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**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**International General Certificate of Secondary Education**

# MARK SCHEME for the October/November 2013 series

## 0580 MATHEMATICS

**0580/41** 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 |
|---|---|---|---|
| 1 | **(a) (i)** $\frac{2}{5}$ cao | 1 | |
| | **(ii)** 3 : 2 cao | 1 | |
| | **(b) (i)** 1.22 | 2 | **M1** for 86.38 – 28 × 1.56 |
| | **(ii)** 1.3 [0] nfww | 3 | **M2** for 1.56 ÷ 1.2 oe<br>**or M1** for 1.56 = 120% soi |
| | **(c)** 33.6[0] | 2 | **M1** for (667 – 314.2) ÷ 10.5 oe |
| 2 | **(a)** 3 correct lines on grid<br>(0, 0) to (40, 5)<br>(40, 5) to (100, 5)<br>(100, 5) to (120, 0) | 2 | Allow good freehand<br>**SC1FT** for 2 lines correct, **FT** from an incorrect line |
| | **(b)** $\frac{5}{40}$ oe | 1 | |
| | **(c)** 3.75 | 4 | **M2** for 0.5 × 40 × 5 + 60 × 5 + 0.5 × 20 × 5 oe [450]<br>or **M1** for evidence of a relevant area = distance and **M1**dep *their* area (or distance) ÷ 120 |

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| Qu | Answers | Mark | Part Marks |
|---|---|---|---|
| 3 | **(a) (i)** 204 or 204.2 to 204.23 | **2** | **M1** for $\pi \times 5 \times 13$ implied by answer in rang 204.1 to 204.3 |
| | **(ii)** 12 cao | **3** | **M2** for $\sqrt{13^2 - 5^2}$ or states 5, 12, 13 triangle or **M1** for $13^2 = 5^2 + h^2$ or better |
| | **(iii)** 314 or 314.1 to 314.2 | **2** | **M1** for $\frac{1}{3} \times \pi \times 5^2 \times$ *their* **(a) (ii)** implied by answer in range 314 to 314.3 |
| | **(iv)** $3.14 \times 10^{-4}$ or 3.141 to $3.142 \times 10^{-4}$ | **2FT** | **FT** *their* **(a) (iii)** $\div 100^3$ correctly evaluated **and** given in standard form to 3 sig figs or better or **M1 FT** for *their* **(a) (iii)** $\div 100^3$ or **SC1** for conversion of *their* $m^3$ into standard form only if negative power |
| | **(b)** 138 or 138.3 to 138.5 | **4** | **M3** for $\frac{10\pi}{26\pi} \times 360$ oe or $\frac{\pi \times 5 \times 13 \textbf{ or } \textit{their} \textbf{ (a)(i)}}{\pi \times 13^2} \times 360$ oe or **M2** for a correct fraction without × 360 or **M1** for $\pi \times 2 \times 13$ oe [81.6 to 81.8] seen or $\pi \times 13^2$ oe [530.6 to 531.2] seen |
| 4 | **(a)** 45.[0] or 45.01 to 45.02 nfww | **4** | **M2** for $55^2 + 70^2 - 2.55.70 \cos 40$ or **M1** for correct implicit equation **A1** for 2026. …. |
| | **(b)** 84.9 or 84.90 to 84.92 | **4** | **B1** for angle BDC = 40 soi **M2** for $\frac{70 \sin(\textit{their}\, 40)}{\sin 32}$ or M1 for correct implicit equation |
| | **(c) (i)** 4060 or 4063 to 4064 nfww | **3** | **M2** for $\frac{1}{2}(55 \times 70 \sin 40) + \frac{1}{2}(70 \times \textit{their}(b) \sin(180 - \textit{their}\, 40 - 32))$ oe or **M1** for correct method for one of the triangle areas |
| | **(ii)** 1020 or 1015 to 1016 | **2FT** | **FT** *their* **(c) (i)** $\div 4$ oe correctly evaluated or **M1** *their* **(c) (i)** $\div$ figs 4 oe |
| | **(d)** 35.4 or 35.35… nfww | **2** | **M1** for $\sin 40 = \frac{\textit{distance}}{55}$ or better or for $\frac{1}{2}$ (55 × 70 sin 40) = (70 × distance) ÷ 2 or better |

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| Qu | Answers | Mark | Part Marks |
|---|---|---|---|
| 5 | **(a) (i)** Correct reflection to (4, 8) (2, 9) (4, 9) | **2** | **SC1** for reflection in line $x = 5$ or reflection in $y = k$ Ignore additional triangles |
| | **(ii)** Correct rotation to (4, 2), (4, 3) (6, 3) | **2** | **SC1** for rotation 180° with incorrect centre Ignore additional triangles |
| | **(iii)** Shear, $x$-axis oe invariant, [factor] 2 | **3** | **B1** each (independent) |
| | **(iv)** $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$ | **2FT** | **FT** *their* shear factor **B1FT** for one correct column or row in 2 by 2 matrix but not identity matrix or **SC1FT** for $\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$ |
| | **(b) (i)** $\mathbf{p} + 2\mathbf{s}$ final answer | **2** | **M1** for recognising $\overrightarrow{OQ}$ as position vector soi |
| | **(ii)** $\mathbf{s} + \frac{1}{2}\mathbf{p}$ final answer | **2** | **B1** for $\mathbf{s} + k\mathbf{p}$ or $k\mathbf{s} + \frac{1}{2}\mathbf{p}$ or correct route ($k \neq 0$) |
| | **(c)** parallel **and** $OQ = 2SR$ oe | **1** | |
| 6 | **(a) (i)** 1.4 to 1.6 | **1** | |
| | **(ii)** 1.15 to 1.25 | **1** | |
| | **(iii)** – 1 | **1** | |
| | **(iv)** – 2.25 to – 2.1<br>– 0.9 to – 0.75<br>2.2 to 2.35 | **3** | **B2** for 2 correct or **B1** for one correct or **B1** for $y = x$ drawn ruled to cut curve 3 times |
| | **(b) (i)** – 15 | **2** | **B1** for [h(3) =] 8 seen or **M1** for $1 - 2(x^2 - 1)$ or better |
| | **(ii)** $\frac{1-x}{2}$ or $\frac{1}{2} - \frac{x}{2}$ oe final answer | **2** | **M1** for $2x = 1 - y$ or $x = 1 - 2y$ or better |
| | **(iii)** – 2, 2 | **3** | **M1** for $x^2 - 1 = 3$ or better **B1** for one answer |
| | **(iv)** $\frac{1}{8}$ oe nfww | **3** | **M2** for $8x = 1$ or $8x - 1 = 0$ or **M1** for $1 - 2(3x)$ [$= 2x$] |

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| Qu | Answers | Mark | Part Marks |
|---|---|---|---|
| 7 | **(a)** 24.7 or 24.66 to 24.67 | **4** | **M1** for midpoints soi<br>(condone 1 error or omission)<br>(5, 15, 25, 35, 45, 55)<br>**and**<br>**M1** for use of $\sum fx$ with $x$ in correct interval including both boundaries (condone 1 further error or omission)<br>**and**<br>**M1** (dependent on second **M**) for $\sum fx \div 120$ |
| | **(b)** **(i)** 50, 90, 114 | **2** | **B1** for 2 correct |
| | **(ii)** Correct curve<br>or ruled polygon | **3** | Ignore section to left of $t = 10$<br>**B1** for 6 correct horizontal plots<br>**and B1FT** for 6 correct vertical plots<br>If 0 scored **SC1** for 5 out of 6 correct plots<br>**and**<br>**B1FT** for curve or polygon through at least 5 of *their* points dep on an increasing curve/polygon that reaches 120 vertically |
| | **(iii)** 21.5 to 23<br>15 to 16.5<br>24 to 26 | <br><br>**4** | **B1**<br>**B1**<br>**B2** or **B1** for 72 or 72.6 seen |
| | **(c)** **(i)** 50, 30 | **2** | **B1** each |
| | **(ii)** Correct histogram | **3FT** | **B1** for blocks of widths 0 – 20, 30 – 60 (no gaps)<br>**B1FT** for block of height 2.5 or *their* 50 ÷ 20<br>**and B1FT** for block of height 1 or *their* 30 ÷ 30 |

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| Qu | Answers | Mark | Part Marks |
|---|---|---|---|
| 8 | **(a)** $\sqrt{(-11)^2 - 4(8)(-11)}$ or better | **B1** | Seen anywhere or for $\left(x - \frac{11}{16}\right)^2$ |
| | $p = -(-11)$, $r = 2(8)$ or better | **B1** | Must be in the form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$<br>or **B1** for $\sqrt{\frac{11}{8} + \left(\frac{11}{16}\right)^2} + \frac{11}{16}$ |
| | – 0.67, 2.05 final answers | **B1B1** | **SC1** for – 0.7 or – 0.672 to – 0.671 **and** 2.0 or 2.046 to 2.047<br>or answers 0.67 **and** – 2.05 |
| | **(b)** 132 | **3** | **M1** for $y = k\sqrt{x}$ oe or $\sqrt{x = ky}$ oe<br>**A1** for k = 6 oe or better or for k = 0.1666 to 0.167<br>[k = 6 implies M1A1] oe |
| | **(c)** 20 with supporting algebraic working | **6** | **B2** for $\frac{x}{2.5} + \frac{x - 14.5}{0.5} = 19$ oe<br>or **B1** for $\frac{x}{2.5}$ or $\frac{x-14.5}{.5}$<br>**M1dep on B2** for first completed correct move to clear both fractions<br>**M1** for second completed correct move to collect terms in $x$ to a single term<br>**M1** for third completed correct move to collect numeric term[s] leading to $ax = b$<br>**SC1** for 20 with no algebraic working |
| 9 | **(a)** $y = 2$ oe | **1** | |
| | $y = 2x$ oe | **2** | **M1** for $y = kx$, $k \neq 0$ or gradient 2 soi |
| | $y = -\frac{1}{2}x + 5$ oe | **2** | **M1** for gradient – ½ soi or $y = kx + 5$oe or $x + 2y = k$ $k \neq 0$ oe<br>If $L^2$ **and** $L^3$ both correct but interchanged then **SC3** |
| | **(b)** $y \geq 2$ oe<br>$y \leq 2x$ oe<br>$y \leq -\frac{1}{2}x + 5$ oe | **3** | **B1** for each correct inequality, allow in any order<br>After 0 scored, **SC1** for all inequalities reversed |
| | **(c)** **(i)** 4 [bushes], 3 [trees] | **2** | **M1** for any correct trial using integer coordinates in region<br>or $30x + 200y = 720$ seen |
| | **(ii)** 2 [bushes], 4 [trees] | **2** | **M1** for any correct trial using integer coordinates in region |
| | 860 | **1** | |

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| Qu | Answers | Mark | Part Marks |
|---|---|---|---|
| 10 | **(a) (i)** $1 + 2 + 3 + 4 + 5 = 15$ | **1** | |
| | **(ii)** Correct substitution equating to sum e.g. $\frac{2(2+1)}{k} = 3$ **and** $k = 2$ stated with no errors seen | **2** | **M1** for using a value of $n$ in $\frac{n(n+1)}{k}$ e.g. $\frac{2(2+1)}{k} = 3$ or for a verification using $k = 2$ e.g. $\frac{2(2+1)}{2} = 3$ |
| | **(iii)** 1830 | **1** | |
| | **(iv)** 30 | **2** | **M1** for $\frac{n(n+1)}{2} = 465$ or better |
| | **(v)** $n - 8$ | **1** | |
| | **(b) (i)** 225, 15 | **2** | **B1** either |
| | **(ii)** $\frac{n^2(n+1)^2}{4}$ oe | **1** | |
| | **(iii)** 36100 | **2** | **M1** for $\frac{19^2(19+1)^2}{4}$ oe or $190^2$ |

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