Year 12 Mathematics Extension 2

Topic: Complex Numbers (3 of 5)
Review Questions: Complex Equations & Polynomials
Term 3, 2026

How to use this review set

These are real past-paper questions, grouped by question pattern. The grey label on each question shows where it is from and its marks.

- The questions are grouped by the pattern that keeps coming up in exams, a few of each in a row, running from the plainer patterns into the harder ones. Work through them and you will meet every type an exam can throw at you.
- This set **is your diagnostic**. Working through it shows you exactly which patterns are solid and which need work. Attempt every question properly in your own book, and go back to your notes to help you work through tough questions if needed.
- Every question you get wrong, need help with or struggle with goes in your **Mistakes Log**, which you should be working on daily to get you exam-ready.

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Solving complex equations

1. Solving equations (quadratics and related)

Q1 2023 HSC Q11(a) · **2 marks**

Solve the quadratic equation $z^2 - 3z + 4 = 0$, where z is a complex number. Give your answers in Cartesian form.

Q2 2025 Hills Grammar Trial Q11(d) · **2 marks**

It is known that $1+2i$ is one of the square roots of $4i-3$. Using this fact, or otherwise, solve $z^2-5z+7-i=0$.

Q3 2025 Kinross Wolaroi Trial Q12(a) · **3 marks**

(i) Show that $(1 - 3i)^2 = -8 - 6i$.

(ii) Hence, or otherwise, solve the equation $2z^2 - 8z + (12 + 3i) = 0$.

Q4 2020 HSC Q11(e) · **4 marks**

Solve $z^2 + 3z + (3 - i) = 0$, giving your answers in the form $a + bi$, where a and b are real.

Q5 2025 Abbotsleigh Trial Q11(d) · **3 marks**

Solve $z^2 + (5 + 5i)z + (6 + 15i) = 0$, giving your answers in the form $z = x + iy$.

Q6 2025 St George Girls Trial Q11(c) · **3 marks**

(i) Show that $(1 - 2i)^2 = -3 - 4i$.

(ii) Hence solve the equation $z^2 - 5z + (7 + i) = 0$.

Q7 2024 HSC Q12(c) · **3 marks**

Consider the equation $|z| = z + 8 + 12i$, where $z = a + bi$ is a complex number and a, b are real numbers.

(i) Explain why $b = -12$.

(ii) Hence, or otherwise, find z.

Q8 2025 Newington Trial Q11(c) · **3 marks**

Find all complex numbers u and v such that $u - v = 2i$ and $uv = 6$.

Polynomials and their roots

2. The conjugate root theorem

Q9 2020 HSC Q2 · **1 mark**

Given that $z = 3 + i$ is a root of $z^2 + pz + q = 0$, where p and q are real, what are the values of p and q?

(A) $p = -6,\ q = -10$

(B) $p = -6,\ q = 10$

(C) $p = 6,\ q = -10$

(D) $p = 6,\ q = 10$

Q10 2024 HSC Q4 · **1 mark**

A monic polynomial $f(x)$ of degree 3 with real coefficients has 3 and $2 + i$ as two of its roots. Which of the following could be $f(x)$?

(A) $x^3 - 7x^2 - 17x + 15$

(B) $x^3 - 7x^2 + 17x - 15$

(C) $x^3 + 7x^2 - 17x + 15$

(D) $x^3 + 7x^2 + 17x - 15$

Q11 2021 HSC Q6 · **1 mark**

Which polynomial could have $2 + i$ as a zero, where k is a real number?

(A) $x^3 - 4x^2 + kx$

(B) $x^3 - 4x^2 + kx + 5$

(C) $x^3 - 5x^2 + kx$

(D) $x^3 - 5x^2 + kx + 5$

Q12 2025 Sydney Boys Trial Q2 · **1 mark**

A polynomial with positive integer coefficients has roots 2 and $4 - 5i$. Which of the following must also be a root?

(A) $5 - 4i$

(B) $4 + 5i$

(C) $5 + 4i$

(D) $-4 + 5i$

Q13 2025 Normanhurst Boys Trial Q11(c) · **2 marks**

The complex numbers $z_1 = 2 - 3i$, z_2 and z_3 are roots of the polynomial $p(z) = z^3 - 8z^2 + 29z - 52$. Find z_2 and z_3.

Q14 2025 Ascham Trial Q11(e) · **3 marks**

It is known that $5 + 6i$ is a zero of the polynomial $P(z) = 2z^3 - 19z^2 + 112z + k$, where k is real.

(i) Find the other two zeroes of $P(z)$.

(ii) Find the value of k.

Q15 2023 HSC Q12(e) · **3 marks**

The complex number $2 + i$ is a zero of the polynomial $P(z) = z^4 - 3z^3 + cz^2 + dz - 30$, where c and d are real numbers.

(i) Explain why $2 - i$ is also a zero of $P(z)$.

(ii) Find the remaining zeros of $P(z)$.

Q16 2025 Hurlstone Trial Q11(d) · **3 marks**

Given that $z = 1 + i$ is a root of $z^3 + pz^2 + qz + 6 = 0$, where p and q are real, find the values of p and q.

3. Solving & factorising polynomials

Q17 2025 Cheltenham Girls Trial Q12(c) · **3 marks**

Solve the equation $x^3 - 5x^2 + 8x - 6 = 0$ over the set of complex numbers.

Q18 2025 Hills Grammar Trial Q13(d) · **3 marks**

The complex number $1 + i$ is a zero of the polynomial $P(z) = z^4 - 2z^3 + z^2 + 2z - 2$. Find the remaining zeros of $P(z)$.

Q19 2025 Baulkham Hills Trial Q13(d) · **3 marks**

The polynomial $P(z) = z^4 - 6z^3 + 38z^2 - 94z + 221$ has $z = 2 + 3i$ as a root. Find the three other roots of $P(z) = 0$.

Q20 2025 St George Girls Trial Q14(a) · **3 marks**

Factorise $P(z) = z^4 - 6z^3 + 18z^2 - 14z - 39$, given that one of the zeroes of $P(z)$ is $2 - 3i$.

Q21 2025 North Sydney Boys Trial Q11(c) · **5 marks**

Consider $P(x) = x^4 - 2x^3 + 8x^2 - 8x + 16$.

(i) Show that $x = 2i$ is a solution of $x^4 - 2x^3 + 8x^2 - 8x + 16 = 0$.

(ii) Hence express $P(x)$ as a product of two quadratic factors.

(iii) Express $P(x)$ as the product of four linear factors.

Q22 2025 Kinross Wolaroi Trial Q13(c) · **5 marks**

Given that $z = 1 - i$ is a zero of $P(z) = 2z^5 - 13z^4 + 52z^3 - 91z^2 + 86z - 26$, find all the roots of $P(z) = 0$.

Q23 2025 Penrith Trial Q12(c) · **3 marks**

The complex number $3 - i$ is a zero of a cubic polynomial $Q(z) = z^3 + pz^2 + qz + r$, where p, q, r are real. Given that $z = -1$ is also a zero of $Q(z)$, find the values of p, q, r and write the complete factorisation of $Q(z)$.