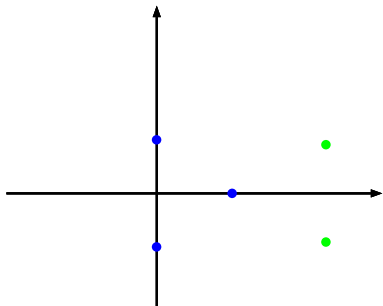


Question	Scheme	Marks	AOs	
6(a)	Attempts sum of roots of $f (= -3/k)$ and product of roots of $g (= 9/m)$ and uses them to form a relationship between k and m .	M1	3.1a	
	So $-3/k = 9/m$	A1	1.1b	
	Sum of roots of g is $2/m \Rightarrow 2/m$ is a root of g as the other roots have no real part. OR root on imaginary axis has form αi , and substituting in g and equating real and imaginary terms gives $2\alpha^2 - 9 = 0$ & $3\alpha - m\alpha^3 = 0$	B1	3.1a	
	$g(2/m) = 0 \Rightarrow m(2/m)^3 - 2(2/m)^2 + 3(2/m) - 9 = 0 \Rightarrow m = \dots$ ($m = 2/3$) OR $\alpha^2 = \frac{9}{2} \neq 0 \Rightarrow m = \frac{3}{\alpha^2} = \dots$ ($= \frac{2}{3}$)	M1	1.1a	
	So $g(x) = 0 \Rightarrow \left(\frac{2}{3}(x-3)\left(x^2 + \frac{9}{2}\right) = 0 \Rightarrow\right) x = 3, \pm \frac{3\sqrt{2}}{2}i$	M1	1.1b	
	$k = -2/9, f(x) = 0 \Rightarrow x = \frac{-3 \pm \sqrt{3^2 - 4(-2/9)(-11)}}{2(-2/9)} = \dots$	M1	2.2a	
	$x = 3, \pm \frac{3\sqrt{2}}{2}i, \frac{27}{4} \pm \frac{3\sqrt{7}}{4}i$		1.1b	
		(7)		
(b)		<p>Correct roots for f plotted (shown green).</p> <p>Correct roots for g plotted (shown blue).</p>	B1ft	1.1b
			B1ft	1.1b
		(2)		

(9 marks)

Notes:

(a)

M1: Identifies sum of roots of f or product of roots of g correctly

A1: Correct equation between k and m

B1: Realises that g having roots on the imaginary axis means the sum of roots is equal to the only real root of the equation or forms correct simultaneous equations after substituting αi into g

M1: Uses factor theorem with their real root to find m or solves their equations to find m

M1: Uses their m to solve $g(x)$. May just see answers from calculator, or can factorise or complete the square.

M1: Deduces the correct value for k and solves $f(x)$ using it. May just see answers from calculator, or can factorise or complete the square.

A1: All five roots correct – may not all be listed in one line, as long as the roots of g and f are clear. Accept exact equivalents.

(b)

B1ft: Correct roots for f plotted, follow through as long as they are complex. If answers to (b) are correct these should be further from the imaginary axis than the real root of g .

B1ft: Correct roots for g plotted, follow through their roots as long as two are on the imaginary axis.