| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 9 | $2\log_p y + \dfrac{10}{\log_p y} - 9 = 0$<br>or $\dfrac{2}{\log_y p} + 10\log_y p - 9 = 0$ | **B1** | For a change of base |
| | $2\left(\log_p y\right)^2 - 9\log_p y + 10 = 0$<br>or $10\left(\log_y p\right)^2 - 9\log_y p + 2 = 0$ | **M1** | For attempt to obtain a 3-term quadratic equation = 0, in either $\log_p y$ or $\log_y p$ |
| | $\log_p y = \dfrac{5}{2}$, $\log_p y = 2$<br>or $\log_y p = \dfrac{2}{5}$, $\log_y p = \dfrac{1}{2}$ | **M1** | **Dep M** mark for attempt to solve the quadratic to obtain 2 solutions |
| | $y = p^{\frac{5}{2}}$ | **A1** | |
| | $y = p^2$ | **A1** | |
| 10 | $\dfrac{65n!}{(n-5)!5!} = \dfrac{2(n-1)(n+1)!}{(n-5)!6!}$<br>$65 = \dfrac{n^2-1}{3}$ | **2** | **B1** for simplifying numerical factorials to 3<br>**B1** for simplifying algebraic factorials to either $(n-1)(n+1)$ or $n^2-1$ |
| | $n = 14$ | **B1** | |
| 11(a) | $\overrightarrow{AC} = \mathbf{c} - \mathbf{a}$ | **B1** | |
| | $\overrightarrow{AB} = \dfrac{2}{5}(\mathbf{c} - \mathbf{a})$ or $\overrightarrow{BC} = \dfrac{3}{5}(\mathbf{c} - \mathbf{a})$ | **B1** | |
| | $\dfrac{2}{5}(\mathbf{c} - \mathbf{a}) = \mathbf{b} - \mathbf{a}$ or $\dfrac{3}{5}(\mathbf{c} - \mathbf{a}) = \mathbf{c} - \mathbf{b}$ | **M1** | For equating two different forms of $\overrightarrow{AB}$ or 2 different forms of $\overrightarrow{BC}$ |
| | $5\mathbf{b} - 3\mathbf{a} = 2\mathbf{c}$ | **A1** | Simplification to obtain the given answer |
| 11(b) | $\overrightarrow{XC} = \mathbf{c} - \dfrac{3\mathbf{a}}{4}$ | **B1** | |
| | $\overrightarrow{XC} = \dfrac{5\mathbf{b}}{2} - \dfrac{9\mathbf{a}}{4}$ | **B1** | |

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|---|---|---|---|
| 11(c) | $m\mathbf{b} - \frac{3}{4}\mathbf{a} = \lambda\left(\frac{5\mathbf{b}}{2} - \frac{9\mathbf{a}}{4}\right)$ | **B1** | |
| | $\lambda = \frac{1}{3}, \quad m = \frac{5}{6}$ | **3** | **M1** for equating like vectors at least once<br>**A1** for $\lambda = \frac{1}{3}$<br>**A1** for $m = \frac{5}{6}$ |
| 12(a) | $\frac{\text{cosec}\theta + 1 + \text{cosec}\theta - 1}{\text{cosec}^2\theta - 1}$ | **B1** | Allow denominator unsimplified |
| | $\frac{2\text{cosec}\theta}{\cot^2\theta}$ | **B1** | |
| | $\frac{2}{\sin\theta} \times \frac{\sin^2\theta}{\cos^2\theta}$<br>$2\sin\theta\sec^2\theta$ | **B1** | Sufficient detail must be seen |
| 12(b) | $2\sin 2\phi\sec^2 2\phi = 4\sin 2\phi$<br>Leading to $\sin 2\phi = 0$<br>$\phi = \pm 90^\circ,\ 0^\circ$ | **2** | **M1** for attempt to solve $\sin 2\phi = 0$ obtaining at least one correct solution<br>**A1** for all solutions |
| | $2\sin 2\phi\sec^2 2\phi = 4\sin 2\phi$<br>$\cos 2\phi = (\pm)\frac{1}{\sqrt{2}}$ | **M1** | For dealing with $\sec^2 2\phi$ to obtain $\cos 2\phi = k$, where $0 \leq k \leq 1$ |
| | $\phi = \pm 67.5^\circ,\ \pm 22.5^\circ$ | **3** | **M1** for solution to obtain at least one correct solution<br>**A1** for a correct pair of solutions<br>**A1** for a second correct pair of solutions with no extra solutions within the range |