

Further Maths

Basic information

- You cannot take Further Maths or Further Maths AS without taking the Maths A-level.
- You have to REALLY love maths – half your timetable will be maths!
- Full A-level- 3 papers, 2 on pure maths, third split in half on Decision maths (algorithms and decisions) and Mechanics (motion and forces)
- AS-level – 2 papers, 1 on pure maths, second split in half on Decision and Mechanics.

Topics covered

- Matrices
- Complex (imaginary) numbers
- Sequences and series
- Proof
- Vectors
- Roots of polynomials
- Polar coordinates

Complex numbers

Friday, 19 June 2020

- The imaginary number, i , is defined as $i = \sqrt{-1}$
- Therefore we can write the solution to $x^2 = -9$ as $x = \pm\sqrt{-9}$
- This then gives us $x = \pm\sqrt{9}\sqrt{-1}$
- So the solutions are $x = \pm 3i$

Complex numbers

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- Solve the equation $(x - 3)^2 = -5$
- $x - 3 = \pm\sqrt{5}i$
- $x = 3 \pm\sqrt{5}i$
- These sorts of numbers which contain a real term and an imaginary term are called complex numbers.
- Complex numbers can be written in the form $a + bi$, where $a, b \in \mathbb{R}$. (a and b are real numbers)
- The set of complex numbers is denoted \mathbb{C} .

Complex numbers

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- Simplify $3(4 - 7i) - 2(3 - 2i)$
- $12 - 21i - 6 + 4i =$
- $6 - 17i$

Complex numbers

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- $i^2 = -1$

Complex numbers

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- How do you rationalise the denominator in the following:

- $\frac{8 + \sqrt{3}}{1 - \sqrt{2}}$

- So how do we rationalise the denominator here?

- $\frac{1+3i}{1-2i}$

- $\frac{1+3i}{1-2i} \times \frac{1+2i}{1+2i}$

- $\frac{1+2i+3i+6i^2}{1+2i-2i-4i^2} = \frac{1+5i-6}{1+4} = \frac{-5+5i}{5} = -1 + i$

Complex numbers

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Solve these equations.

a $x^2 = -25$

b $x^2 = -121$

c $x^2 = -20$

d $x^2 + 8 = 0$

Have a go at these

Answers on the next slide

Fully simplify each of these expressions.

a i^3 **b** i^4 **c** i^5

d $(2i)^3$ **e** $(3i)^4$ **f** $2i^2(5i-9)^2$

Simplify these fractions, giving your answers in the form $a+bi$ where $a, b \in \mathbb{R}$

a $\frac{3}{2+i}$ **b** $\frac{2i}{1-5i}$ **c** $\frac{1+7i}{3-i}$

Complex numbers

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a $x = \pm 5i$

b $x = \pm 11i$

c $x = \pm 2\sqrt{5}i$

d $x = \pm 2\sqrt{2}i$

a $-i$

b 1

c i

d $-8i$

e 81

f $-112 + 180i$

a $\frac{6}{5} - \frac{3}{5}i$

b $-\frac{5}{13} + \frac{1}{13}i$

c $-\frac{2}{5} + \frac{11}{5}i$

d $-\frac{1}{5} - \frac{7}{5}i$

e $(1 - 2\sqrt{2}) + (-2 - \sqrt{2})i$

f $-\sqrt{2}$