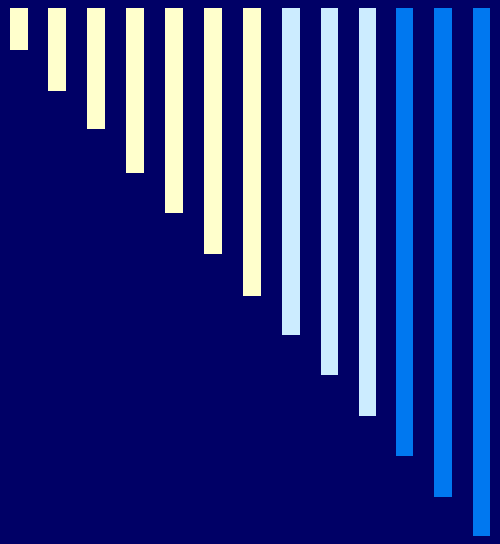


Mathematics and Further Mathematics

AS and A2 Level

Introduction

Course Structure

- You will study a number of different modules to attain the level of qualification you want. These are as follows:

AS Maths	3 Modules
A2 Maths	6 Modules
AS Further Maths	9 Modules
A2 Further Maths	12 Modules

For each qualification you will need to sit a number of pure mathematics modules and some applied mathematics modules (Mechanics, Statistics or Decision).

Pure Mathematics C1-C4 & FP1-FP3

- When studying pure mathematics at AS and A2 level you will be extending your knowledge of such topics as algebra and trigonometry as well as learning some brand new ideas such as calculus. While many of the ideas that you will meet in pure mathematics are interesting in their own right, they also serve as an important foundation for other branches of mathematics, especially mechanics and statistics.

Mechanics M1-M5

- Mechanics deals with the action of forces on objects. It is therefore concerned with many everyday situations, e.g. the motion of cars, the flight of a cricket ball through the air, the stresses in bridges, the motion of the earth around the sun. Such problems have to be simplified or modelled to make them capable of solution using relatively simple mathematics.

Statistics S1-S4

- When you study statistics you will learn how to analyse and summarise numerical data in order to arrive at conclusion about it. You will extend the range of probability problems that you looked at in GCSE using the new mathematical techniques learnt in the pure mathematics units.

Decision D1-D2

- In decision mathematics you will learn how to solve problems involving networks, systems, planning and resource allocation. You will study a range of methods, or algorithms, which enable such problems to be tackled. The ideas have many important applications in such different problems as the design of circuits on microchips to the scheduling of tasks required to build a new supermarket.

Past Exam Questions

- Some questions from previous A level exam papers…

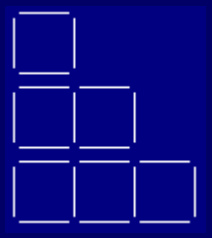
Pure Mathematics (C1)

Ann has some sticks that are all of the same length. She arranges them in squares and has made the following 3 rows of patterns:

Row 1

Row 2

Row 3



She notices that 4 sticks are required to make the single square in the first row, 7 sticks are required to make 2 squares in the second row and in the third row she needs 10 sticks to make 3 squares.

a) Find an expression, in terms of n, for the number of sticks required to make a similar arrangement of n squares in the nth row. (3)

Ann continues to make squares following the same pattern. She makes 4 squares in the 4^{th} row and so on until she has completed 10 rows.

b) Find the total number of sticks Ann uses in making these 10 rows. (3)

Ann started with 1750 sticks. Given that Ann continues the pattern to complete k rows but does not have sufficient sticks to complete the $(k+1)$th row,

c) Show that k satisfies $(3k-100)(k+35)<0$.

(4)

d) Find the value of k.

(2)

Statistics (S1)

A second hand car dealer has 10 cars for sale. She decides to investigate the link between the age of the cars, x years, and the mileage, y thousand miles. The data collected from the cars are shown in the table below.

Age, x (years)	2	2.5	3	4	4.5	4.5	5	3	6	6.5
Mileage, y (thousands)	22	34	33	37	40	45	49	30	58	58

You may assume that $\Sigma x = 41$, $\Sigma y = 406$, $\Sigma x^2 = 188$, $\Sigma xy = 1818.5$

a) Find S_{xx} and S_{xy}. (3)

b) Find the equation of the least squares regression line in the form $y=a+bx$. Give the values of a and b to 2 decimal places. (4)

c) Give a practical interpretation of the slope b. (1)

d) Using your answer to part (b), find the mileage predicted by the regression line for a 5 year old car. (2)

Mechanics (M1)

Two particles *A* and *B* have masses 4 kg and *m* kg respectively. They are moving towards each other in opposite directions on a smooth horizontal table when they collide directly. Immediately before the collision, the speed of *A* is 5 ms^{-1} and the speed of *B* is 3 ms^{-1}. Immediately after the collision, the direction of motion of *A* is unchanged and the speed of *A* is 1 ms^{-1}.

a) Find the magnitude of the impulse exerted on *A* in the collision.

(2)

Immediately after the collision, the speed of *B* is 2 ms^{-1}.

b) Find the value of *m*.

(4)

Decision (D1)

29 52 73 87 74 47 38 61 41

The numbers in the list represent the lengths in minutes of nine radio programmes. They are to be recorded onto tapes which each store up to 100 minutes of programmes.

a) Obtain a lower bound for the number of tapes needed to store the nine programmes. (2)

b) Use the first-fit bin packing algorithm to fit the programmes onto the tapes. (3)

GCSE Topics

- The A level Maths course will build very quickly on certain GCSE topics that you need to make sure you are confident with before you start.
- You will be set a piece of work to complete over the summer to make sure some of the key topics remain fresh in your mind. SUMMER WORK

KEY GCSE MATHS TOPICS

ALGEBRA

- Solving linear equations
- Simultaneous equations
- Expanding brackets
- Factorising
- Inequalities
- Solving Quadratic equations by factorising, quadratic formula, and completing the square
- Recognise the difference of two squares

- Rearranging formulae
- Algebraic fractions
- Transforming graphs

NUMBER

- Indices
- Surds

SHAPE AND SPACE

- Pythagoras' Theorem
- Trigonometry in right angled triangles (SOHCAHTOA)
- Sine and cosine rule
- Area of a non-right angled triangle

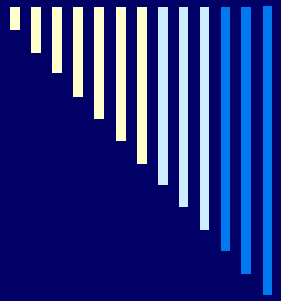
Organisation

An important part of the A level Mathematics course is the organisation of your notes and work. Your maths work will be checked frequently.

- You will need: A folder for each module (dividers for sections). Lined or squared paper. Pens etc. Scientific calculator (we recommend a natural display calculator).

What can you do to prepare?

- Use the topic list to make sure you are confident with each topic.
- On www.mymaths.co.uk there are a number of A level module lessons which you could work on.
- Complete the summer work with full workings and clear presentation.
- CGP head start to maths book



QUESTIONS ? ? ? ?

Core Mathematics C1

Mensuration

Surface area of sphere $= 4\pi r^2$

Area of curved surface of cone $= \pi r \times$ slant height

Arithmetic series

$u_n = a + (n-1)d$

$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n[2a + (n-1)d]$

Statistics S1

Correlation and regression

For a set of n pairs of values (x_i, y_i)

$$S_{xx} = \Sigma(x_i - \bar{x})^2 = \Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}$$

$$S_{yy} = \Sigma(y_i - \bar{y})^2 = \Sigma y_i^2 - \frac{(\Sigma y_i)^2}{n}$$

$$S_{xy} = \Sigma(x_i - \bar{x})(y_i - \bar{y}) = \Sigma x_i y_i - \frac{(\Sigma x_i)(\Sigma y_i)}{n}$$

The product moment correlation coefficient is

$$r = \frac{S_{xy}}{\sqrt{S_{xx} S_{yy}}} = \frac{\Sigma(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\{\Sigma(x_i - \bar{x})^2\}\{\Sigma(y_i - \bar{y})^2\}}} = \frac{\Sigma x_i y_i - \frac{(\Sigma x_i)(\Sigma y_i)}{n}}{\sqrt{\left(\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}\right)\left(\Sigma y_i^2 - \frac{(\Sigma y_i)^2}{n}\right)}}$$

The regression coefficient of y on x is $b = \frac{S_{xy}}{S_{xx}} = \frac{\Sigma(x_i - \bar{x})(y_i - \bar{y})}{\Sigma(x_i - \bar{x})^2}$

Least squares regression line of y on x is $y = a + bx$ where $a = \bar{y} - b\bar{x}$