Question Number	Scheme	Marks
9.	**Way 1** $\log_4 \frac{a}{b} = 3$ **or** $\log_4 a = \log_4 64b$ $\frac{a}{b} = 64$ Solves $ab = 25$ with $\frac{a}{b} = k$ and proceeds to $a =\ldots$ **or** $b =\ldots$ e.g. $a^2 = 1600 \Rightarrow a = ...$ $a = 40$ **and** $b = \frac{5}{8}$	M1 A1 dM1 A1 **(4)** **(4 marks)**

Note: Condone the absence of base 4 throughout.

If candidates write $\log_4 a - \log_4 b = 3 \rightarrow \frac{\log_4 a}{\log_4 b} = 3 \rightarrow \frac{a}{b} = 4^3$ **allow maximum 1010.**

M1: **Correct** use of addition or subtraction law for logs e.g. $\log_4 a - \log_4 b \rightarrow \log_4 \frac{a}{b}$

or $\log_4 a = 3 + \log_4 b = \log_4 p + \log_4 b = \log_4 pb$ (for some constant $p > 0$ with $p \neq 3$)

or (**Way 2**) $\log_4 ab \rightarrow \log_4 a + \log_4 b$

Alternatively, via **Way 3**, achieves a correct $a = 4^{3+\log_4 b}$ or $b = 4^{\log_4 a - 3}$

In **Way 4**, attempts to make a or b the subject of the first equation and substitutes into the second equation.

Not scored for just e.g. $3 = \log_4 64$ or for e.g. $\log_4 a - \log_4 b = 3$ going directly to $\frac{a}{b} = 3$

A1: **Way 1**: Achieves a second correct equation in terms of a and b with logs removed i.e. $\frac{a}{b} = 4^3$ o.e.

Way 2: Achieves a correct equation only in a **or** only in b which may still have logs.
e.g. $2\log_4 a = 3 + \log_4 25$ **or** $2\log_4 b = \log_4 25 - 3$

Way 3: Achieves a correct equation only in a **or** only in b which may still have logs.
e.g. $b \times 4^{3+\log_4 b} = 25$ or $a \times 4^{\log_4 a - 3} = 25$

Way 4: Writes e.g. $a = \frac{25}{b}$ and substitutes into the second equation to achieve a correct equation only in a or only in b e.g. $\log_4 \frac{25}{b} - \log_4 b = 3$ (proceed to mark as in **Way 2**).

Note that in all approaches they may have already replaced 3 with $\log_4 64$

dM1: Dependent on first M mark.

Way 1: Solves to find a value for *a* or *b* using simultaneous equations. Expect to see a method for solving the simultaneous equations but allow slips in rearranging or e.g. transcription errors.
If they just write down values then they should be correct for their simultaneous equations.

Ways 2 & 4: Replaces 3 with $\log_4 p$ ($p > 0$ with $p \neq 3$) and otherwise uses logs **correctly** to find *a* or *b.*

Way 3: Replaces 4^3 with p ($p > 0$ with $p \neq 3$) and otherwise uses logs **correctly** to find *a* or *b.*

There must be a clear method to remove the logs: they cannot proceed directly from e.g $\log_4 \frac{25}{b^2} = 3$ to $b = \ldots$

Some examples:

- **Way 2:** $\log_4 a^2 = \log_4 p + \log_4 25 \Rightarrow \log_4 a^2 = \log_4 (25p) \Rightarrow a^2 = 25p \Rightarrow a = ...$
- **Way 2:** $\log_4 b^2 = \log_4 25 - \log_4 p \Rightarrow \log_4 b^2 = \log_4 \left(\frac{25}{p}\right) \Rightarrow b^2 = \frac{25}{p} \Rightarrow b = ...$
- **Way 3:** $a = 4^{3+\log_4 b} \Rightarrow b \times 4^{3+\log_4 b} = 25 \Rightarrow b^2 \times 64 = 25 \Rightarrow b = ...$
- **Way 3:** $b = 4^{\log_4 a - 3} \Rightarrow a \times 4^{\log_4 a - 3} = 25 \Rightarrow \frac{a^2}{64} = 25 \Rightarrow a = ...$
- **Way 4:** $a = \frac{25}{b} \Rightarrow \log_4 \frac{25}{b} - \log_4 b = 3 \Rightarrow \log_4 \frac{25}{b^2} = 3 \Rightarrow \frac{25}{b^2} = 64 \Rightarrow b = ...$
- **Way 4:** $b = \frac{25}{a} \Rightarrow \log_4 a - \log_4 \frac{25}{a} = 3 \Rightarrow \log_4 \frac{a^2}{25} = 3 \Rightarrow \log_4 \frac{a^2}{25} = \log_4 64 \Rightarrow a = ...$

A1: Both *a* and *b* correct and no other solutions. Allow $b = 0.625$ but not a rounded or truncated decimal.

If e.g. $b = -\frac{5}{8}$ is found it must be rejected.

Question Number	Scheme	Marks
10 (a)	Either $kn=36$ **or** $\frac{n(n-1)}{2}k^2=567$	M1
	Both $kn=36$ **and** $\frac{n(n-1)}{2}k^2=567$	A1
	$\Rightarrow \frac{n(n-1)}{2}\left(\frac{36}{n}\right)^2=567\Rightarrow n=...$ **or** $\Rightarrow \frac{36}{k}\left(\frac{36}{k}-1\right)\times\frac{k^2}{2}=567\Rightarrow k=...$	dM1
	e.g. $\Rightarrow \frac{648(n-1)}{n}=567\Rightarrow 648n-648=567n\Rightarrow n=8$ **or** $\Rightarrow 648-18k=567\Rightarrow k=\frac{9}{2}$ o.e.	A1
	$k("8")=36\Rightarrow k=...$ **or** $\left("\frac{9}{2}"\right)n=36\Rightarrow n=...$	ddM1
	$n=8$ **and** $k=\frac{9}{2}$ o.e.	A1
		(6)
(b)	$\{p=\}\ \frac{n(n-1)(n-2)}{3!}k^3=\frac{"8"\times"7"\times"6"}{6}\times\left("\frac{9}{2}"\right)^3=...$	M1
	$=5103$	A1
		(2)
		(8 marks)

Note: Misreading 567 as 576 should lead to $n = 9$ and $k = 4$ and may score maximum (a) M1A1dM1A0ddM1A0 (b) M1A1 Other misreads of 567 should be treated similarly.

(a)

M1: States either $kn=36$ **or** $\frac{n(n-1)}{2}k^2=567$ accepting equivalents but see note below.

Condone an incorrect $\frac{n(n-1)}{2}k=567$ (usually coming from a bracketing error) or use of e.g. 576.

This mark cannot be awarded from e.g. $\binom{n}{1}k=36$ or ${}^nC_2(kx)^2=567x^2$ or with factorials

e.g. $\frac{n!}{(n-2)!}k^2=567$ or versions including x terms such as $knx=36x$ unless followed by a correct $kn=36$ or $\frac{n(n-1)}{2}k^2=567$

A1: Both $kn=36$ **and** $\frac{n(n-1)}{2}k^2=567$ correct.

dM1: Forms an equation in one variable and solves leading to a value for k or n.