**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**International General Certificate of Secondary Education**

# MARK SCHEME for the May/June 2014 series

## 0580 MATHEMATICS

**0580/43** 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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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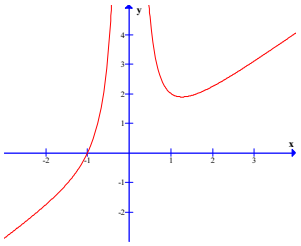
**Abbreviations**

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

| Qu | | Answers | Mark | Part Marks |
|---|---|---|---|---|
| 1 | (a) | 62100[.00] Final answer | 2 | **B1** for 62074[. 35] or 62070 |
| | (b) | 39300 | 3 | **M2** for 45981÷ 1.17 oe<br>**or M1** for 45981 associated with 117 [%] |
| | (c) | 20436 | 2 | **M1** for 45981÷ (3+4+2) or 45981 × 4 |
| | (d) | 4 | 3 | **M2** for $\frac{1.5\times1000}{330}$ oe<br>**or M1** for figs 4545... or 455 |
| | (e) | 25545 | 2 | **M1** for 45981 × $\frac{5}{9}$ |
| 2 | (a) | $10 < x \leq 25$ $25 < x \leq 30$<br>$30 < x \leq 35$ $35 < x \leq 50$<br>$50 < x \leq 60$ | 2 | 5 correct<br>**B1** for 3 or 4 correct<br>**or SC1** for all correct but in the form 10 to 25 or 10 – 25 |
| | | 13 33 19 [4] 15 6 | 3 | **B2** for 4 correct<br>**or B1** for 3 correct |
| | (b) | 25.1[0] or 25.13 to 25.14 nfww | 4 | **M1** for mid-values soi, condone one error or omission<br>5 17.5 27.5 32.5 42.5 55 soi<br>**and M1** for $\sum fx$ for any $x$ in intervals including boundaries, but all $f$s must be integers, condone one further error or omission<br>**and M1 dep** for $\sum fx \div 90$<br>**Dep** on 2nd **M** mark earned |

| Qu | | Answers | Mark | Part Marks |
|---|---|---|---|---|
| 3 | (a) (i) | 72[.0] or 71.98 to 71.99 nfww | 3 | **M2** for [sin P = ] $\frac{97}{\frac{1}{2}\times 12\times 17}$ oe<br>**or M1** for implicit version |
| | (ii) | 16.2 or 16.18 to 16.19 nfww | 4 | **M2** for $6^2+17^2-2\times 6\times 17\times\cos(\textit{their}\ 72)$<br>**or M1** for implicit form<br>**and A1** for [$XR^2$ =] 261.8 to 262 |
| | (b) | 7.61 or 7.612... nfww | 4 | **M3** for [$a$ =] 9.4 × sin 37 ÷ cos 42 oe<br>or [$a$ = ] 9.4sin37/sin(90–42)<br>**or M2** for [$a$ =] their height ÷ cos 42 oe<br>or $\frac{a}{\sin 37}=\frac{9.4}{\sin(90-42)}$ oe<br>**or M1** for their height ÷ $a$ = cos 42<br>or for [their height = ] 9.4 × sin 37 oe<br>**or B1** for 48° correctly used or seen in correct position on diagram |
| | (c) | 50 | 1 | |
| | | 130 | 1 | |
| 4 | (a) | 0, 4.5, 3.11[1…] | 3 | **B1, B1, B1** |
| | (b) | Complete correct curve with minimum below $y = 2$<br>  | 5 | **B3 FT** for 9 points correctly plotted<br>**B2 FT** for 7 or 8 points correctly plotted<br>**or B1 FT** 5 or 6 points correctly plotted<br>**and B1 indep** two separate branches not touching or cutting $y$-axis |
| | (c) | – 0.5 to – 0.6<br>0.6 to 0.7<br>2.8 to 2.9 | 1<br>1<br>1 | if 0 **SC1** for $y = 3$ indicated |
| | (d) | Correct line or no line **and**<br>– 0.7 to – 0.6 nfww | 3 | Must check line - not if wrong line<br>**B2** for $y = 1 - x$ ruled correctly<br>**or SC1** for ruled line with either gradient –1 or $y$-intercept 1 but not line y = 1 or correct freehand line |

| Qu | | Answers | Mark | Part Marks |
|---|---|---|---|---|
| | **(e)** | tangent ruled at $x = 2$<br>and<br>0.62 to 0.8 | **3** | Accept integer/integer provided in range<br>**B1** for correct tangent drawn<br><br>**and M1** for change in $y$ / change in $x$ dep on any tangent or close attempt at tangent at any point<br>Must see correct or implied calculation from a drawn tangent |
| | **(f)** | $\frac{1}{x^2} = -x$ or $1 + x^3 = 0$ | **M1** | |
| | | $1 = -x^3$ or $x^3 = -1$ | **M1** | **dep M1** |
| | | $x = \sqrt[3]{-1}$ | **A1** | **dep M2** |
| **5** | **(a) (i)** | $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$ | **1** | |
| | **(ii)** | 5.83 to 5.831 | **2** | **M1** for $3^2 + 5^2$ seen |
| | **(b) (i)** | $-2\mathbf{p} + \mathbf{q}$ oe | **1** | accept unsimplified |
| | **(ii)** | $\overrightarrow{PS} = -\mathbf{p} + 2\mathbf{q}$ or $\overrightarrow{SP} = \mathbf{p} - 2\mathbf{q}$ | **B1** | |
| | | $\overrightarrow{MS} = -\frac{2}{3}\mathbf{p} + \frac{4}{3}\mathbf{q}$ seen<br>or $\overrightarrow{SM} = \frac{2}{3}\mathbf{p} - \frac{4}{3}\mathbf{q}$ seen<br>or $\overrightarrow{RM} = \frac{2}{3}(-2\mathbf{p} + \mathbf{q})$ soi<br>or $\overrightarrow{MR} = \frac{2}{3}(2\mathbf{p} - \mathbf{q})$ soi<br>or $\overrightarrow{MQ} = \frac{1}{3}(-2\mathbf{p} + \mathbf{q})$ soi<br>or $\overrightarrow{QM} = \frac{1}{3}(2\mathbf{p} - \mathbf{q})$ soi | **B1** | |
| | | $\overrightarrow{PM} = \mathbf{p} + \overrightarrow{RM}$<br>or $\mathbf{p} - \overrightarrow{MR}$<br>or $-\mathbf{p} + \mathbf{q} + \overrightarrow{QM}$<br>or $-\mathbf{p} + \mathbf{q} - \overrightarrow{MQ}$<br>$[= -\frac{1}{3}\mathbf{p} + \frac{2}{3}\mathbf{q}]$ | **M1** | Any correct route for $\overrightarrow{PM}$ eg $\overrightarrow{PR} + \overrightarrow{RM}$ |
| | | 1 : 3 nfww | **A1** | After 0 scored, **SC1** for 1 : 3 |

| Qu | | Answers | Mark | Part Marks |
|---|---|---|---|---|
| 6 | (a) (i) | $\frac{1}{6}$ | 1 | |
| | (ii) | $\frac{4}{6}$ oe | 1 | |
| | (iii) | $\frac{2}{6}$ oe | 1 | |
| | (b) | $\frac{16}{36}$ oe | 3 | **M2** $\frac{2}{6}\times\frac{4}{6}+\frac{4}{6}\times\frac{2}{6}$ only oe<br>**or M1** for one of $\frac{2}{6}\times\frac{4}{6}$ or $\frac{4}{6}\times\frac{2}{6}$ soi by $\frac{2}{9}$ |
| | (c) | $\frac{48}{360}$ oe | 3 | **M2** for $\frac{4}{6}\times\frac{3}{5}\times\frac{2}{4}\times\frac{2}{3}$ only oe<br>**or M1** for denominators 6, 5, 4, 3 soi in product of four fractions |
| 7 | (a) (i) | 148 | 1 | |
| | (ii) | 122 | 2 | **B1** for 58 seen at *A* or 32 seen at *Y* |
| | (iii) | 148 | 1 | |
| | (iv) | 106 nfww | 3 | **B1** for [sum of interior angles =] 720<br>**and M1** for $\frac{1}{2}$ {(*their* 720) – (*p*+*q*+*t*+90)} |
| | (b) (i) | 63 | 2 | **B1** for angle *RPS* = 27 or 90 at *P* or at *S* seen or stated |
| | (ii) | 54 | 2 | **B1** for *their x* or 63 or letter *x* at *Q* seen or state |

| Qu | | Answers | Mark | Part Marks |
|---|---|---|---|---|
| 8 | (a) (i) | $7\times 2+(2x-3)(x+4)=2(x+4)$ | M1 | Allow if bracket[s] omitted but recovers |
| | | $2x^2+8x-3x-12$ or better seen | B1 | |
| | | $2x^2+3x-6=0$ | A1 | with no errors seen and brackets correctly expanded on both sides and no omission of brackets |
| | (ii) | $\sqrt{(3)^2-4(2(-6))}$ or better | B1 | or $\left(x+\frac{3}{4}\right)^2$ |
| | | $p=-3$ and $r=2(2)$ | B1 | Must see $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ or both |
| | | | | Or $-\frac{3}{4}$ + or $-\sqrt{\frac{57}{16}}$ |
| | | 1.14 and – 2.64 cao | B1B1 | **SC1** for 1.1 and – 2.6 final answer or 1.137 and – 2.637 final answer or 1.14 and – 2.64 seen in working or for -1.14 and 2.64 as final ans |
| | (b) | $\pi\times x^2+\pi\times x\times 3x$ | M2 | or **M1** for $\pi\times x\times 3x$ |
| | | $4[\pi]x^2=[\pi]r^2$ | M1 | **Dep on M2** |
| | | $2x=r$ | A1 | with no errors seen |
| 9 | (a) | $4-6x$ final answer | 1 | |
| | (b) | $9x-8$ final answer | 2 | **M1** for $4-3(4-3x)$ seen |
| | (c) | $\frac{1}{27}$ final answer | 3 | **M2** for $3^{-3}$ soi by final answer 0.037037… to 3sf or better **or M1** for [g( – 1) =] 3 soi |
| | (d) | $\frac{4-x}{3}$ oe final answer | 2 | **M1** for a correct first step $3x=4-y$ oe or $x=4-3y$ or $\frac{y}{3}=\frac{4}{3}-x$ |
| | (e) | $\frac{4}{3}$ or $1\frac{1}{3}$ or 1.33 or better | 3 | **M2** for $3x-4=0$ or better **or M1** for $3^{-(4-3x)}$ |

| Qu | | Answers | Mark | Part Marks |
|---|---|---|---|---|
| 10 | (a) | [$r$ =] 2.30[9...] | 3 | **B2** for [r =] 2.31<br>**or M2** for $4\tan 30$<br>**or M1** for $\frac{r}{4} = \tan 30$ |
| | (b) | 333 or 332.5 to 332.6 | 4 | **M3** for $0.5 \times 8 \times 8 \times \sin 60 \times 12$ oe<br>**or M2** for $0.5 \times 8 \times 8 \times \sin 60$ oe<br>**or M1** for *their* triangle area × 12 shown dep on '$\frac{1}{2}$' used within *their* area of triangle method |
| | (c) (i) | 30 | 3 | **M2** for $12 \div 0.4$ or $120 \div 4$<br>**or SC1** for figs 3 |
| | (ii) | 6.65 or 6.647 to 6.648[...] | 2 | **M1** for $\pi \times 2.3^2 \times 0.4$<br>**or SC1** for $\pi \times 2.3^2 \times 4$ soi by 66.5 or 66.47 to 66.48[…] |
| | (iii) | 40[.0] or 40.1 or 40.0 to 40.2 nfww | 3 | **M2** for $100 - \frac{their(c)(i) \times their(c)(ii)}{their(b)} \times 100$<br>or $\frac{their(b) - their(c)(i) \times their(c)(ii)}{their(b)} \times 100$<br>**or M1** for $\frac{their(c)(i) \times their(c)(ii)}{their(b)} \times 100$<br>or $\frac{their(b) - their(c)(i) \times their(c)(ii)}{their(b)}$ |
| 11 | (a) | $\frac{1}{8}\ \frac{1}{16}\ \frac{1}{32}$ | 2 | **B1** for 2 correct |
| | | $\frac{1}{2^{n-1}}$ oe | 2 | **SC1** for $\frac{1}{2^n}$ oe |
| | | $2^{-3}\ 2^{-4}\ 2^{-5}$ | 1 | |
| | | $2^{1-n}$ or $2^{-(n-1)}$ | 1 | |
| | (b) (i) | 64 256 1024 | 1 | |
| | | $2^6\ 2^8\ 2^{10}$ | 1 | |
| | (ii) | $2^{2(n-1)}$ or $2^{2n-2}$ | 1 | |
| | (c) | 16384 | 2 | **B1** for $n = 8$ |