| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **10** | **(i)** | | $\overrightarrow{AC} = \begin{pmatrix} 2-a \\ 4-b \\ 2 \end{pmatrix}$, $\overrightarrow{AB} = \begin{pmatrix} 4-a \\ 2-b \\ 0 \end{pmatrix}$ | **M1** | **1.1** | Forming vectors for sides AB and AC | Implied by next M1 |
| | | | $(4-a)^2 + (2-b)^2 = (2-a)^2 + (4-b)^2 + 4$ o.e. | **M1** | **1.1a** | Use of AB = AC | |
| | | | $16 - 8a + a^2 + 4 - 4b + b^2 = 4 - 4a + a^2 + 16 - 8b + b^2 + 4$ | **M1** | **1.1** | expanding | |
| | | | $4a - 4b + 4 = 0 \Rightarrow a - b + 1 = 0$ | **A1** | **2.1** | **AG** Convincing completion | |
| | | | | **[4]** | | | |

| Question | | | Answer | Marks | AOs | Guidance | |
|---|---|---|---|---|---|---|---|
| 10 | (ii) | | D has position vector $\begin{pmatrix}3\\3\\1\end{pmatrix}$ where D is midpoint of BC | B1 | 3.1a | Midpoint<br><br>OR if clearly minimising AC or AB - **M1** for relevant vector using $a$ and $b$ (May be implied by second M1) | |
| | | | $\overrightarrow{AD} = \begin{pmatrix}3-a\\2-a\\1\end{pmatrix}$ | M1 | 1.1 | Finding relevant vector in terms of $a$ or $b$ only | |
| | | | $\text{Area} = \frac{1}{2}AD.BC = \frac{2\sqrt{3}\sqrt{(3-a)^2+(2-a)^2+1}}{2}$ | M1 | 1.1 | Expression for AD or $AD^2$ (correct method but may have errors) | May use area proportional to AD, AC or AB without calculation of expression for area |
| | | | $\sqrt{3}\sqrt{2\left((a-2.5)^2+0.75\right)}$ | M1 | 3.1a | Completion of square | Or differentiation of AD, $AD^2$, AC, AB, $AC^2$ or $AB^2$. |
| | | | $a = 2.5$ for min | A1 | 2.2a | | |
| | | | Position vector $\begin{pmatrix}2.5\\3.5\\0\end{pmatrix}$ | A1 | 3.2a | | |
| | | | | [6] | | | |