Haywards Heath College

GETTING READY FOR PACK

A Level Further Maths

We are delighted you have chosen to study A Level Further Maths at Haywards Heath College

WHAT YOU WILL STUDY	
Unit/Topic	Pearson Edexcel Core Pure Mathematics Book 1 and Book 2 Pearson Edexcel Further Mechanics 1 Pearson Edexcel Decision Mathematics 1

WHAT YOU NEED	
Kit List	N/A
Course Supplement	N/A
Equipment	Exercise books are provided Folder to organise handouts etc. Stationery Calculator – Casio fx-991EX is recommended, could consider the more expensive Casio fx-CG50
Essential Textbooks	Pearson Edexcel Core Pure Mathematics Book 1/AS (ISBN 978-1-292-18333-6) Pearson Edexcel Core Pure Mathematics Book 2 (ISBN 978-1-292-18334-3) Pearson Edexcel Further Mechanics 1 (ISBN 978-1-292-18331-2) Pearson Edexcel Decision Mathematics 1 (ISBN 978-1-292-18329-9)

ENRICHMENT	
Trips	N/A
Guest Speakers	N/A
Events	Maths Challenge

OPTIONAL ADDITIONAL READING/STUDY	

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SUMMER WORKING TASK INFORMATION
Completion Date: First Lesson Week Commencing 9/9/24
This pack will help you make the best possible start to studying this subject. The tasks in this pack should take you about 4-6 hours to complete. The tasks are designed to get a bit more difficult as you work through them as they are preparing you for studying at a higher level and to become an effective independent learner. You should try to get as far as you can working on your own but if you do need help, please email us at **info@haywardsheath.ac.uk** telling us which Getting Ready For pack you are working on and what help you need. Help is available throughout the summer holidays.

SUMMER WORKING TASK	
Skills Focus	**Researching, Independent Learning and Problem Solving.** **Introduction to Complex Numbers.**
Task 1 Online course **Target Grade** All	Using the A level maths transition course www.integralmaths.org (See A level maths GRFP) you should attempt the "Going Deeper" sections. You should choose 3 topics to go deeper into and tick off the sections you complete. You are unlikely to have time to do them all, so just choose a couple of topics.
Task 2 Research and questions **Target Grade** All	**Introduction to Complex Numbers** Further Maths includes work on complex numbers. Using the pdf added below named **'GRFP Further maths Task 0.2'** Read the notes very carefully and watch the videos below as necessary. Answer all the questions thoroughly. Using the answers provided, mark your work in a different colour and review anything you got wrong. Please bring your answers to your first Further Maths lesson. **Helpful videos from Khan Academy:** Intro to the imaginary numbers Simplifying roots of negative numbers Powers of the imaginary unit Intro to complex numbers Adding complex numbers Subtracting complex numbers Multiplying complex numbers Solving quadratic equations: complex roots Dividing Complex numbers

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Task 3 Questions **Target Grade** Extension	**Complex Numbers Challenge** Using pdf added below named **GRFP Further maths Task 0.3** You may have to do a bit more of your own research but have a go! Complete with full working and mark/annotate in a different colour. Bring to your first Further Maths lesson. **Hint:** z* is called the **complex conjugate** of z. The real part is the same but the imaginary part has a change of sign. E.g. If z = 3 + 4i, then z* = 3 – 4i, or if z = -2 – 6i then z* = -2 + 6i. When solving equations replace z with x + iy and replace z* with x – iy, then compare real and imaginary parts.
Notes:	

Getting Ready For A Level Further Maths
Task 0.2 – Introduction to Complex Numbers

The square root of a negative number

Until now you may have learnt that you cannot square root a negative number, but now you are going to see how this is possible in the following way:
Suppose $i^2 = -1$ then we can deduce that $\sqrt{-1} = i$
This means we can use i every time we want to find the square root of a negative number.

Example: $\sqrt{-9} = \sqrt{9}\sqrt{-1} = 3i$ Check this by working backwards: $(3i)^2 = 9i^2 = 9 \times -1 = -9$

Powers of i

We can find other powers of i also:

Examples: $i^3 = i^2 \times i = -1 \times i = -i$ and $i^4 = i^2 \times i^2 = -1 \times -1 = 1$ etc….

Calculations with Complex Numbers

Complex numbers are any numbers that have i in them, such as $3 + 4i$ or $2 - 7i$.
You can calculate with them as long as you remember that $i^2 = -1$.

Examples: $(3 + 4i) + (5 - 7i) = 8 - 3i$
$(2 - 3i)(3 + 5i) = 6 - 9i + 10i - 15i^2 = 6 + i - (15 \times -1) = 6 + i + 15 = 21 + i$

***Remember to watch the videos for fuller explanations and demonstrations.**

Exercise

Now try these examples, simplifying as far as possible:

1) a) $\sqrt{-25}$ b) $\sqrt{-49}$ c) $\sqrt{-121}$

2) a) i^3 b) i^4 c) i^5 d) i^8 e) i^{34} f) i^{-1}

3) a) $(4 - 7i) + (2 - 6i)$ b) $(3 + 8i) - (1 + 5i)$ c) $(11 + i) - (12 - 2i)$

4) a) $(2 + 5i)(3 + 2i)$ b) $(3 + 7i)(4 - i)$ c) $(6 - 4i)(7 - 8i)$

5) Use the quadratic formula to solve for x and give answers as simplified as possible:

a) $x^2 + 4x + 5 = 0$ b) $x^2 + 6x + 11 = 0$ c) $2x^2 + 3x + 2 = 0$

6) Try these divisions, making the denominator real in the same way you would rationalise the denominator using surds (remember that $i = \sqrt{-1}$, so it is just like working with surds!)

a) $\frac{3+4i}{2+i}$ b) $\frac{22-2i}{4-5i}$ c) $\frac{2+4i}{5-3i}$

Answers

1) a) 5i b) 7i c) 11i

2) a) -i b) 1 c) i d) 1 e) -1 f) -i

3) a) 6 – 13i b) 2 + 3i c) -1 + 3i

4) a) -4 + 19i b) 19 + 25i c) 10 – 76i

5) a) -2 ± i b) $-3 \pm \sqrt{2}i$ c) $\frac{-3}{4} \pm \frac{\sqrt{7}}{4}i$

6) a) 2 + i b) $\frac{98}{41} + \frac{102}{41}i$ c) $\frac{-1}{17} + \frac{13}{17}i$

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Task 0.3 – Complex Numbers Challenge – Exam Questions
Answers are provided but make sure you show a full method

Q1.

(a) Solve the equation $w^2 + 6w + 34 = 0$, giving your answers in the form $p + q\text{i}$, where p and q are integers.

(3)

(b) It is given that $z = \text{i}(1 + \text{i})(2 + \text{i})$.

(i) Express z in the form $a + b\text{i}$, where a and b are integers.

(3)

(ii) Find integers m and n such that $z + mz^* = n\text{i}$.

(3)
(Total 9 marks)

Q2.

(a) Solve the following equations, giving each root in the form $a + b\text{i}$:

(i) $x^2 + 9 = 0$;

(1)

(ii) $(x + 2)^2 + 9 = 0$.

(1)

(b) (i) Expand $(1 + x)^3$.

(1)

(ii) Express $(1 + 2\text{i})^3$ in the form $a + b\text{i}$.

(3)

(iii) Given that $z = 1 + 2\text{i}$, find the value of

$$z^* - z^3$$

(2)
(Total 8 marks)

Answers

M1.(a)

$= -3 \pm 5i$

(b) (i)

$= -3 + i$

(ii)

$\Rightarrow m = -1, n = 2$

M2.(a) (i) $x = \pm 3i$

(ii) $x = -2 \pm 3i$

(b) (i) $(1 + x)^3 = 1 + 3x + 3x^2 + x^3$

(ii)$= -11 - 2i$

(iii)

$= 12$