches joined<br>**B3 FT** for 9 or 10 points plotted<br>or **B2 FT** for 7 or 8 points plotted<br>or **B1 FT** for 5 or 6 points plotted<br>and **B1** for two separate branches not touching or cutting *y*-axis |
| (c) | 2.1 to 2.6<br>8.5 to 9 | 1<br>1 | |
| (d) | 2, 3, 5, 7 | 2 | **SC1** for correct 4 values and no more than one extra positive integer or ±2, ±3, ±5, ±7<br>or 3 correct values and no extras |
| (e) | (– 2, – 12) | 1 | |
| (f) (i) | $20 + x^2 = x^3$<br>$x^3 - x^2 - 20 = 0$ | M1<br>A1 | Multiplication by *x*<br>No errors or omissions |
| (ii) | Fully correct curve $y = x^2$ | 2 | **SC1** for U – shaped parabola, vertex at origin |
| (iii) | 2.5 to 3.5 | 1 | |
| (iv) | 3.[0] to 3.1 or FT their answer to (iii) | 1FT | **FT** 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 |
| | $A = their\frac{1}{2}(80-2x)\times x$ 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] or $x(x-10) - 30(x-10)$ [= 0] or **SC1** for $(x+a)(x+b)$ 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 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 **and** 34.1 or 34.14…<br>or 5.86 **and** 34.14 seen in working<br>or –5.86 **and** –34.14 as final answers |
| (b) (i) | $\frac{200}{x} - \frac{200}{x+10}$ | M2 | or **M1** for $\frac{200}{x}$ or $\frac{200}{x+10}$ soi |
| | $\frac{200(x+10)-200x}{x(x+10)} = \frac{2000}{x(x+10)}$ | A1 | 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 or $\frac{5}{18}$ [h] oe or $16.\dot{6}$ or 16.7 or 16.66 to 16.67 or $\frac{50}{3}$ [min]<br>or **M1** for $2000 \div 80(80+10)$ or $\frac{200}{80} - \frac{200}{90}$ |

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| Question | Answer | Mark | Part marks |
|---|---|---|---|
| 7 (a) (i) | $\frac{1}{2}\mathbf{p}$ | 1 | |
| (ii) | $\frac{1}{2}\mathbf{p} - \frac{1}{3}\mathbf{r}$ | 1 | |
| (iii) | $\mathbf{p} + \frac{2}{3}\mathbf{r}$ | 1 | |
| (b) | $\mathbf{r} + \frac{3}{2}\mathbf{p}$ | 2 | **M1** for correct unsimplified answer or for correct route or for recognising $\overrightarrow{OU}$ as position vector |
| (c) | 6 nfww | 3 | **B2** for $(2k)^2 + ([-]k)^2 = 180$ oe<br>or **M1** for $(2k)^2 + ([-]k)^2$ oe |
| 8 (a) | 2 | 2 | **M1** for $2x + 1 = 1 + 4$ |
| (b) | 17 | 2 | **B1** for [h(3) =] 8 soi or $2\times2^x + 1$ oe |
| (c) | $\frac{x-1}{2}$ oe final answer | 2 | **M1** for $y - 1 = 2x$ or $\frac{y}{2} = x + \frac{1}{2}$ or $x = 2y + 1$ |
| (d) | $4x^2 + 4x + 5$ final answer | 3 | **M1** for $(2x+1)^2 + 4$<br>and **B1** for $[(2x+1)^2 =] 4x^2 + 2x + 2x + 1$ or better |
| (e) | $\sqrt{2}$ or 1.41 or 1.414.... | 1 | |
| (f) | –1 | 1 | |
| 9 (a) (i) | $-\frac{1}{2}x + 2$ oe | 3 | **SC2** for $y = -\frac{1}{2}x + c$ oe<br>or **SC1** for $y = kx + 2$ oe, $k \neq 0$<br>or<br>**M1** for [gradient =] $\frac{-2}{4}$<br>and **M1** for substituting (4, 0) or (0, 2) into $y = (\textit{their } m)x + c$ |
| (ii) | $\frac{16}{a^2}\left[+\frac{0^{[2]}}{b^2}\right] = 1$ or $\frac{4^2}{a^2}\left[+\frac{0^{[2]}}{b^2}\right] = 1$<br>and $a^{[2]} = 4^{[2]}$ | 1 | |
| | $\left[\frac{0^{[2]}}{a^2}\right] + \frac{4}{b^2} = 1$ or $\left[\frac{0^{[2]}}{a^2}\right] + \frac{2^2}{b^2} = 1$<br>and $b^{[2]} = 2^{[2]}$ | 1 | |

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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 $2\times\tan^{-1}\left(\frac{their\sqrt{3}}{2}\right)$ oe<br>or **M1** for tan = $\frac{their\sqrt{3}}{2}$ oe |
| (c) (i) | $8\pi$ final answer | 1 | |
| (ii) | $72\pi$ final answer | 2FT | FT *their* (c)(i) × 9 in terms of $\pi$<br>**M1** for area factor of $3^2$ or 9<br>or [new *a*] = 12, [new *b*] = 6 |

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