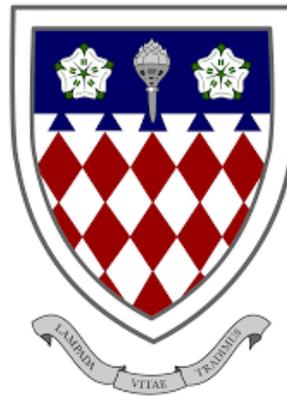
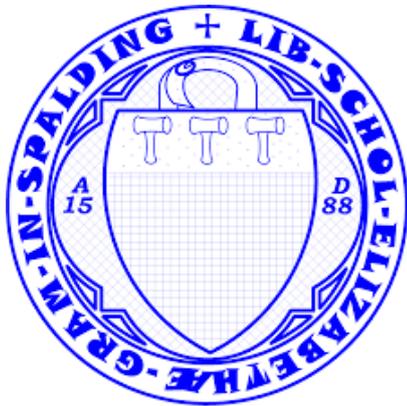


Spalding Grammar School
& Spalding High School
Mathematics Departments



Study Skills in AS/A Level Mathematics

A Practical Guide to Success



Studying Mathematics at SHS and SGS

This booklet is designed to help to improve your study skills in Mathematics. It contains ideas from a number of sources from personal and student experiences. We are all different and what may work for one person may not work for another. You should try some of the methods described here to see what works for you. Nobody can do your studying for you nor can your friend take your exams for you - it is up to you! But there is always help at hand.

1 Proactive Study

(a) Active Study versus Passive Study

Be actively involved in managing the learning process, the mathematics and your study time:

- Take responsibility for studying, recognising what you do and don't know, and knowing how to get help with what you don't know. This may include using any or all of the following: your teachers, your friends, the internet, textbooks etc.
- Attend all your lessons and tutorials and take complete notes. Exam questions are often based on material and examples covered in class as well as on those in any recommended text. There is a high correlation between the number of lessons attended and your grade. Most A grade students miss fewer than two or three lessons during the year.
- Be an active participant in lessons. Ask questions in class! Remember - there are usually other students wanting to know the answers to any questions you ask. Don't let teachers ignore something you don't understand. Always challenge answers if you think they are wrong. Everyone makes mistakes and all mathematics teachers at the both schools will welcome your challenge, especially if it prevents them getting further into the mire!
- Go and see your teachers and ask questions when necessary. Your teachers will be pleased to see that you are interested, and you will be actively helping yourself.
- Good study habits throughout the year make it easier to study for exams.
- Make sure you are given a copy of the syllabus at the beginning of the course.

(b) Studying Maths is different from studying other subjects!

A very important part of learning Maths is doing problems. Maths is not something you master just by reading.

- Do the work set in good time. Don't leave it until the last minute when there is no time to get help or you may rush and make careless mistakes.
- The problems help you learn the formulas and techniques you do need to know, as well as improve your problem-solving prowess.
- A word of warning - most modules build throughout the year. You must keep up with the work, falling a day or two behind puts you at a disadvantage. Falling a week behind puts you in deep trouble. If you miss a class for any reason, make sure you get the notes as soon as possible and get help if you need it.



- You will probably find modules will overlap to a certain extent. Many of the ideas hang together. Identifying and learning the key concepts mean you don't have to memorise as much.

(c) A Level Maths is Different from GCSE Maths

At AS/A level you will cover material at a much faster pace than you did at GCSE level. Lower down the school a topic is developed and then usually followed by a period of practice, with your teacher present, to consolidate the learning. Although most AS/A level classes have a day or so between lessons, each successive class will go on to new material, and you will be expected to complete any unfinished exercises. You are expected to absorb new material much more quickly and may not have set work checked in such detail as you had at GCSE level. Students who get into this study pattern early almost invariably gain top grades. Those who do not, struggle and limp from one topic to another, without really having full understanding. They are unlikely to achieve grades A or B. Start as you mean to go on: not only will the work be easier, but you will enjoy it and also do well in the examination.

(d) Study Time

- You may know a rule of thumb about maths (and other) subjects - about 1 hour of study time per class hour. But this may not be enough!
- Take as much time as you need to do all the work set to get complete understanding of the material. You may find it helpful to find similar examples in textbooks to practice on.
- Work with your friends in an informal study group. You may find it helpful to meet at a regular time each week. Go over problems you've had trouble with. Either someone else in the group will help you, or you will discover you're all stuck on the same problems. If so, then it's time to get help from elsewhere such as your teacher.
- The more challenging the material, the more time you should spend on it.

2 Problem Solving

(a) Types of Problems

- As you study Mathematics you will meet more complex problems: in early work, problems often require just one step to find a solution; as you progress you will tackle problems which require several steps to solve them. Break these problems down into smaller pieces and solve each piece - divide and conquer!
- Problemtypes:
 1. Problems testing memory recall
 2. Problems testing skills,
 3. Problems requiring application of skills to familiar situations,
 4. Problems requiring application of skills to unfamiliar situations (you develop a strategy for a new problem type),
 5. Problems requiring that you extend the skills or theory you know before applying them to an unfamiliar situation.



- When you tackle problems, always write out complete solutions, as if you were taking an exam. Don't just scratch out a few lines and check the answer in the back of the book. Full workings are good practice for exams and make it easier for you to spot any errors.
- If your answer is not right, rework the problem; don't just do some mental gymnastics to convince yourself that you could get the correct answer. If you can't get the answer, get help.
- The practice you get doing set work and reviewing will make exam problems easier to tackle.

(b) Tips on Problem Solving

- In most cases you cannot solve a problem just by looking at it! If you cannot see how to start then you need to use a pencil and paper and try various things.
- Apply the following four-step process:
 1. The first and most important step in solving a problem is to understand the question, that is, identify exactly which quantity the problem is asking you to find or solve. Make sure you read the whole question.
 2. Next you need to devise a plan, that is, identify which skills and techniques you have learned can be applied to solve the problem at hand.
 3. Carry out the plan.
 4. Look back: Does the answer you found seem reasonable? Also review the problem and method of solution so that you will be able to recognise and solve similar problems more easily.
- **Some problem-solving strategies:**
 1. use one or more variables,
 2. complete a table,
 3. consider a special case,
 4. look for a pattern,
 5. sketch a graph,
 6. draw a picture or diagram,
 7. make a list,
 8. solve a simpler related problem,
 9. use reasoning,
 10. work backwards,
 11. solve an equation,
 12. look for a formula,
 13. use coordinates.



(c) **"Word" Problems are Really "Applied" Problems**

The term "word problem" has only negative connotations. It's better to think of them as "applied problems". These problems should be the most interesting ones to solve. Sometimes the "applied" problems don't appear very realistic, but that's usually because the corresponding real applied problems are too hard or complicated to solve at your current level. But at least you get an idea of how the maths you are learning can help solve actual real-world problems, particularly in Mechanics and Statistics

Solving a Word Problem

- First convert the problem into mathematics. This step is (usually) the most challenging part of an applied problem. If possible, start by drawing a picture. Label it with all the quantities mentioned in the problem. If a quantity in the problem is not a fixed number, name it by a variable. Identify the goal of the problem. Then complete the conversion of the problem into math, i.e., find equations which describe relationships among the variables, and describe the goal of the problem mathematically.
- Solve the maths problem you have generated, using whatever skills and techniques you need (refer to the four-step process above). As a final step, you should convert the answer of your maths problem back into words, so that you have now solved the original applied problem.

3 Tests and Exams

(a) **Preparation**

- Everyday Study is a Big Part of Exam Preparation. Revision of any topic should start, no later than the week later you've been taught it!
- Good study habits throughout the year make it easier to study for exams.
- Do all the work when it is assigned. You cannot hope to cram 3 or 4 weeks of worth of learning into a couple of days of study. Doing the work set is the best way to get practice.

(b) **Studying for the exam**

- Start by going over each section, reviewing your notes and checking that you can still do the work set (actually work through them again). Use any worked examples you have in textbooks and notes - cover up the solutions and work out the solutions yourself. Check your work against the solutions given.
- Put yourself in an exam-like situation, work at problems from review sections at the end of chapters or sample exams and work to a time. It's important to keep working at problems the whole time you're studying. Past papers will be available.
- Start studying early. Several days to a week before a test, at least two months for the final examination.
- Construct a revision timetable - and stick to it! Build in leisure time. After a hard session of revision you need time off to relax.
- Do revision in small chunks of 1 - 2 hours.



- Get lots of sleep the night before the Exam. Maths Exams are easier when you are mentally sharp.

(c) Strategies in the Exam Room

Just as it is important to think about how you spend your study time (in addition to actually doing the studying), it is important to think about what strategies you will use when you take an exam (in addition to actually doing the problems on the exam).

Good exam-taking strategy can make a big difference to your mark!

- First read through the full paper. You'll get a sense of its length. Try to identify those problems you definitely know how to do right away, and those you expect to have to think about, possibly grade them A, B, C.
- All questions compulsory but do the problems in the order that suits you! Start with the problems that you know for sure you can do (the A's). This builds confidence and means you don't miss any sure points just because you run out of time. Then try the problems you think you can figure out (the B's); then finally try the ones you are least sure about (the C's). Time is of the essence - work as quickly and continuously as you can while still writing legibly and showing all your working. If you get stuck on a problem, move on to another one - you can come back later.
- Work by the clock. On a 90-minute, 75 mark exam, you have 6 minutes for a 5 marks question. However, aim at 1 mark per minute and this will give you a bit of breathing space at the end.
- Starting with the easy questions will probably put you ahead of the clock. When you work on a harder problem, spend no more than the allotted time on that question (i.e. 6 minutes for a 5 mark question), and if you have not almost finished it, go on to another problem. Do not spend 20 minutes on a problem which will yield few or no marks when there are other problems still to try.
- Show all your working making it as easy as possible for the person marking the exam to see how much you do know. Try to write a well-reasoned solution. If your answer is incorrect, you will get partial credit based on the work you show.
- Never waste time erasing! Just draw a neat line through the work you want ignored and move on. Not only does erasing waste precious time, but you may discover later that you erased something useful (and/or maybe worth partial credit if you cannot complete the problem).
- In a multiple-step problem outline the steps before actually working the problem.
- Don't give up on a several-part problem just because you can't do the first part. Attempt the other part(s) if the actual solution depends on the first part, at least explain how you would do it.
- Make sure you read the questions carefully, and do all parts of each problem.
- Verify your answers - does each answer make sense, given the context of the problem?
- If you finish early, check every problem (rework as many as possible from scratch on a separate piece of paper).



SUMMARY

(a) Use all the Resources You Have Available

Get Help as soon as you need it. Don't wait until an exam is near or an assignment is due to be handed in. New material builds on previous sections, so anything you don't understand now will make future material difficult to understand.

- Ask questions as often as you need to. You get help and stay actively involved in the class.
- Visit your teachers in their spare time. They like to see students who want to help themselves.
- Ask friends, members of your study group, or anyone else who can help. The classmate who explains something to you learns just as much as you do, for he/she must think carefully about how to explain the particular concept or solution in a clear way. So don't be reluctant to ask a classmate.
- All students need help at some point, so be sure to get the help you need.

(b) Asking Questions

Don't be afraid to ask questions. Any question is better than no question at all (at least your teacher will know you have a problem). A good question will allow your helper to quickly identify exactly what you don't understand.

- A question such as: "I don't understand anything in this topic, can you help me?" is too vague and the best you can expect in reply to such a remark is a brief review of the topic, which will probably overlook the particular thing(s) which you don't understand.
- Good question: "why doesn't $(a+b)^2$ equal $a^2 + b^2$. "This is a very specific question that will get a very specific response and hopefully clear up your difficulty.
- Bad question: "I can't sketch graphs."
- Good question: "I have difficulty in sketching $y = 5 + 2 \sin x$ "
- Good question: "How can you tell the difference between the equation of a circle and the equation of a line?"
- Acceptable question: "How do you do question 17?"
- Better question: "Can you show me how to start question 17?" (which means that you hope that given the start you think you'll be able to complete it)
- Even better question: "This is how I tried to do question 17. What went wrong?" The focus of attention is on your thought process.
- Right after you get help with a problem, work another similar problem by yourself.



(c) You Control the Help You Get

Helpers should be coaches, not crutches. They should encourage you, give you hints as you need them, and sometimes show you how to do problems. But they should not, nor be expected to, actually do the work you need to do. They are there to help you figure out how to learn maths for yourself

- When you go for help, have specific questions to ask. You should run the session as much as possible.
- Do not allow yourself to become dependent on others, they cannot take the exams for you. You must take care to be the one in control of tutoring sessions.
- You must recognise that sometimes you do need some coaching to help you through, and it is up to you to seek out that coaching. Don't fall into the trap of copying a fellow student's work and handing it in as your own. You will be found out! Also you will not learn any Maths to help you later in the exam!

And finally, we want you to enjoy, and be successful at AS/A level Mathematics at either Spalding High School or Spalding Grammar School. It should be challenging but never onerous. It should make you feel happy most of the time, but there will be times when you just can't seem to get the right answer and you feel like pulling your hair out! Don't worry: just follow some of the advice above. Some parts you'll understand quickly, others will take more time and effort. You will get a lot of things wrong along the road to getting the important things right. This is perfectly normal. Remember, the world's greatest mathematician spent a lot of their life not always getting things right: what made them great was that they never gave up.

* We would appreciate your comments on this booklet, especially if you've found any errors or you have discovered a wonderful learning style that you think would benefit future generations of mathematicians, please let us know.