Question Number	Scheme	Notes	Marks
6(a)	$f(x)=3x^2+kx-5 \Rightarrow \{\alpha\beta=\}-\frac{5}{3}$	Correct value for $\alpha\beta$. Accept $-1.\dot{6}$ Allow if e.g., "(a)" omitted and seen later	B1
			(1)
(b)	$\alpha+\beta=9\alpha\beta \Rightarrow -\frac{k}{3}=9\times"-\frac{5}{3}" \Rightarrow k=...$	Uses $\pm\frac{k}{3}$ for the sum of roots, sets equal to 9 times their product of roots and solves for k	M1
	$\{k=\}45$	Correct value (no equivalents) **from correct work**. Answer only is M1A1	A1
			(2)
(c)	$\{(\alpha+\beta)^3=\}\alpha^3+3\alpha^2\beta+3\alpha\beta^2+\beta^3$	Correct expansion seen. Terms may be uncollected e.g., $\alpha^3+2\alpha^2\beta+\alpha\beta^2+\alpha^2\beta+2\alpha\beta^2+\beta^3$	B1
	$\Rightarrow \alpha^3+\beta^3=(\alpha+\beta)^3-3\alpha^2\beta-3\alpha\beta^2$ $=(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)*$	Achieves given answer via an intermediate step following expansion that is not just collecting terms on RHS of $(\alpha+\beta)^3=...$ No errors seen. Both sides must be seen but allow correct use of LHS=/RHS=. **Previous mark required.**	**d**B1*
	Working backwards: $(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)=\alpha^3+3\alpha^2\beta+3\alpha\beta^2+\beta^3-3\alpha^2\beta-3\alpha\beta^2=\alpha^3+\beta^3$ B1: $(\alpha+\beta)^3=\alpha^3+3\alpha^2\beta+3\alpha\beta^2+\beta^3$ or e.g., $\alpha^3+2\alpha^2\beta+\alpha\beta^2+\alpha^2\beta+2\alpha\beta^2+\beta^3$ **d**B1*: Correct proof with $-3\alpha\beta(\alpha+\beta)$ seen expanded. Both sides must be seen but allow correct use of LHS=/RHS=. **Previous mark required.**		
			(2)

Question Number	Scheme	Notes	Marks
6(d)	Note that the work for the first four marks might be seen embedded in a quadratic expression/equation. May also see use of $\left(x-\alpha^2-\beta\right)\left(x-\alpha-\beta^2\right)$ If the work **clearly** relies on using the solutions to $3x^2+45x-5=0$ $\left(\frac{-45\pm\sqrt{2085}}{6}\right.$ or 0.1103... & $\left.-15.1103...\right)$ then allow a max of 101010		
	$\alpha^2+\beta+\alpha+\beta^2=\alpha+\beta^2+\alpha^2+\beta$ $=\alpha+\beta+(\alpha+\beta)^2-2\alpha\beta$	Evidence of a correct algebraic expression in terms of $\alpha+\beta$ and $\alpha\beta$ only for the new sum of roots. If not seen in its entirety it could be implied by e.g. a numerical expression/value.	1st M1 (Sum)
	$=-15+(-15)^2-2\left(-\frac{5}{3}\right)$ $=-15+225+\frac{10}{3}=\frac{640}{3}$	Correct value for new sum**.** If inexact allow awrt 213 from a correct calculation. Allow if exact values are recovered later. **Must have used a correct expression and** $\alpha\beta=-\frac{5}{3},\ \alpha+\beta=-\frac{45}{3}$ but allow slip in algebra if it is clearly recovered by e.g., an appropriate calculation	A1
	$\left(\alpha^2+\beta\right)\left(\alpha+\beta^2\right)=\alpha^3+\beta^3+\alpha\beta+(\alpha\beta)^2$ $=(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)+\alpha\beta+(\alpha\beta)^2$ Allow $\alpha^2\beta^2$ for $(\alpha\beta)^2$ but $\alpha\beta^2$ must be recovered by later work	Evidence of a correct algebraic expression for the new product of roots in terms of $\alpha+\beta$ and $\alpha\beta$ only. If not seen in its entirety it could be implied by e.g. a numerical expression/value.	2nd M1 (Product)
	$=(-15)^3-3\left(-\frac{5}{3}\right)(-15)-\frac{5}{3}+\left(-\frac{5}{3}\right)^2$ $=-3375-75-\frac{5}{3}+\frac{25}{9}=-\frac{31040}{9}$	Correct value for new product. If inexact allow awrt -3450 from a correct calculation. **Must have used a correct expression and** $\alpha\beta=-\frac{5}{3},\ \alpha+\beta=-\frac{45}{3}$ but allow slip in algebra if it is clearly recovered by e.g., an appropriate calculation	A1
	$x^2-\left(\frac{640}{3}\right)x+\left(-\frac{31040}{9}\right)\ \{=0\}$	Applies x^2-(their *new* sum of roots)$x+$their *new* product of roots **correctly** (e.g., no missing "x") with non-zero **values** (which could be inexact). Allow without the "=0" for this mark. Not dependent. If just see e.g., $a=...,\ b=...,\ c=...$ then must see e.g., ax^2+bx+c	M1
	$9x^2-1920x-31040=0$	Correct equation as shown or an integer multiple. Could recover inexact values. Must include the "= 0". Could use e.g., z consistently for x. Requires all previous marks. If just see e.g., $a=...,\ b=...,\ c=...$ then must see e.g., $ax^2+bx+c=0$	A1
			(6)
			Total 11