		This mark is dependent on BOTH previous M marks.
	A1	For a conclusion. A simple # sign, 'shown', 'QED' or underlining is sufficient.

Question number	Scheme	Marks
8	$\alpha+\beta=4k\sqrt{2}$ and $\alpha\beta=2k^4-1$	B1 B1
	$(\alpha+\beta)^2=\alpha^2+\beta^2+2\alpha\beta \Rightarrow \left(4k\sqrt{2}\right)^2=66+2\left(2k^4-1\right)$	M1 A1
	$k^4-8k^2+16=0$	M1
	$\left(k^2-4\right)^2=0 \Rightarrow k=2$	M1 A1
	$(\alpha+\beta)^3=\alpha^3+3\alpha^2\beta+3\alpha\beta^2+\beta^3$ **or** $\alpha^3+\beta^3=(\alpha+\beta)\left(\alpha^2+\beta^2-\alpha\beta\right)$	M1
	$\alpha^3+\beta^3=(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)$ **or** $\alpha^3+\beta^3=(\alpha+\beta)(66-\alpha\beta)$	A1
	$\alpha^3+\beta^3=\left(8\sqrt{2}\right)^3-3\times31\times8\sqrt{2}=280\sqrt{2}$ **or** $8\sqrt{2}(66-31)=280\sqrt{2}$	M1
	p=280	A1 (11)
		Total 11 marks

Mark	Notes
B1	For **either** $\alpha+\beta=4k\sqrt{2}$ **or** $\alpha\beta=2k^4-1$
B1	For **both** $\alpha+\beta=4k\sqrt{2}$ **and** $\alpha\beta=2k^4-1$
M1	For the correct algebra on $\alpha^2+\beta^2$ (in any order) **and** substitution of their values of $\alpha\beta$ and $\alpha+\beta$ providing both sum and product are in terms of k. $(\alpha+\beta)^2=\alpha^2+\beta^2+2\alpha\beta \Rightarrow \alpha^2+\beta^2=\left('4k\sqrt{2}'\right)^2-2\left('2k^4-1'\right)$
A1	For obtaining $\left(4k\sqrt{2}\right)^2=66+2\left(2k^4-1\right)$ in any order.
M1	For simplifying to form a 3TQ in k^4 i.e., $4k^4-32k^2+64=0$ oe Accept as a minimum $4k^4-32k^2\pm Q=(0)$ $Q\neq0$
M1	For factorising or solving the 3TQ using any valid method. See General Guidance.
A1	For $k=2$ If they also give $k=-2$ withhold this mark.

Method 1	
M1	For expanding $(\alpha+\beta)^3=\alpha^3+3\alpha^2\beta+3\alpha\beta^2+\beta^3$ or $\alpha^3+\beta^3=(\alpha+\beta)(\alpha^2+\beta^2-\alpha\beta)$
A1	For obtaining $\alpha^3+\beta^3=(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)$ or $\alpha^3+\beta^3=(\alpha+\beta)(66-\alpha\beta)$ This must be such that $\alpha\beta$ and $\alpha+\beta$ can be substituted in directly.
M1	For substitution of $\alpha+\beta$ and $\alpha\beta$ for their positive value of k into a **correct** expansion of $\alpha^3+\beta^3$ **NOTE:** If they do not obtain $k = 2$, then full substitution of their numerical value for k into $\alpha+\beta$ **and** $\alpha\beta$ must be seen for the award of this mark. For example: $\alpha^3+\beta^3=\left(4\times\text{'their }k\text{'}\sqrt{2}\right)^3-3\times\left(2\times\text{'their }k^4\text{'}-1\right)\times\left(4\times\text{'their }k\text{'}\sqrt{2}\right)$
A1	For $p = 280$
Method 2	
M1	Finds the exact value of α and β Solves the equations $\left(\alpha\beta=2k^4-1 \text{ and } \alpha+\beta=4k\sqrt{2}\right)$ simultaneously to give a value for α and β $\alpha=\frac{31}{\beta}\Rightarrow\alpha+\beta=\frac{31}{\beta}+\beta=8\sqrt{2}\Rightarrow\beta^2-8\sqrt{2}\beta+31=0$ $\Rightarrow\beta=\ldots\quad\alpha=\ldots$
A1	For $\alpha=1+4\sqrt{2}\quad\beta=-1+4\sqrt{2}$ OR $\beta=1+4\sqrt{2}\quad\alpha=-1+4\sqrt{2}$
M1	Substitutes these values into $\alpha^3+\beta^3=p\sqrt{2}$ to find a value for p $\left(1+4\sqrt{2}\right)^3+\left(-1+4\sqrt{2}\right)^3=24\sqrt{2}+256\sqrt{2}=280\sqrt{2}\Rightarrow p=\ldots$
A1	$p=280$