Solutions

2.1 The other root is $2-i$: sum $4=-p$, product $5=q$. So $p=-4$, $q=5$.

2.2 $f(1)=1-3+7-5=0$ ✓. Divide: $x^3-3x^2+7x-5=(x-1)(x^2-2x+5)$. $x^2-2x+5=0 \Rightarrow x=\dfrac{2\pm\sqrt{4-20}}{2}=1\pm 2i$. Roots: $1,\ 1\pm 2i$. (Product: $1\cdot 5=5$ ✓.)

2.3 $1-2i$ is also a root, giving the factor x^2-2x+5. Dividing: $\dfrac{x^4-2x^3+6x^2-2x+5}{x^2-2x+5}=x^2+1$, since $(x^2-2x+5)(x^2+1)=x^4-2x^3+6x^2-2x+5$ ✓. The other roots are $\pm i$.

2.4 Product of roots $=(1+3i)(1-3i)\cdot k^2=10k^2$. For a monic quartic the product equals the constant term (sign + for degree 4): $10k^2=50 \Rightarrow k=\pm\sqrt{5}$.

3.1 (a) Sum 1, product $\frac{1}{4}+\frac{9}{4}=\frac{5}{2}$: factor $z^2-z+\frac{5}{2}$, or $2z^2-2z+5$ scaled. (b) Comparing $(2z^2-2z+5)(z^2+mz+n)=2z^4+2z^3+7z^2+4z+15$: constant $5n=15 \Rightarrow n=3$; z^3: $2m-2=2 \Rightarrow m=2$. Check the rest: $(2z^2-2z+5)(z^2+2z+3)=2z^4+2z^3+7z^2+4z+15$ ✓. (c) $z^2+2z+3=0$ gives $z=-1\pm i\sqrt{2}$, so the roots are $\frac{1}{2}\pm\frac{3}{2}i,\ -1\pm i\sqrt{2}$.

3.2 Factor $z^2-6z+34$; comparing coefficients: $c=2$, $b=6$, $P=7$, $Q=204$; other roots from $7z^2+6z+2=0$: $z=\dfrac{-6\pm\sqrt{-20}}{14}=\dfrac{-3\pm i\sqrt{5}}{7}$ (and the conjugate $3-5i$).

Local review guidance: conjugate stated and the quadratic factor formed from sum and product; coefficient comparison or division carried through exactly; complex roots simplified to $a+bi$ form. This is authored classroom guidance.