



# **Sutton Coldfield Grammar School for Girls**



## **A-Level Mathematics Summer Work**

# You've made it to the end of the GCSE Maths course.

## You deserve an amazing summer break and a brilliant results day.

Now if you are thinking of studying A-Level Maths, you should be commended for your astute decision-making. However, A-level Maths and A-level Further Maths do not have the reputation for being some of the hardest A-Levels for nothing.

What can you do to ensure the best possible start to the course? Well, it's pretty easy really - don't forget everything you studied for GCSE Maths, especially the Algebra. Definitely read through your Algebra notes before September - there is a nice overlap between Grade 7-9 Algebra and the Year 12 course, so if you can keep those skills sharp you should have a good start. If the algebra part of the GCSE wasn't your thing, then you may be at a disadvantage in Y12.

On the next two pages are some questions that you need to complete on paper and **hand in on your first maths lesson** in year 12.

There are also some suggestions for ways to keep your maths skills fresh, without the maths textbooks.

This is a selection of the Mathematics from GCSE that you will be expected to be able to do before starting the A-level course.

Complete the questions on paper and bring them to your first A-level Maths lesson. Remember to show all working out and indicate your answers clearly

### Indices

1. Simplify the following

a)  $x^3 \times x^{11}$       b)  $\frac{k^5}{k^2}$       c)  $3x^4 \times 7x^6$       d)  $(3x^2)^3$

e)  $8x^7 \div 4x^3$       f)  $\frac{(6pq)^3}{(2p^2q)^2}$

2. Without using a calculator, find the value of the following, showing sufficient working to make your method clear.

a)  $5^0$     b)  $4^{-2}$     c)  $9^{\frac{1}{2}}$     d)  $8^{\frac{2}{3}}$     e)  $25^{-\frac{3}{2}}$

### Algebraic Manipulation

3. Simplify the following.

a)  $x^2 + 3x^2$       b)  $2a \times 5b$       c)  $5a - 3b - a + 2b$

4. Expand and simplify.

a)  $4(x + 7)$       b)  $x(1 - x)$       c)  $-y(y + x)$   
d)  $5a - 2(2a + 3)$       e)  $2x - (x - 1)$       f)  $(x - 5)(x + 9)$   
g)  $(2y - 1)(y - 4)$       h)  $(3x - 2)^2$       i)  $(2x - 3y)(5x + 2y)$   
j)  $(x - 1)(x - 2)(x + 3)$

5. Simplify.

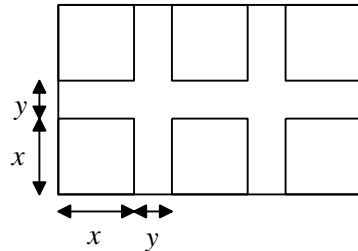
a)  $\frac{8x^2 + 12x^4}{2x}$       b)  $\frac{9x^4 + 12x^7}{6x}$

6. Factorise.

a)  $9y^2 - 3y$       b)  $8x^2y + 12xy^2$       c)  $x^2 - 6x - 16$   
d)  $4x^2 - 9$       e)  $2x^2 - 18x + 28$       f)  $2x^2 - 50$   
g)  $x^3 - 4x$       h)  $2x^2 + 5x + 2$       i)  $3x^2 + 10x - 8$

## Applications of Algebra

7. A large window consists of six square panes of glass as shown.  
Each pane is  $x$  metres by  $x$  metres, and all the dividing wood is  $y$  metres wide.



- a) Write down expressions for the length, width and hence the total area of the whole window in terms of  $x$  and  $y$ .
- b) Show that the total area of the dividing wood is  $7xy + 2y^2$ .
- c) The total area of glass is  $1.5 \text{ m}^2$ , and the total area of the wood is  $1\text{m}^2$ . Find the values of  $x$  and  $y$ .
8. Fred cycled from home to his friend's house and back again.  
The distance between their houses is 20km.  
On his way to his friend's house, Fred cycled at  $x$  km/h.  
On the way back, Fred cycled 2 km/h slower. It took Fred 4 hours altogether to cycle to his friend's house and back.
- a) Write down an equation for  $x$ .
- b) Show that the equation can be written as  $x^2 - 12x + 10 = 0$
- c) Solve the equation in b), giving your answers to 1 decimal place.
- d) Only one of these answers can be Fred's speed. Explain.

Here are some more suggestions for ways to keep your maths skills sharp, without the maths text books.

### Try the free Sumaze apps

Number and logic problems in a maze-style game. If you have a lot of free time Sumaze 1 can be done in under two days



### Investigate YouTube

Look for the Numberphile channel or videos by the 'Festival of the Spoken' nerd team



Unsurprisingly Matt Parker (Stand Up Maths) is involved in both

### Watch a film

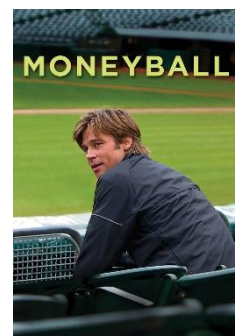
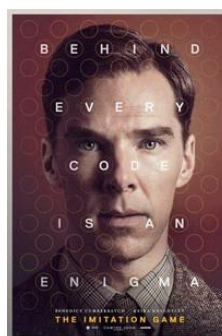
'Hidden Figures' PG

'Moneyball' 12A

'Beautiful Mind' 12

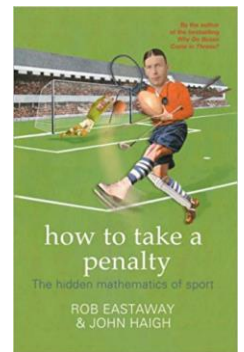
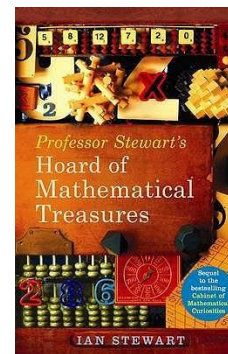
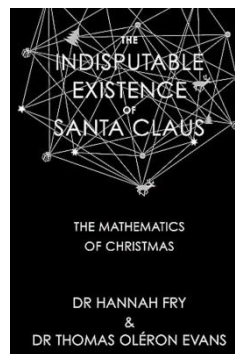
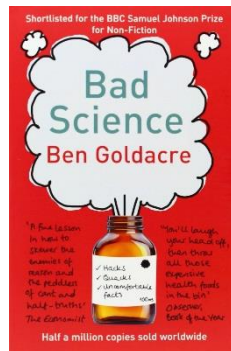
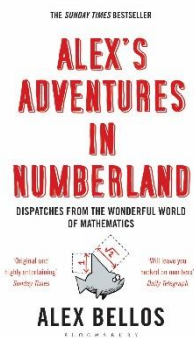
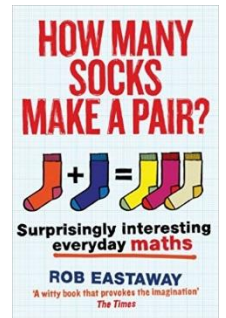
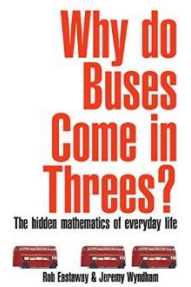
'The Imitation Game' 12

You'll be surprised how many results you get if you Google 'maths films on Netflix', however they aren't all available on the UK service



## Read a book and follow the authors on social media

- 'Why do Busses come in threes' or 'How many socks make a pair' both by Rob Eastaway
- 'Alex's Adventures in Numberland'
- 'Bad Science' by Ben Goldacre
- 'The indisputable existence of Santa Claus: The mathematics of Christmas' by Dr Hannah Fry & Dr Thomas Oleron Evans

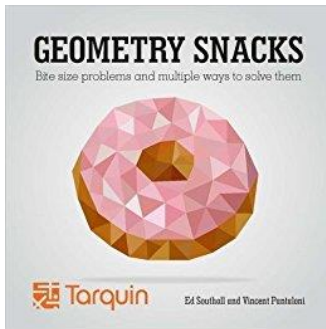


## Go to an event

If you get the opportunity to, go to a popular Maths or Science lecture. You'll be surprised where they pop up - even the famous Hay Literary festival has a maths lecture! Don't worry if you don't understand all of it, you won't be alone, but you'll start to see the links between different areas

## Puzzles

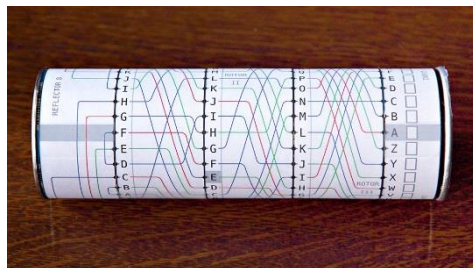
Invest in some Maths related puzzle books:  
Sudoku, mathdoku, menseki meiro (books are in other languages, but you don't need the instructions, just the pictures), logic problems  
They'll all keep your brain alert



Geometry snacks is another book with fun and interesting geometrical problems if you fancy something a bit different from number puzzles.

## Eat some tubes of Pringles with friends

- Google Pringles Enigma machine
- Make enigma machines out of the tubes



- Text each other coded messages whilst sunbathing (in the rain)

Above all have a brilliant summer and we will see you in  
September!

The only way  
to **learn**  
**mathematics**  
is to **do**  
**mathematics.**

PAUL HALMOS