# OCR Further Pure 1

## Complex Numbers

## Section 1: Introduction to complex numbers

### Study Plan

**Background**

You have already encountered several number systems in your study of mathematics. Starting with learning to count with the natural numbers, you have progressed through fractions and decimals, negative numbers, and real numbers. Each extension to the number system allows us to solve more problems. For example, the equation

$$x + 4 = 0$$

has no solution in the natural numbers, but it does in the integers.
The equation

$$x^2 - 2 = 0$$

has no solution in the rational numbers, but it does have two real solutions, $x = \sqrt{2}$ and $x = -\sqrt{2}$.
However, within the real numbers there is no solution to an equation such as

$$z^2 + 4 = 0.$$

The complex numbers are an extension to the real numbers in which there is a solution to the equation above. It turns out that the complex numbers are the final extension we need for the number system, as all possible polynomial equations have solutions in the complex numbers.

In this section you will learn to manipulate complex numbers, and some of the basic terminology associated with complex numbers.

**Detailed work plan**

1. Read section 7.1 and section 7.2 up until the end of the part on multiplication (pages 107 – 110). There are some further examples of addition, subtraction and multiplication in the Notes and Examples.

2. **Exercise 7A**
   Attempt question 1.
   This should help to familiarise you with working with complex numbers.

3. For additional practice try the interactive questions ***Addition and subtraction of complex numbers*** and ***Multiplication of complex numbers***.

4. Read the rest of section 7.2, on division of complex numbers (pages 110 – 112). There is an additional example in the Notes and Examples.

5. **Exercise 7A**
   Attempt questions 2, 3, 4 and 5.

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6. For additional practice try the interactive questions ***Dividing complex numbers***.

7. Read section 7.3 (pages 112 – 115) on solving equations. Each of the three worked examples look at a different type of equation. Example 7.3.1 shows how you can solve a linear equation involving complex numbers, Example 7.3.2 shows simultaneous equations involving complex numbers, and Example 7.3.3 shows a quadratic equation in which the roots are complex numbers. There are further examples in the Notes and Examples. In particular, look at Example 6, which shows the useful technique of equating real and imaginary parts.

8. Look at the Flash resource ***Complex roots of quadratics***. This shows how the complex roots of a quadratic equation are related to the graph of the quadratic function. You do not need to know this work for your exam, but it is interesting background work.

9. **Exercise 7B**
   Attempt questions 1, 2, 3 and 4.

10. For additional practice try the interactive questions ***Complex conjugates*** and the Flash resource ***Working with complex numbers***.