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

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

Paper 4 Paper 4 (Extended) **October/November 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) | 60 and 45 | 2 | **M1** for 105 ÷ ( 4 + 3) |
| (ii) | 117.6[0] final answer | 2 | **M1** for 105 × 1.12 oe |
| (iii) | 125 | 3 | **M2** for $105 \div (1 - \frac{16}{100})$ oe<br>or **M1** for 105 seen associated with 84% |
| (b) | 30.68 final answer | 6 | **B5** for 30.7[0] or 30.68…<br>or **B4** for 905 to 906 **and** 875<br>or 405 to 406… **and** 375<br>**OR**<br>**M1** for $500 \times \left(1+\frac{2}{100}\right)^{30}$ [– 500] oe<br>**M1** for [500 +] $\frac{500 \times 2.5 \times 30}{100}$<br>**B1** for 905 to 906 or 875<br>or 405 to 406 or 375 |
| (c) | 480 or 479.8 to 479.9… | 3 | **M2** for $1469 \div \left(1+\frac{3.8}{100}\right)^{30}$ oe<br>or **M1** for $P \times \left(1+\frac{3.8}{100}\right)^{30} = 1469$ oe |
| (d) | 6.5[0] or 6.500… | 3 | **M2** for $\sqrt[11]{\frac{120150}{60100}}$ [×100 – 100] oe<br>or **M1** for $60100 \times (\ )^n = 120150$ oe<br>where $n$ = 5 or 11 or 55 |

| Question | Answer | Mark | Part marks |
|---|---|---|---|
| 2 (a) (i) | 15 to 15.2 | 1 | |
| (ii) | 10.8 to 11 | 1 | |
| (iii) | 9 to 9.2 | 1FT | **FT** 20 – *their* **(a)(ii)** |
| (iv) | 10 | 1 | |
| (v) | 24 | 2 | **B1** for 176 written |
| (b) (i) | 16.75 nfww | 4 | isw attempted time conversion after correct answer<br>**M1** for 5, 12.5, 17.5, 25, 45 soi<br>**M1** for $\Sigma fx$<br>**M1 dep** for their $\Sigma fx \div 200$ |
| (ii) | Fully correct histogram | 4 | **B1** for each correct block<br>If zero scored, **SC1** for frequency densities of 9.6, 12, 2.6 and 0.6 seen |
| 3 (a) (i) | 51.7 or 51.69 to 51.70… | 4 | **M3** for<br>$(2\times\frac{2}{3}\times\pi\times13^3+\pi\times13^2\times25)\times2.3\,[\div1000]$ oe<br>or **SC3** for figs 517 or figs 5169 to 5170…<br>or **M2** for $(2\times\frac{2}{3}\times\pi\times13^3+\pi\times13^2\times25)$ oe<br>**OR**<br>**M1** for $2\times\frac{2}{3}\times\pi\times13^3$ seen<br>or $\pi\times13^2\times25$ seen<br>**M1indep** for *their* volume × 2.3 ÷ 1000 |
| (ii) | 1.96 or 1.957 to 1.958 … | 4 | **M3** for<br>$(2\times2\times\pi\times13^2+\pi\times2\times13\times25)[\div100^2]\times4.7$ oe<br>or **SC3** for figs 196 or figs 1957 to 1958…<br>**M2** for $(2\times2\times\pi\times13^2+\pi\times2\times13\times25)$ oe<br>**OR**<br>**M1** for $2\times2\times\pi\times13^2$ seen or $\pi\times2\times13\times25$ seen<br>**M1indep** for *their* area divided by $100^2$ soi |

| Question | Answer | Mark | Part marks |
|---|---|---|---|
| (b) | 6.2[0] or 6.203 to 6.204 | 3 | **M2** for $x^3 = \frac{500}{\frac{2}{3}\pi}$ oe or better<br>or **M1** for $\frac{1}{3} \times \pi \times x^2 \times 2x = 500$ oe |
| (c) | 286 or 285.7… | 3 | **M2** for $\frac{180}{A} = \left(\frac{180}{360}\right)^{\frac{2}{3}}$ oe<br>or **M1** for $\left(\sqrt[3]{\frac{360}{180}}\right)^{[2]}$ oe or $\left(\sqrt[3]{\frac{180}{360}}\right)^{[2]}$ oe seen<br>or $\frac{A^3}{180^3} = \frac{360^2}{180^2}$ |
| 4 (a) | 0.92, …., …., 0.5, – 1, …., ….., – 1, 0.5, …., …., 0.92 | 3 | **B2** for 4 or 5 correct<br>or **B1** for 2 or 3 correct |
| (b) | Fully correct graph | 5 | **B4** for correct graph but branches joined<br>OR<br>**B3FT** for 11 or 12 correct points<br>or **B2FT** for 9 or 10 correct points<br>or **B1FT** for 7 or 8 correct points<br><br>**B1indep** for a branch on each side of the $y$-axis, without touching it |
| (c) (i) | Correct ruled line through (–2, 1) and (2, –3) | 2 | **B1** for straight line with gradient –1 or cutting $y$-axis at –1 or correct line but freehand or short correct ruled line |
| (ii) | 0.7 to 0.95 | 1 | |
| (iii) | [$p$ = ] 2 and [$q$ = ] – 2 | 3 | **B2** for $x^3 + 2x^2 - 2 = 0$ oe<br>or **B1** for $x^2 - 2 = -x^3 - x^2$ oe or better<br>or $1 + 1 - \frac{2}{x^2} + x\ [= 0]$ or better |
| (d) (i) | (1.3 to 1.6, 0) | 1 | |
| (ii) | Ruled line from (0, –2) to intersection of *their* graph with positive $x$-axis | 1FT | |
| (iii) | Tangent [ to curve ]<br>$A$ or (1.3 to 1.6, 0) | 1<br>1 | |

| Question | Answer | Mark | Part marks |
|---|---|---|---|
| 5 (a) (i) | Image at (–2, – 4), (4, – 4), (4, 0) | 2 | **SC1** for translation $\begin{pmatrix}-4\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-8\end{pmatrix}$ |
| (ii) | 8.94 or 8.944… | 2 | **M1** for $\sqrt{(-4)^2+(-8)^2}$ or $\sqrt{4^2+8^2}$ |
| (b) (i) | Enlargement<br>[factor] 0.5 oe<br>[centre] (0, 0) oe | 1<br>1<br>1 | |
| (ii) | $\begin{pmatrix}0.5 & 0\\0 & 0.5\end{pmatrix}$ oe | 2FT | **FT** their scale factor from **(b)(i)** dep on enlargement and centre (0, 0)<br><br>**B1FT** for one row or column |
| (iii) | 0.25 or $\frac{1}{4}$ | 1FT | **Strict FT** *their* matrix but not for identity matrix |
| 6 (a) | 126 or 126.4 to 126.5 | 3 | **M2** for $\sqrt{220^2-180^2}$ oe<br>or **M1** for $BC^2 + 180^2 = 220^2$ oe |
| (b) | 99.9 or 99.86 to 99.87 | 4 | **M2** for $180^2 + 170^2 - 2 \times 180 \times 170 \cos 33$<br>or **M1** for $\cos 33 = \frac{180^2+170^2-CD^2}{2\times180\times170}$<br>**A1** for 9970 or 9973 to 9974 |
| (c) | 92.6 or 92.58 to 92.59 | 2 | **M1** for $\frac{\text{dist}}{170} = \sin 33$ oe |
| (d) | 115.1 or 115.0 to 115.1 | 3 | **M1** for $\cos = \frac{180}{220}$ oe<br>**M1dep** for 47 + 33 + *their* angle *BAC* |
| (e) | 19700 or 19708 to 19720 | 3 | **M1** for 0.5 × 180 × 170 × sin33 oe<br>or 0.5 × 180 × *their* **(c)** oe<br>**M1** for 0.5 × 180 × *their* **(a)** oe<br>or 0.5 × 180 × 220 × sin(*their BAC*) oe |

| Question | Answer | Mark | Part marks |
|---|---|---|---|
| 7 (a) | 0.7, 0.1 oe correctly placed<br>0.2, 0.8 oe correctly placed | 1<br>1 | |
| (b) (i) | 0.44 nfww oe | 3 | **M2** for $1 - \textit{their}\ 0.7 \times \textit{their}\ 0.8$<br>or for 0.3 + *their* 0.7 × *their* 0.2 oe<br><br>or **M1** for *their* 0.7 × *their* 0.8<br>or for<br>two of 0.3 × 0.9, 0.3 × *their* 0.1,<br>*their* 0.7 × *their* 0.2 |
| (ii) | 110 | 1FT | **FT** 250 × *their* **(b)(i)** |
| (c) | If late at first two stations then certain to be late at station *C* oe | 1 | Indication of certain event (allow 1 or 100% probability or sure) at third station if late at first two stations |
| 8 (a) | $\frac{323}{x} + \frac{323}{x+2} = 36$ oe three term equation | B2 | **B1** for $\frac{323}{x}$ seen oe or $\frac{323}{x+2}$ seen oe |
| | 323(*x* + 2) + 323*x* = 36*x*(*x* + 2) oe<br>or $\frac{323x + 646 + 323x}{x(x+2)} = 36$ oe | M1 | i.e. for clearing the fractions (or all still over common denominator) or reducing the two algebraic fractions to one fraction and expanding the brackets in the numerator |
| | $36x^2 - 574x - 646 = 0$<br>$18x^2 - 287x - 323 = 0$ | A1 | answer reached without any omissions or errors with at least one intermediate line with brackets expanded after M1 |
| (b) (i) | 17, 19 | 1 | |
| (ii) | ( ……. + 19)(……. – 17) | 2 | **SC1** for ( ……. + *a*)(……. + *b*) where *a*, *b* are integers and *ab* = –323 or *a* + 18*b* = –287 |
| (iii) | $17, -\frac{19}{18}$ oe | 1FT | **FT** *their* **(b)(ii)** |
| (c) | 11 cao | 1 | |

| Question | Answer | Mark | Part marks |
|---|---|---|---|
| 9 (a) | 236 | 3 | **B2** for 243 and 7<br>or **M2** for $3^{2(2)+1}-(2(3^{[1]})+1)$ oe<br>**B1** for h(5) or f(3) soi<br>or **M1** for $3^{2x+1}-(2(3^{x})+1)$ or better |
| (b) | $6x + 1$ final answer | 2 | **M1** for $3(2x + 1) – 2$ |
| (c) | $x < 3$ oe final answer | 2 | **M1** for $1 + 2 > 3x – 2x$ or $2x – 3x > –2 –1$ oe |
| (d) | –2 | 1 | |
| (e) | $\frac{x+2}{3}$ oe final answer | 2 | **M1** for $x = 3y – 2$ or $y + 2 = 3x$ or $\frac{y}{3}=x-\frac{2}{3}$ |
| (f) | $\frac{6x^2-x+3}{2x+1}$ final answer | 3 | **M1** for $5 + (2x + 1)(3x – 2)$ or better isw<br>**B1** for common denominator $2x + 1$ isw |
| (g) | 9 | 1 | |
| 10 (a) | 115 or 114.5 to 114.6 | 3 | **M2** for $\frac{r^2}{\frac{\pi r^2}{360}}$ or better<br>or **M1** for $\frac{w}{360}\times\pi\times r^2=r^2$ |
| (b) | 126 | 3 | **M2** for $\frac{x}{360}\times 2\pi r[+2r]=[2r+]\frac{7\pi r}{10}$ or better<br>or **M1** for $\frac{x}{360}\times 2\pi r$ |
| (c) | 120 | 4 | **B3** for $\frac{y}{2}=60$ or $x$ (base angle) = 30<br>OR<br>**M3** for $\cos x$ or $\sin\left(\frac{y}{2}\right)=\frac{\sqrt{3}}{2}$ oe or $\cos y=-\frac{1}{2}$ oe<br>or **M2** for $\cos x$ or $\sin\left(\frac{y}{2}\right)=\frac{q\sqrt{3}}{2q}$<br>or $[\cos y]=\frac{q^2+q^2-\left(q\sqrt{3}\right)^2}{2\times q\times q}$ oe<br>or **M1** for<br>$\left[\left(q\sqrt{3}\right)^2=\right]q^2+q^2-2\times q\times q\cos y$ oe<br>After **M0**, **SC1** for $[h^2=]q^2-\left(\frac{1}{2}q\sqrt{3}\right)^2$ or for $q$ replaced by 1, 2, 4, etc. |