| Question number | Scheme | Marks |
|---|---|---|
| 10 (a) | $\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB} = -(2\mathbf{a} - \mathbf{b}) + 3\mathbf{a} + \mathbf{b} = \mathbf{a} + 2\mathbf{b}$ | M1A1<br>[2] |
| (b) | $\overrightarrow{OC} = \overrightarrow{OB} + \overrightarrow{BC} = 3\mathbf{a} + \mathbf{b} - \mathbf{a} + 3\mathbf{b} = 2\mathbf{a} + 4\mathbf{b} = 2(\mathbf{a} + 2\mathbf{b})$<br>Conclusion required; same direction and $\overrightarrow{OC}$ is a multiple of $\overrightarrow{AB}$ therefore $\overrightarrow{OC}$ is parallel to $\overrightarrow{AB}$. | M1<br><br>A1<br>[2] |
| (c) | $\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC} = \mathbf{a} + 2\mathbf{b} + (-\mathbf{a} + 3\mathbf{b}) = 5\mathbf{b}$<br>$\overrightarrow{AX} = \mu\overrightarrow{AC} = \mu 5\mathbf{b}$<br>$\overrightarrow{AX} = \overrightarrow{AO} + \overrightarrow{OX} = -(2\mathbf{a} - \mathbf{b}) + \lambda(3\mathbf{a} + \mathbf{b})$<br>$\Rightarrow \mu 5\mathbf{b} = -(2\mathbf{a} - \mathbf{b}) + \lambda(3\mathbf{a} + \mathbf{b})$<br>$\Rightarrow -2 + 3\lambda = 0 \Rightarrow \lambda = \frac{2}{3}$<br>$\Rightarrow 5\mu = 1 + \lambda \Rightarrow \mu = \frac{1}{3}$<br>$\Rightarrow AX : XC = 1:2$ | B1<br>B1<br><br>M1<br>M1<br><br>M1<br><br>A1<br><br>A1<br>[7] |
| | | **Total 11 marks** |
| **(a)** | | |
| **M1** | Use of $\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$ | |
| **A1** | $\mathbf{a} + 2\mathbf{b}$ | |
| **(b)** | | |
| **M1** | Use of $\overrightarrow{OC} = \overrightarrow{OB} + \overrightarrow{BC}$ | |
| **A1** | Correct conclusion i.e. $\overrightarrow{OC} = 2\overrightarrow{AB}$ $\therefore \overrightarrow{OC}$ is parallel to $\overrightarrow{AB}$ | |
| **(c)** | | |
| **B1** | $\overrightarrow{AC} = 5\mathbf{b}$ may be implied by $2^{\text{nd}}$ B1 | |
| **B1** | $\overrightarrow{AX} = \mu 5\mathbf{b}$ or $\overrightarrow{XC} = \lambda 5\mathbf{b}$ | |
| **M1** | A correct vector for $\overrightarrow{AX}$ or $\overrightarrow{OX}$ or $\overrightarrow{BX}$ or $\overrightarrow{CX}$ or $\overrightarrow{BC}$ including an unknown multiple of a vector e.g. $\overrightarrow{AX} = -(2\mathbf{a} - \mathbf{b}) + \lambda(3\mathbf{a} + \mathbf{b})$ | |
| **M1** | Equate 2 forms of the same vector e.g. $\mu 5\mathbf{b} = -(2\mathbf{a} - \mathbf{b}) + \lambda(3\mathbf{a} + \mathbf{b})$ | |
| **M1** | Comparing coefficients | |
| **A1** | $\lambda = \frac{2}{3}$ or $\mu = \frac{1}{3}$ | |
| **A1** | $AX : XC = 1:2$ | |