# MARK SCHEME for the October/November 2010 question paper

# for the guidance of teachers

# 0580 MATHEMATICS

0580/43          Paper 4 (Extended), maximum raw mark 130

UNIVERSITY of CAMBRIDGE
International Examinations

**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)** $200 \div 10 \times 3$ oe <br> $200 \div 10 \times 2$ oe | M1 <br> M1 | |
| | **(b)** 65 | 2 | **M1** for $\dfrac{39}{60} \times 100$ oe    35 is **M0** |
| | **(c)** 46 | 3 | **M2** for $36.80 \div 0.8$ oe <br> or **M1** for 80% = 36.80 oe |
| | **(d)** 0.6(0) | 3 | **M2** for $5(x + 12) + 2x = 64.2$ oe <br> or $(64.2 - 5 \times 12) \div 7$ <br> or $5x + 2(x - 12) = 64.2$ oe or $(64.2 + 2 \times 12) \div 7$ <br> or **M1** for $y = x + 12$ and $5y + 2x = 64.2$ <br> or $y = x - 12$ and $5x + 2y = 64.2$ <br> After **M0**, **SC1** for $k(x \pm 12)$ seen |
| **2** | **(a)** $(\cos Q =) \dfrac{4^2 + 4.5^2 - 7^2}{2 \times 4 \times 4.5}$ o.e. <br><br> 110.74…. | M2 <br><br> E2 | **M1** for $7^2 = 4^2 + 4.5^2 - 2 \times 4 \times 4.5 \times \cos(Q)$ <br><br> If **E0** then **A1** for $-0.354(1….)$ |
| | **(b)** $(RS =) \dfrac{7 \sin 40}{\sin 85}$ <br><br> 4.516 … | M2 <br><br> E1 | **M1** for $\dfrac{RS}{\sin 40} = \dfrac{7}{\sin 85}$ o.e. <br><br> Can be implied by second M |
| | **(c)** Angle $R = 55°$ <br> $0.5 \times 7 \times 4.52 \times \sin(\text{their } 55)$ o.e. <br> $0.5 \times 4 \times 4.5 \times \sin 110.7$ o.e. <br> Triangle $PRS$ + Triangle $PQR$ <br> 21.4 (21.36 – 21.42) | B1 <br> M1 <br> M1 <br> M1 <br> A1 | (May be seen on diagram) <br> (12.95 – 13.0)    their 55 is (180 – 40 – 85) <br> (8.418 – 8.42)  ($s = 7.75$) <br> Dependent on M1, M1 <br> www 5 |

| 3 | (a) $5x^2 - x$ or $x(5x - 1)$ | 2 | **M1** for $x^2 + 3x$ or $4x^2 - 4x$ correct |
|---|---|---|---|
| | (b) $27x^9$ | 2 | **B1** for 27 or for $x^9$ |
| | (c) (i) $7x^7(1 + 2x^7)$ | 2 | **M1** for any correct partially factorised expression <br> or $7x^7(1 + ...)$ |
| | (ii) $(y + w)(x + 2a)$ | 2 | **M1** for $x(y + w) + 2a(y + w)$ or $y(x + 2a) + w(x + 2a)$ |
| | (iii) $(2x + 7)(2x - 7)$ | 1 | |
| | (d) $\dfrac{-5 \pm \sqrt{5^2 - 4(2)(1)}}{2(2)}$ oe | 2 | In square root **B1** for $5^2 - 4(2)(1)$ or better (17) <br> If in form $\dfrac{p + \sqrt{q}}{r}$ or $\dfrac{p - \sqrt{q}}{r}$ <br> **B1** for $p = -5$ and $r = 2(2)$ |
| | –2.28 <br> –0.22 | 1 <br> 1 | **SC1** for –2.3 or –2.281 to –2.280 and <br> –0.2 or –0.220 to –0.219 |
| 4 | (a) (i) $\begin{pmatrix} 25 \\ 43 \end{pmatrix}$ | 1 <br> 1 | If 0, 0 then **SC1** for 25 and 43 seen |
| | (ii) (16) | 2 | **B1** for 16 without brackets |
| | (iii) $\dfrac{1}{-2}\begin{pmatrix} 5 & -3 \\ -4 & 2 \end{pmatrix}$ isw <br> or $\begin{pmatrix} -\frac{5}{2} & \frac{3}{2} \\ 2 & -1 \end{pmatrix}$ | 2 | **B1** for determinant = –2 <br> or **B1** for $k\begin{pmatrix} 5 & -3 \\ -4 & 2 \end{pmatrix}$ |
| | (b) Reflection only | 1 | If more than one transformation given – no marks available |
| | $x$-axis oe | 1 | independent |
| | (c) $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ | 2 | **B1** for one correct column |

| 5 | **(a)** **(i)** | Accurate perpendicular bisector, with 2 pairs of arcs, of *CD*. | 2 | **SC1** if accurate without arcs. |
|---|---|---|---|---|
| | **(ii)** | Accurate angle bisector, with two pairs of arcs, of angle *A*. | 2 | **SC1** if accurate without arcs. |
| | **(b)** | SHOP written in correct region | S1 | Dependent on at least **SC1** in **(i)** and **(ii)** and intersection |
| | **(c)** **(i)** | Arc, centre *B*, radius 5cm, reaching across *ABCD*. | 1 | Allow good freehand |
| | **(ii)** | Area outside their arc centre *B* and outside SHOP shaded | 1ft | dep on **S1** |
| 6 | | | | **Accept** fraction, %, dec equivalents (3sf or better) throughout but not ratio or words<br>i.s.w. incorrect cancelling/conversion to other forms<br>Pen –1 once for 2 sf answers |
| | **(a)** **(i)** | 33 | 1 | |
| | **(ii)** | $\dfrac{243}{3125}$ (0.07776) | 2 | Accept 0.0778. **M1** for $\left(\dfrac{3}{5}\right)^5$ oe |
| | **(b)** **(i)** | $\dfrac{2}{5}, \dfrac{3}{4}, \dfrac{1}{8}, \dfrac{7}{8}$ | 3 | **B1** for $\dfrac{2}{5}$ and $\dfrac{3}{4}$   **B1** for $\dfrac{1}{8}$   **B1** for $\dfrac{7}{8}$ |
| | **(ii)** | $\dfrac{1}{20}$ (0.05)      cao | 2 | **M1** for their $\dfrac{2}{5}$ × their $\dfrac{1}{8}$ |
| | **(iii)** | $\dfrac{1}{5}$ (0.2)      ft | 2ft | ft $\dfrac{3}{20}$ + their **(b)(ii)**  or **M1** for $\dfrac{3}{5}\times\dfrac{1}{4}$ |
| 7 | **(a)** | – 5.4<br>3.7 | 1<br>1 | |
| | **(b)** | 8 points correctly plotted ft | P3 | **P3ft** their table.<br>**P2ft** for 6 or 7 points. **P1ft** for 4 or 5 points |
| | | Smooth cubic curve through all 8 points | C1 | Only ft points if shape not affected. |
| | **(c)** | –2, –4, 4 | 2 | **B1** for 2 correct |
| | **(d)** | 7 points correctly plotted  **ft** | P2 | **P2ft**  **P1ft** for 5 or 6 points |
| | | Two **separate** smooth branches of rectangular hyperbola | C1 | Must pass through all 7 points, only ft if shape not affected and no contact with either axis. |
| | **(e)** **(i)** | $-2.9 \leqslant x \leqslant -2.8$<br>$2.05 \leqslant x \leqslant 2.15$ | 1<br>1 | Not with *y* coordinates |
| | **(ii)** | $a = 10$<br>$b = -40$ | 1<br>1 | |

| 8 | (a) (i) | 396 (395.6 – 396) | 4 | **M1** for $\frac{2}{3} \times \pi \times 3^3$ and **M1** (independent) for $\pi \times 3^2 \times 12$, <br> **M1** (dependent on M2) for adding <br> $126\,\pi$ implies **M3** |
|---|---|---|---|---|
| | (ii) | 3.13 (3.125 – 3.128….)  ft | 2ft | ft their **(i)** × 7.9 ÷ 1000 . <br> **M1** for × 7.9  soi by figs 313 or 3125 – 3128… |
| | (iii) | 144 (144 – 144.4)  ft | 2ft | ft 15 × 6 × 6 – their **(a)(i)** <br> **M1** for 6 × 6 × 15 oe |
| | (b) (i) | 311 (310.8 – 311.1) | 5 | **M1** for $2 \times \pi \times 3^2$ and **M1** (independent) for $\pi \times 6 \times 12$ **and M1** for $\pi \times 3^2$, <br> **M1** (dependent on M3) for adding. <br> ($99\pi$ implies **M4**) |
| | (ii) | 3.50 (3.496 to 3.50)  ft | 2ft | ft their **(b)(i)** × 0.01125 <br> **M1** for their **(b)(i)** ÷ 8 and × figs 9 <br> implied by figs 3496 to 350 |
| 9 | (a) (i) | $\begin{pmatrix} 9 \\ 5 \end{pmatrix}$ | 1 | |
| | (ii) | $\begin{pmatrix} 4 \\ 7 \end{pmatrix}$ | 1 <br> 1 | If 0, **SC1** for $\overrightarrow{CB} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$ seen |
| | (iii) | $\overrightarrow{BA}$ or $-\overrightarrow{AB}$ | 1 | *BA* not indicated as a vector is not enough. |
| | (iv) | 10.3 (10.29 – 10.30) | 2 | **M1** for (their 9)$^2$ + (their 5)$^2$ |
| | (b) (i) | 2**u** | 1 | |
| | (ii) | $\frac{1}{2}(\mathbf{t} - \mathbf{u})$  oe | 2 | **M1** for $\frac{1}{2}$ (their $\overrightarrow{BA} + \overrightarrow{AD} + \overrightarrow{DC}$) or equivalent <br> correct route for $\overrightarrow{BM}$, along obtainable vectors in terms of **t** and **u** <br> or **M1** for correct unsimplified answer |
| | (iii) | $\frac{3}{2}\mathbf{u} + \frac{1}{2}\mathbf{t}$  oe  ft | 2ft | ft their **(i)** + their **(ii)** simplified <br> or **t** + **u** – their **(b)(ii)** simplified <br> **M1** for correct (or **ft**) unsimplified **(i)** + **(ii)** <br> or **t** + **u** – their **(b)(ii)** |

| 10 | (a) | 7, 8, 8, 10, 11, 16<br>and 8, 8, 8, 10, 10, 16 | 5 | Mark answer spaces only or clearly indicated lists. Allow numbers in any order but must be lists of 6 integers<br>**B4** for either correct list<br>If not **B4** then<br>**B1** for a series with mode 8<br>and **B1** for a series with median 9<br>and **B1** for a series with sum 60 |
|---|---|---|---|---|
| | (b) (i) | $(30 \times 65 + 35 \times 85 + 40 \times 95 +$<br>$40 \times 110 + 15 \times 135) \div 160$<br><br><br><br>94.7　(94.68 – 94.69) | 4 | **M1** for mid-values soi (allow 1 error/omission)<br>and **M1** for use of $\sum fx$ with $x$ in correct interval including both boundaries allow one further error/omission<br>and **M1** (dependent on second M) for ÷ 160 www 4 |
| | (ii) | Heights of 4, 2, 0.5 with correct interval widths | 4 | **B3** for 2 correct<br>or **B2** for 1 correct<br>or **B1** for all three freq. densities correct but no/incorrect graph |
| 11 | (a) | 30　42<br>42　56<br>71　97 | 4 | **B3** for 2 correct rows<br>or **B2** for 1 correct row<br>or **B1** for any term in column 5 correct |
| | (b) (i) | 2550 | 1 | |
| | (ii) | 30 | 1 | |
| | (c) | $(n + 1)(n + 2)$　oe final ans | 1 | |
| | (d) (i) | $2n^2 + pn + 1 = t$<br>Uses a value of $n$ up to 6 and a matching $t$ from the table<br>e.g. puts $n = 3$ and $t = 31$<br>$2 \times 3^2 + 3p + 1 = 31$ 　　　**M1**<br><br>**OR**<br>Use $p = 4$ to get $2n^2 + 4n + 1 = 31$<br>and simplifies to 3 term eqn 　**M1**<br><br>**OR** both<br>$2 \times 9 + 4 \times 3 + 1 (= 31)$ 　　**M1**<br>with one part evaluated<br>**OR**<br>$n(n + 1) + (n + 1)(n + 2) – 1$<br>or better 　　　　　　　**M1** | 2 | Correct solution shown with 1 intermediate step to $p = 4$ **E1**<br><br><br>Solve correctly to get $n = 3$ **E1**<br><br><br>Conclusion e.g. 31 = 31 **E1**<br><br><br>Correct simplification to $2n^2 + 4n + 1$ **E1** |
| | (ii) | 241 | 1 | |
| | (iii) | 12 | 3 | **M1** for $2n^2 + 4n + 1 = 337$<br>and **M1** for $(n – 12)(n +14)$ or correct expression for $n$ using formula |
| | (e) | $L = A + D – 1$　oe | 1 | |