

A Level Further Mathematics Transition Booklet

$f(x) = \frac{d^p}{\Gamma(p)} x^{p-1} e^{-dx} \quad x > 0$; $\Gamma(p) = \int_0^\infty x^{p-1} e^{-x} dx$ $\mathcal{L}(f) = \Gamma(p) f^*(s) = \frac{d^p}{\Gamma(p)} \Gamma(p) s^{-p} e^{-d/s}$
 $u(1) = 2u(1) = np \ln d - n[\Gamma(p) + (p-1)2x] - d \sum x = d = \frac{np}{\sum x} \Rightarrow \Delta = \frac{p}{x}$
 $E(\Delta) = E\left(\frac{np}{\sum x}\right) = \int_0^\infty \frac{np}{x} \frac{1}{\Gamma(p)} x^{p-1} e^{-dx} dx = \frac{np}{\Gamma(p)} \int_0^\infty x^{p-2} e^{-dx} dx = \frac{\Gamma(p-1)}{\Gamma(p)} dp$
 $\Gamma(p) = (p-1) \Rightarrow \frac{\Gamma(p-1)}{\Gamma(p)} = \frac{(p-2)}{(p-1)} = \frac{1}{p-1} \Rightarrow E\Delta = \frac{1}{p-1} np = \frac{np}{p-1}$
 $\text{Var } E\Delta = \left(\frac{np}{p-1}\right)^2 \text{Var } \Delta = E\Delta^2 - (E\Delta)^2 = \frac{(np)^2}{(p-1)(p-2)} \left[\frac{p^2}{(p-1)^2} - \frac{1}{p-1} \right] = \frac{(np)^2}{(p-1)(p-2)} \left[\frac{p^2 - (p-1)}{(p-1)^2} \right] = \frac{(np)^2}{(p-1)(p-2)} \frac{p^2 - p + 1}{(p-1)^2}$
 $(np)^2 \frac{[p^2 - (p-1)] - (p-2)}{(p-1)^2 (p-2)} = \frac{(np)^2}{(p-1)(p-2)}$
 $F(x) = P(T \leq x) = P\{X_1 \leq x\} = P\{X_1 \leq x\} = P\{X_1 \leq x\}$
 $F(x) = \int_0^x \frac{t^{p-1}}{\Gamma(p)} dt = \frac{1}{\Gamma(p)} \left[\frac{t^p}{p} \right]_0^x = \frac{x^p}{p \Gamma(p)}$
 $P\{x_1 \leq x\} = \left[\frac{x^p}{p \Gamma(p)} \right]^n = \frac{x^{np}}{p^n \Gamma(p)^n}$
 $E(T_2) = E(\bar{x}) = \frac{2}{n} E(\sum x) = \frac{2}{n} np = 2$
 $\frac{1}{x^2} \frac{d}{dx} x^{n+2} = \frac{1}{x^2} (n+2)x^{n+1} = (n+2) \frac{1}{x}$
 $a^2 + b^2 = c^2, c = \sqrt{a^2 + b^2}$
 $c^2 - a^2 = b^2, c^2 - b^2 = a^2$
 $\frac{a}{c} = \frac{HB}{n}$
 $a^2 = c \times HB$ and $b^2 = c \times HA$
 $a^2 + b^2 = c \times HB + c \times HA = c \times (HB + HA) = c \times AB = c^2$
 $\frac{1}{x^2} \frac{d}{dx} x^{n+2} \sim \frac{1}{x} \sim \frac{1}{x} \sin \alpha = \frac{a}{c}$
 $\tan \alpha = \frac{a}{b}$

This pack contains information about A Level Mathematics and Further Mathematics and a programme of activities and resources to prepare you to start an A Level in Mathematics and Further Mathematics in September. Please use this during the summer term and the summer holidays to prepare for your A Level course.

Please note the compulsory summer work which starts on page 4

The **A Level Further Mathematics** course also consists of three main sections Within the **Pure Mathematics (50%)** of the Further Mathematics course you will study:

- Proof
- Complex Numbers
- Matrices
- Further Algebra and Functions
- Further Equations
- Further Vectors
- Hyperbolic Functions
- Polar Coordinates
- Differential Calculus

In **Further Statistics (25%)** you will study more probability distributions and hypothesis tests, diving deeper into the world of statistical analysis.

In **Decision Mathematics (25%)** you will study algorithms, graph theory and linear programming, this links closely with computer science but has many real-life applications.

Examination:

Further Mathematics A level is made up of four 1 hour 30 minutes examinations, each one worth 75 marks and equating to 25% of the overall qualification. The exams are:

- Core Pure 1
- Core Pure 2
- Option 1 (Further Statistics 1)
- Option 2 (Decision Mathematics 1)

Summer Work

Compulsory

A successful A Level mathematician must demonstrate complete algebraic fluency, have a solid understanding of graphs and their equations and be able to solve geometric problems using a variety of methods. The following tasks have been created to help learners best prepare for the A Level course by recapping core skills from the GCSE course. Each task booklet consists of key points, examples and exercises for learners to complete. You need to be able to demonstrate competency at each key skill by completing part of each exercise but it is not essential that you answer every question, each exercise includes several extension questions that as Further Mathematicians you are expected to complete.

Task 1: Algebra

You shall receive a printed copy of the task 1 booklet.

Here is a link to an electronic copy:

<https://woottonparkschool.sharepoint.com/:b:/s/FlexibleLearning/EVYa56HLXntBsEEJgUBJ9iMBU8QCkpZ8lniegnvNY21V2Q?e=MfELge>

Task 2: Graphs

You shall receive a printed copy of the task 2 booklet.

Here is a link to an electronic copy:

<https://woottonparkschool.sharepoint.com/:b:/s/FlexibleLearning/EdEyWoTy9opMhkorsCmE6bABf0PZrXmEzo2kfyMjtlOvaw?e=N9AQN9>

Task 3: Geometry and Proportion

You shall receive a printed copy of the task 3 booklet.

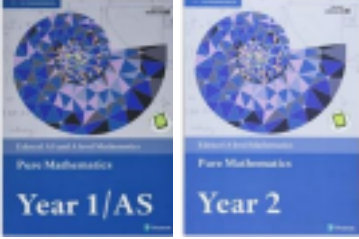
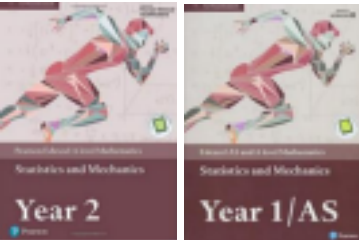
Here is a link to an electronic copy:

https://woottonparkschool.sharepoint.com/:b:/s/FlexibleLearning/EbT222WITStApocr9v_Raq0Bhz2fVgUoT-7Qk4s2LExHrw?e=pmn6jT



Suggested Reading List

Below are the links to the Mathematics A-Level textbooks. You may wish to have your own version of each textbook so that you can annotate examples and exercises throughout the course.

In year 12 you will use the A level Mathematics text books:

	<p>Edexcel AS and A Level Mathematics, Pure Mathematics, Year 1</p> <p>Edexcel A Level Mathematics, Pure Mathematics, Year 2</p>
	<p>Edexcel AS and A Level Mathematics, Statistics and Mechanics, Year 1</p> <p>Edexcel A Level Mathematics, Statistics and Mechanics, Year 2</p>

In year 13 you will use the A level Further Mathematics text books:

	<p>Edexcel AS and A level Further Mathematics, Core Pure Mathematics, Book 1/AS</p> <p>Edexcel A level Further Mathematics, Core Pure Mathematics, Book 2</p>
	<p>Edexcel AS and A level Further Mathematics, Decision Mathematics 1</p> <p>Edexcel AS and A level Further Mathematics, Further Statistics 1</p>

You are also required to have the casio FX-991EX calculator



This is essential as you will be expected to perform functions on this calculator in an examination that most calculators used at GCSE are unable to perform.

Available on [amazon](#) and most stationary stores.

- The History of Maths <https://www.bbc.co.uk/programmes/b00dxjls>
- Hannah Fry's Mysterious World of Maths
<https://www.bbc.co.uk/programmes/b0bn9dth>
- Ted Talks – Maths Playlist https://www.ted.com/playlists/189/math_talks_to_blow_your_mind • BBC Four in our Time – Maths podcast <https://www.bbc.co.uk/sounds/play/p00545hk> • Podcasts focussing on interesting areas of maths <https://player.fm/series/the-ncetm-maths-podcast-2361943>
- Numberphile Youtube channel: <https://www.youtube.com/user/numberphile> • Eddie Woo YouTube Channel: <https://www.youtube.com/user/misterwootube> • The Guardian Monday Puzzle - <https://www.theguardian.com/science/series/alex-bellos-monday-puzzle>

Books:

Here is a list of Popular Mathematics books that are not specifically related to the course but you may enjoy reading

- Simon Singh – Fermat's Last Theorem
- Simon Singh – The Codebook
- Simon Singh – The Simpsons and their Mathematical Secrets
- Alex Bellos – Alex Adventure's in Numberland
- Alex Bellos – Alex through the Looking Glass
- Matt Parker – Humble Pi
- Matt Parker – Things to make and do in the fourth dimension
- Jordan Ellenberg – How Not to be Wrong: The hidden Maths of everyday life
- Ian Stewart – Seventeen Equations that Changed the World

Expectations and Workload

We are delighted you have chosen to study Further Mathematics. You can expect well-planned and resourced lessons delivered by teachers who genuinely want to see you achieve your potential. In return we expect you to arrive promptly and properly equipped to all lessons. You will also be expected to use your private study time in an organised and effective way to supplement and reinforce what you have learnt in class. **Simply turning up to most of the lessons will not be enough to secure your target grade.** The work you do outside of your lessons will have a very significant impact on your results. Above all else, we expect you to display *enthusiasm* and *passion* for Mathematics.