



Kineton Sixth

Achieving Personal Best

A Level Further Maths Bridging Course

Congratulations on your choice to enter for the Further Maths A-Level course. Whilst it is a very demanding course, most mathematicians enjoy the challenge and rigour of extending their maths knowledge and skills. You will need all of the GCSE and a lot of A-Level maths skills to complete the challenge of these questions. The understanding of the new concepts is very tough and often abstract. You will enjoy solving Differential Equations, Matrix problems, polynomial equations and systems of linear equations using difficult ideas such as complex numbers, Gaussian Elimination and De Moivre's Theorem. Most of all though you will need determination and hard-work to succeed.

During your first maths lesson in September, the work completed from this booklet must be handed to your Pure Mathematics class teacher.

We hope that you will use this introduction to give you a good start to your A-level work and that it will help you enjoy and benefit from the course.

You may find the following websites useful:

<https://www.corbettmaths.com/contents>

Revision videos (specific video numbers given at the start of each topic in this booklet)

<http://www.hegartymaths.com/>

Revision videos

<http://www.themathsteacher.com/index.php>

Revision videos and worksheets

<http://www.bbc.co.uk/schools/gcsebitesize/maths/>

Information, videos and online tests

<http://www.khanacademy.org/exercisedashboard>

Revision videos and online questions

Also check out the Jack Brown videos on Youtube

Simplifying Complex Numbers

1. Rewrite the following as a multiple of i :
 - a. $\sqrt{-4}$
 - b. $\sqrt{-25}$
 - c. $\sqrt{-20}$
2. Write the following expressions in the form $x + yi$:
 - a. $5 - 3i - 2 + 5i$
 - b. $(3 + 2i)(1 - 5i)$
 - c. $(3i)^4$
 - d. $(1 + i)^6$

Write the following expressions in the form $x + yi$:

- e. $\frac{5}{3+2i}$
- f. $\frac{4}{5-3i}$
- g. $\frac{3+i}{5-4i}$

3. Argand Diagrams

4. Plot the following complex numbers on an Argand diagram:
 - a. $5 + 2i$
 - b. $2 + 5i$
 - c. $-3 + 4i$
 - d. $5 - 2i$
5. Which two points form a conjugate pair?
6. Which two points have position vectors that are perpendicular?

Solving Equations

7. Solve the following equations, giving your answers in the form $a + bi$:
 - a. $x^2 - 3x + 4 = 0$
 - b. $3x^2 + 5x + 2 = 0$
 - c. $x^3 - x^2 + 3x + 5 = 0$ [Hint: guess a solution and factorise]

Extension

8. Assuming that the square root of a positive real number has only two solutions (which are real), show that i is unique up to a change of sign. [Hint: let $i^2 = -1$ and $j^2 = -1$, then consider $(i - j)^2$]
9. Find the two square roots of i in the form $x + yi$.

Show more generally that every non-zero complex number $a + bi$ has two square roots of the form $x + yi$, one of which is minus the other.