EdExcel Further Pure 1

Complex Numbers

Section 2: The Argand diagram and the modulus-argument form

Study Plan (New specification Heinemann textbook)

Background

If you want to place a complex number on a number line, you have a problem. Is 1 + i larger or smaller than 1? Clearly this kind of question just does not make sense. In this section you will learn about the Argand diagram, which provides a way of representing complex numbers geometrically, in two dimensions, in the same way that a number line can represent the real numbers in one dimension.

You will also look at writing a complex number in a different form. Until now you have dealt with complex numbers in the form $z = x + y\mathrm{i}$, so the number is written in terms of the real and imaginary parts. The alternative form is in terms of the *modulus* (the distance of the point z from the origin in the Argand diagram) and the *argument* (the angle between a line from the origin to the point z, and the real axis).

Detailed work plan

1. Read section 1.4 (pages 10 – 13), which introduces geometrical representation of complex numbers. There are some further notes on representing addition and subtraction of complex numbers using vectors in the **Notes and Examples**.

2. You can explore complex numbers in the Argand diagram using the Flash resource **The Argand diagram**.

3. **Exercise 1D**
   Attempt questions 1, 2, 3, 4, 5 and 7.

4. Read section 1.5 (pages 14 – 18), which looks at the modulus and argument of a complex number. If you have not yet done the trigonometry work in Core 2, you can find some extra help **HERE** on angles measured in radians, and angles greater than 90°. There are some further notes and extra examples in the **Notes and Examples**.

5. **Exercise 1E**
   Attempt questions 1, 2, 3, 4, 5, 6, 7 and 8.

6. Read section 1.6 (pages 19 – 20). Note that you need to know the relationship $|z_1 z_2| = |z_1||z_2|$. There is a further example in the **Notes and Examples**. There is also some extension work which looks at the arguments of products and quotients of complex numbers, and the

geometrical interpretation of multiplying and dividing.

7. The Flash resource **Multiplication and division in the Argand diagram** demonstrates what happens geometrically when you multiply or divide complex numbers given in the modulus-argument form.

8. **Exercise 1F**
   Attempt at least half the parts of questions 1, 2, 3 and 4.

9. You can test yourself on the modulus-argument form of complex numbers using the interactive questions **Complex numbers: polar form**.

10. You can also try the **Complex numbers puzzle**.