Core Pure 1

Complex Numbers

Chapter Overview

1: Understand and manipulate ($\times$, $\div$) complex numbers.

2: Find complex solutions to quadratic equations.

3: Find complex solutions to cubic and quartic equations.

2 **Complex numbers**	2.1	**Solve any quadratic equation with real coefficients.** **Solve cubic or quartic equations with real coefficients.**	**Given sufficient information to deduce at least one root for cubics or at least one complex root or quadratic factor for quartics, for example:** **(i)** $f(z) = 2z^3 - 5z^2 + 7z + 10$ **Given that** $2z - 3$ **is a factor of** $f(z)$**, use algebra to solve** $f(z) = 0$ **completely.** **(ii)** $g(x) = x^4 - x^3 + 6x^2 + 14x - 20$ **Given** $g(1) = 0$ **and** $g(-2) = 0$**, use algebra to solve** $g(x) = 0$ **completely.**
	2.2	**Add, subtract, multiply and divide complex numbers in the form** $x + iy$ **with** x **and** y **real.** **Understand and use the terms 'real part' and 'imaginary part'.**	**Students should know the meaning of the terms, 'modulus' and 'argument'.**

2 **Complex numbers** *continued*	2.3	**Understand and use the complex conjugate.** **Know that non-real roots of polynomial equations with real coefficients occur in conjugate pairs.**	**Knowledge that if** z_1 **is a root of** $f(z) = 0$ **then** z_1^* **is also a root.**
	2.4	**Use and interpret Argand diagrams.**	**Students should be able to represent the sum or difference of two complex numbers on an Argand diagram.**
	2.5	**Convert between the Cartesian form and the modulus-argument form of a complex number.**	Knowledge of radians is assumed.
	2.6	**Multiply and divide complex numbers in modulus argument form.**	**Knowledge of the results** $\lvert z_1 z_2 \rvert = \lvert z_1 \rvert \lvert z_2 \rvert$, $\left\lvert \frac{z_1}{z_2} \right\rvert = \frac{\lvert z_1 \rvert}{\lvert z_2 \rvert}$ $\arg(z_1 z_2) = \arg z_1 + \arg z_2$ $\arg\left(\frac{z_1}{z_2}\right) = \arg z_1 - \arg z_2$ Knowledge of radians and compound angle formulae is assumed.

Complex Number Basics

Examples: Write the following in terms of i

$\sqrt{(-36)} =$ $\sqrt{-\mathbf{1}} =$

$\sqrt{-4} =$ $\sqrt{-7} =$

Simplify:

$(2 + 3i) + (4 + i) =$

$i - 3(2 - i) =$

$\frac{10+4i}{2}$ =

Solving Quadratic Equations

Examples

1. Solve $z^2 + 25 = 0$

2. Solve $z^2 + 3z + 5 = 0$

Exercise 1A/B
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