MATH1061 Cheatsheet (Linear Algebra)

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1 Complex numbers

1.1 Imaginary unit

Imaginary unit
$i = \sqrt{-1}$

1.2 Cartesian, polar, exponential forms

Name	Form
Cartesian	$z = a + bi$
Polar	$r(\cos\theta + i\sin\theta)$
	often abbreviated as: $r\text{cis }\theta$
Exponential	$re^{i\theta}$

1.3 Complex conjugate

Complex conjugate
Complex conjugate of $z = a + bi$ is $\overline{z} = a - bi$

Complex conjugate properties	
Property	**Definition**
Conjugate of a Sum	$\overline{z + w} = \overline{z} + \overline{w}$
Conjugate of a Product	$\overline{zw} = \overline{z} \times \overline{w}$
Conjugate of a Power	$\overline{z^n} = (\overline{z})^n$

1.4 Modulus of a complex number

Modulus
The modulus of a complex number $z = a + bi$ is $\lvert z \rvert = \sqrt{a^2 + b^2} = \sqrt{z\overline{z}}$

Modulus properties	
Property	**Definition**
Multiplicative Property of Moduli	$\lvert zw \rvert = \lvert z \rvert \lvert w \rvert$
Division Property of Moduli	$\lvert \dfrac{z}{w} \rvert = \dfrac{\lvert z \rvert}{\lvert w \rvert}$
Triangle Inequality	$\lvert z + w \rvert \leq \lvert z \rvert + \lvert w \rvert$
Reverse Triangle Inequality	$\lvert z - w \rvert \geq \lvert z \rvert - \lvert w \rvert$

1.5 Addition, subtraction, multiplication, division

Operation	let $z = a + bi$ and $w = c + di$
Addition	$z + w = (a + c) + (b + d)i$
Subtraction	$z - w = (a - c) + (b - d)i$
Multiplication	$z \times w = (a + bi)(c + di)$
	$z \times w = ac + adi + bci + bdi^2$
	$z \times w = (ac - bd) + (ad + bc)i$
Division	$z \div w = \dfrac{z}{w} \times \dfrac{\overline{w}}{\overline{w}}$
	$z \div w = \dfrac{a + bi}{c + di} \times \dfrac{c - di}{c - di}$