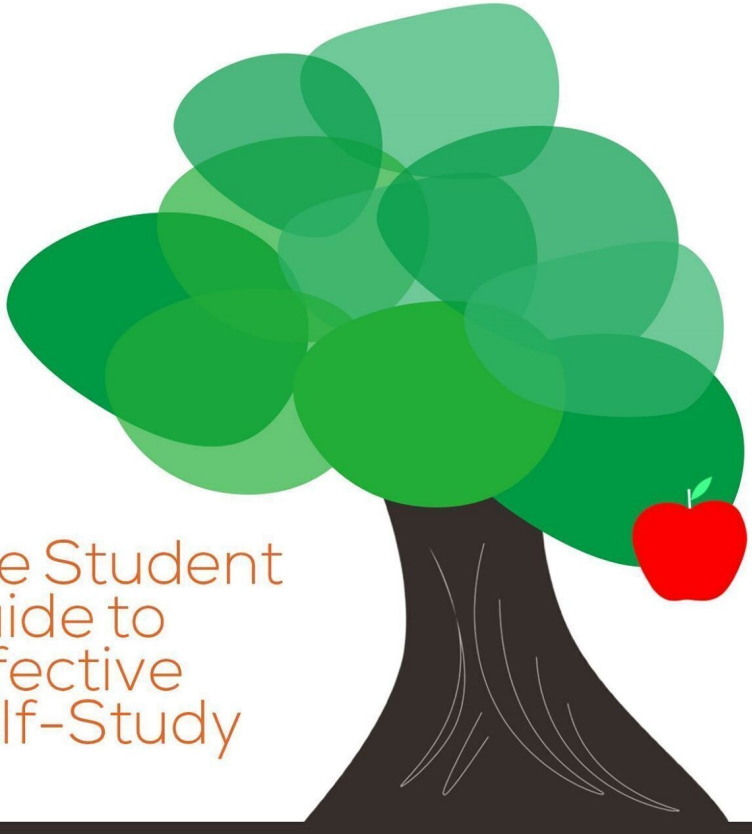
Learn Better At Home



The Student Guide to Effective Self-Study

Tejas Acharya, Tom Flatters, Peter Wallich, and Scarlett Whelan

Tejas Acharya, Tom Flatters, Peter Wallich, and Scarlett Whelan

Learn Better At Home

This book was professionally typeset on Reedsy
Find out more at reedsy.com

Contents

Preface

(Feel free to skip straight to the Introduction to jump right in.)

When schools closed as a result of the COVID-19 pandemic, we wanted to see how we could help. We ran some surveys for school students and discovered a key tension that came up again and again: lots of students were expected to self-study more than before, but didn't feel they had the tools to do that. In some cases, they were simply handed textbook extracts and expected to learn. Previously, the teacher had explained everything and helped them along. It can be tricky to adapt at the best of times, let alone during a pandemic.

We couldn't find a general guide to self-study that was targeted at students. We hope this book will be useful to anyone who reads it, but we've chosen to focus particularly on school students.

There's another key difference about this book: as current university students (at the time of writing), we've just been through secondary school, and we know what it's like to self-study. We have self-studied to pass exams, but also to gain a better understanding of the world.

We couldn't find anything available that's quite like what we're writing: a comprehensive, in-depth ebook on learning from home, whatever your learning aims - written by students. We hope that you find it helpful, and we welcome feedback.

The money we raise from this book will be donated to GiveDirectly[1]. GiveDirectly has been ranked by independent charity evaluator GiveWell as a top charity for social impact. At the time of writing, GiveDirectly has a particular focus on supporting some of those suffering most as a result of COVID-19.

We want this book to be available to anyone, whether or not they have money to give. But if you do have the means, it would mean a lot to us if you would give generously. If you would like to increase your donation after reading this book, you can make another donation at learnbetterathome.com. You could make a real impact.

Note to parents

Spending so much more time working at home has been a big change for many of us.

On top of managing your own working life, we recognise you want to support your children in the best way you can, which isn't always easy!

Hopefully, your child is reading this book because they've decided they want to hone their self-study skills. In that case, your job is halfway done.

Everyone has their own, positively unique way of self-motivating and managing their schedule. As young people who have spent lots of time engaging in a variety of study techniques, this is a fact we're very aware of. This book aims to provide some insights on how students can understand their own needs and work towards fulfilling them.

At times, your child might want you to be more actively involved in their learning, but our main aim is to encourage them to shape their own effective methods. The best things you can do are to trust in their capabilities and to support them on this journey!

This includes, to the best of your ability, providing a calm and supportive working environment. Whether your child is struggling to finish courses, learn without a teacher, or more generally engage with their learning in this new climate, they are likely to come up against some tough moments.

We suggest that you continue to bear in mind the difficult and idiosyncratic nature of this undertaking, and support your self-teaching student in any way that you can.

Note to readers outside the UK

Welcome! We're so excited that we can reach out to the whole world through an ebook. This book is designed for students in secondary school (11 or older), wherever you are in the world, but we hope it has something useful for learners of any age.

Here are a couple of pointers about terms we might use.

We'll use 'school' or 'secondary school' to refer to the school you go to from 11 to 18. In the US, this would be middle school or high school. We won't be using 'school' to mean 'university'.

Since we are most familiar with the UK's education system, we will sometimes use UK examples. These include 'GCSE' and 'A-level', which are the names of national exams taken at ages 15-16 and 17-18, respectively.

We think the mindsets, techniques, and tools here are general enough to be helpful to you wherever you are in the world and whatever you are studying. If anything we write is unclear, please contact us!

Disclaimer

What's written here is what we think is useful. This comes from our experience, conversations, and reading. We are not experts in psychology or neuroscience. Despite our efforts, it's quite possible that we've made some mistakes here. This book aims to be comprehensive, but won't be exhaustive. (If it were, it would also be exhausting to read!)

A lot of this book is based upon personal experiences and strategies that we have found effective. Treat it as a starting point. It's up to you - as the reader - to try things out in order to find what works best for you.

We regret to inform you that we cannot accept responsibility for disappointing exam results or thermonuclear war.

---

[1] Sometimes, we have to pay fees, for example to process payments. These fees will usually only account for a small proportion of your donation. If you buy the Kindle edition, we will receive a smaller amount in royalties than the total amount you pay. We reserve the right to raise money in the future for another promising charity instead. (That said, at the time of writing we have no intention of doing so.) Previously, we raised money for *The Life You Can Save*'s COVID-19 Fund.

Introduction

You're on your way towards learning one of life's most important skills: the ability to teach yourself effectively. This is an important skill whether or not you're in lockdown.

Learning doesn't need to end when you leave school or university, and you'll have more opportunities in life if you're open to continuously learning. But you won't always have a teacher to help you along.

Pretty much all the world's greatest minds have taught themselves something at some stage, and this book is the first step on your way to joining them - or, at the very least, passing your exams…

'Self-study' might sound boring, but it's actually one of the most useful skills you can learn. (Yes, really.) It can unlock opportunities and help you to understand the world better. But it's also a really difficult skill to learn.

We're sharing key tools, tips, and methods for success in learning at home. For example, you'll learn about the best ways to get started with work, how to deal with times when you don't feel motivated, and tools like the Feynman technique to help you learn effectively.

Whether you want to succeed in your exams or teach yourself a new subject, we've got you covered. (Not literally - this isn't an insurance policy, sorry!)

You can learn to self-study. We've all done it, and you can do it too! We have all self-studied at university - generally, at university you have to learn a lot more independently than at school. Aside from that:

- **Tejas** self-studied all his A-levels: Maths, Further Maths, Physics, and Computer Science. He also taught himself content for American AP exams and for fun!
- **Scarlett** taught herself a lot of her GCSEs, as well as much of her A-level courses in English Literature and Chemistry.
- **Tom** taught himself GCSE Further and Additional Mathematics, as well as some A-level topics. He's also spent a lot of time taking online computer science courses.
- I (**Peter**) taught myself about 40% of A-level Further Maths, as well as some material from online courses.[2]

Reading this Book

"Learn Better At Home" can be read from cover to cover, but doesn't have to be. There's a lot of stuff we wanted to write about, and of course not all of it will be relevant to everybody. For example, you might not be studying mathematics. In that case, you might want to skip our chapter on maths. Or maybe you are satisfied with your working routine, so you skip the section about timetabling.

In fact, many of the chapters are closely related. Because of this, we've added 'Where Next?' links at the end of each chapter. These links recommend chapters you could look at next. By using these links, you can find loads of different pathways through this book! And you're more than welcome to find your own.

Let's repeat that: **You *don't* have to read this book in order!**

By all means, we recommend you dip in and out of this book as and when you need to. You can keep coming back to this book, and you'll probably learn new and different things from it each time you read it :)

Motivation, ***Mindset***, and ***Goals*** are three key concepts useful for getting you to *want* to learn. If you want practical tips for getting started with studying, we recommend checking out ***Part II: Getting Down to Work***.

Or if you're keen to understand the five stages of effective study, you can jump to our ***general guidance*** on this topic. We also have some specific advice for ***maths***, ***English literature***, and ***chemistry***.

Where Next?

- ***Chapter 1: Why Are You Reading This Book?***
- ***Chapter 4: Goals***
- ***Chapter 9: Effective Study***

---

[2] You can find out more about us here.

I

Motivation, Mindset, and Goals

1

Why Are You Reading This Book?

You're reading this book for a reason. Why?

Maybe your school has shut down[3]. Your teachers have sent you a load of work - pages to read, problems to solve - and just expected you to absorb it all. This could go on for months. Without the same level of support from your teachers, you're struggling to understand everything. Without the same rigid daily schedule, you're struggling to keep plugging away at it without getting distracted.

This book will help you with these things. But they're not the reason **why** you're reading it.

After all, you're not alone in these struggles. But most students in your situation probably won't be reading this. Maybe some of them have heard about it, but they still aren't reading it. Why? What's the missing ingredient?

Maybe, just maybe, it's this: **motivation**. There's something you want to get out of this book, and a crucial first stage is to figure out what that is.

We assume you want to learn to study better - but that's probably not what brought you here. You probably didn't just wake up one morning and think, 'You know, I'd love to be able to self-study effectively.' Chances are, there's something more specific that is motivating you.

Maybe you're taking exams next year and you want to succeed in them. Maybe you want to improve your chances of getting into university by having a string of good grades. Or maybe you've realised there's a new topic you want to explore - you're not in it for the exam score, but for the satisfaction that comes with really understanding something new that changes your perspective.

Whatever your motivation is, you're doing something special. You're going beyond and pushing yourself to get better. You want more. Keep wanting more. We hope this book helps you reach your goals. We know you can do it.

Your goals can change, too. And that's fine. Knowing how to self-study can help you in all sorts of situations. For example, you might learn to self-study now because you want to get good grades in your exams. That would also help you if you go to university, where you'll find you have to do more independent study to understand the material.

Learning to self-study effectively will also save you time. Your time is valuable and limited, so why waste it studying ineffectively? Don't be scared to take your time - don't worry if you seem to be taking longer than someone else to understand a concept, for example. When you're self-teaching, you have much more flexibility than in a classroom: you can take longer over things you find more difficult or more interesting. But it's also possible to waste a lot of time if you're not careful. The tips in this book should help you avoid that.

Another thing: We're not here to judge. We're not interested in telling you that the source of your motivation is **wrong** or that you should be motivated by something else. If your main goal right now is to get good exam grades, then that's fine - as long as it gets you moving!

Instead, we're here to help you achieve what you want to achieve. And asking **why** you're reading this is a key first step towards doing that.

I (Peter) love maths: it's full of beauty and surprises. But that wasn't my main motivation when I was working towards my mock exam in Further Maths, an A-level I'd decided to start studying months later than usual. Instead, I just wanted to get the best mark I could and show my school and my parents that I could do it. But that didn't matter. What mattered was that my motivation got me moving.

I would recommend exploring your subjects and finding something in each of them to enjoy (even maths - check out our

Bonus Chapter on this). It's worth it in itself, and also means you're more likely to succeed in the exam. But you don't need to feel ashamed if your current focus is on being prepared for exams.

More than that: it helps to know what is motivating you, because you can use that information to improve your study process.

Let's get a bit more detailed. But first, a *Quick Task*. You'll see ***Quick Tasks*** throughout this book. We're not forcing you to do anything, but we think you'll learn much more and make faster progress if you actively pause to complete these.

Quick Task #1

> *What is your main motivation for reading this book? Think about it for a minute, and then write down your answer. Try to sum it up using as few words as possible.*

Summary

You're reading this book because you're motivated by something.

- *Figure out what that thing is. We're not here to judge you based on what's motivating you.*

Where Next?

- ***Chapter 2: Dealing with Motivation***
- ***Chapter 4: Goals***
- ***Bonus Chapter: Discovering Your Subjects***

[3] If you're reading this in a post-COVID world, then you might think that not having to go to school would be a lot of fun. Turns out it can be very tough. But we know you'll have your own struggles too.

2

Dealing with Motivation

Motivation is a tricky one.

It tends to fluctuate wildly. Sometimes, you'll feel super-motivated. Other times, you just won't.

Imagine that you want to eat less sugar. You've heard that refined sugar is wrecking your health, so you decide to cut it out of your diet. You get started and are excited about escaping that addictive junk. At that time, you're motivated enough to make big adjustments: buy new types of food, make different meals, and resist the temptation for sweet treats. But then, later, you're tired, annoyed at your parents, and just can't be bothered. Then, those tempting chocolate biscuits just seem too difficult to resist… You just don't have the same motivation at that time.

We've all felt demotivated at times. And it seems impossible to completely eliminate those moments of flatness. But there are ways to make things easier. Let's talk about three: self-recognition, behaviour hacking, and core motivation strengthening.

Self-recognition

'Know yourself.'

It's a maxim (important principle) that's endured for thousands of years. There are so many reasons why it's important to understand yourself. One reason is this: If you recognise your behaviours, you can accept them and improve them.

Let's say you've caved and spent all afternoon watching Netflix instead of doing your homework. Lots of people might stop there, either half-heartedly hoping it won't happen again or getting frustrated at themselves.

But you're not going to be one of these people. You can do better.

How? By thinking about it just a little bit more.

Why did you watch Netflix? Maybe you were studying in front of the TV, staring at a textbook you didn't understand about a subject you weren't interested in. You've just recognised what was going on in this situation. And that's so important.

'Why am I so demotivated?' some people might ask after their Netflix binge. 'Why am I so bad at studying?' their inner voice might continue. And so the negative self-talk goes on. When people feel rubbish about themselves, they're unlikely to work productively. So the next day, they might just do the same: 5 more episodes in and they're feeling even worse.

You might feel frustrated, too. That's actually a good sign: it shows you care about your work. But you're not going to blame yourself in the same way. Why?

Having thought about it, you know some of the reasons you had that first Netflix binge. Is 'having tried to work in front of the TV' so bad? Is 'not being ecstatic to learn the difference between sedimentary and metamorphic rocks' really a personality flaw? Obviously not.

Really, it's factors like these that caused your Netflix binge, and it's the Netflix binge that made you frustrated at yourself. So maybe it's worth adopting a new perspective: your frustration isn't a *fundamental part of you* - it's an emotion you might happen to feel right now.

Imagine you feel scared. In English, you might say: 'I am scared.' But in Spanish, you'd probably say, 'Tengo miedo.' (Literally, 'I have fear.'). There's more than one way to think about your emotions.

If you see emotions as transient, coming and going like waves on the sea, you're more likely to be able to deal with them effectively than if you view them as a fixed part of your identity.

Instead of asking 'Why *am I* this way?', reframe the question as, 'Why do *I have* this feeling right now?' Chances are, you'll be less likely to blame yourself and fall into negative emotional spirals. As a result, you're likely to be more productive.

This is important, because it can help you deal with emotions better. Instead of hating yourself, you can take the opportunity to see if you can find somewhere else to work - and some way to get really excited about rocks!

Behaviour hacking

This leads neatly into the second way you can make things easier for yourself: behaviour hacking. Here, we'll use the term 'behaviour hacking' to refer to anything you can do that changes your behaviour without targeting your *overall* motivation.

For example, you could improve your environment[4] by putting your textbook and stationery somewhere far away from your TV. Then, to watch TV while you studied (something we definitely don't recommend), you'd have to bring all your stuff somewhere else. Nothing about your motivation to study has really changed here, but it's quite possible you'll be less likely to fall into the Netflix binge trap. This is a behaviour hack.

Another type of hack involves something called a 'commitment device'. We've already talked about how motivation fluctuates a lot. Say you're feeling super motivated at 5 p.m., but you think that by 6 p.m. you'll be getting bored. You message your friend and arrange a call at 6:30 p.m. to talk through the exercises you have to do tonight. Now it's 6, and you want to watch Netflix. But you've committed to your friend and don't want to let them down. Right now, you're much more motivated than you would have been if you hadn't arranged that call, even though your overall levels of motivation about your work haven't really changed.

Core motivation strengthening

Your motivation is at different levels at different times. Aside from making yourself more motivated at some specific time, you might want to think about ways to make yourself more motivated *in general*.[5] For now, we'll call this type of general motivation 'core motivation'.

How do you strengthen your core motivation? Here are three steps to get started.

Firstly, *understand it.* Get it clear. That's why we asked you earlier to write down your main motivation for reading this book. It's worth taking some time to really think about what motivates you. Why are you doing what you are doing?

Often, *goals* are sources of motivation. We'll talk more about goals later, but here's one example: 'I want to get three ... grades at A-level.' (You can fill in the blank with the grades you want.)

We already mentioned that universities rely on exam grades. Often, companies will screen job applicants by their exam grades too. You probably don't want to be screened out. (It doesn't matter whether this technique is fair - it's what lots of companies do, and you want to get that job!) Unlike most students, who will settle for lower grades than they're capable of achieving, you're willing to put in the hours to achieve top results.

Secondly, *feel it.* Let it sink in. A key way to do this is through visualisation. This might sound wishy-washy, but there's some

evidence (scientific[6], as well as anecdotal) to suggest you're more likely to achieve goals when you visualise them. Imagine picking up your exam results and seeing your hard work pay off. Close your eyes and imagine submitting your university or job application, free from worrying whether your grades are good enough. Imagine being freer financially, and freer in general to do what you want.[7] Enjoy that feeling.

Thirdly, *remember it*. Feel free to experiment and figure out what works to help *you* remember your goals. Some people find that it helps them to write down their goals or feelings, which can also help you in the first step: getting your core motivation clear.

For example, I have a friend (we'll call him 'Joe') who flunked his A-level exams. 'Results day' was horrible for him. He sat down at home, angry. Most people might stop there and write themselves off as a failure. That's not only wrong, but actively harmful. But my friend knew he could do better. So he wrote a letter to himself: he was feeling terrible and promised himself that he would do better when he retook his exams the next year.

He told me that he looked at that letter whenever he felt demotivated that year. Couldn't be bothered to do that homework assignment? He looked at that letter. Revision taking too long? The letter was there. Yet another past paper? The letter was staring him in the face.

And now he's studying at a top university. His hard work and determination paid off.

Quick Task #2

Pick something that motivates you. Go through the three-step process to strengthen that motivation:

- *Understand it.*
- *Feel it.*
- *Remember it.*

Summary

Your motivation changes across time. That's normal, but there are things you can do to make your life easier:

- ***Self-recognition**: Recognise what's causing you to feel demotivated or down. View your emotions as* things you have in the moment*, not* what you are.
- ***Behaviour hacks**: Find simple ways to do what you want to do, even when you don't feel like it.*
- ***Core motivation strengthening**: Improve your overall motivation. For each goal,* ***understand it, feel it,*** *and* ***remember it****.*

Where Next?

- ***Chapter 3: Mindset***
- ***Chapter 5: When Things Go Wrong***
- ***Chapter 7: Tips for Getting Started***

---

[4] For information about using behaviour hacking to build habits, check out ***Chapter 8: Habits and Environment***.

[5] The concept of motivation *in general* is a bit vague, but it's good enough for what we're going to talk about.

[6] Cheema, Amar, and Rajesh Bagchi. 2011. "The Effect Of Goal Visualization On Goal Pursuit: Implications For Consumers And Managers". *Journal Of Marketing* 75 (2): 109-123. doi:10.1509/jmkg.75.2.109.

[7] Yes, of course it's possible to do very well despite bad grades. But usually it's much easier to have the career you want if you can get good grades.

3

Mindset

'Whether you think you can, or you think you can't - you're right.' (Henry Ford)

This sounds cliché. But it's full of truth.

Your mindset is your attitude towards things. It is what you think you can and cannot do, as Henry Ford said.

Often, people feel that they are stupid. This is usually false. In fact, people who are *more* competent than average often underestimate their ability. On the other hand, people who are less competent often overestimate their ability - they lack the competence necessary to realise that they are less competent. This is such a famous result that it has a name. It's called the Dunning-Kruger Effect.[8]

The takeaway here is that, if you feel stupid, it really doesn't mean you actually *are* stupid. Often it's the most intelligent people who

feel stupid most often, since they have a particularly strong ability to realise what they don't know or understand.

Another common attitude is to feel like you're a fraud who doesn't belong or that you have 'faked' your accomplishments. In fact, it's so common it's been given a name: Impostor Syndrome. It's worth recognising that this is very common[9] and that there are resources available to help you deal with it.

In general, you might think in one of two ways - coined the 'fixed' and 'growth' mindsets by psychologist Carol Dweck in her book 'Mindset'[10]. You may have seen these terms at school on walls and displays, but have you ever considered what they really mean?

One of the easiest ways to understand the difference between these two mindsets is by contrasting two people - 'Fixed Phil' (who has a fixed mindset) and 'Growth Greg' (who has a growth mindset).

Phil and Greg both go to school together, and are in the same class. During one lesson, the teacher asks a question. Phil is quick to shy away and avoid answering, while Greg is happy to put himself out there and answer the question. Greg likes challenges, while Phil avoids them.

Later, the teacher gives Greg and Phil their test scores from last week. Fixed Phil doesn't bother checking his mistakes, but Greg focusses mostly on his mistakes. Greg is more than happy to take the constructive criticism onboard because he believes that this

will help him in the future. Phil thinks that if he can't understand a topic now, he never will.

That evening, Phil and Greg are doing their homework. Phil puts in the least effort possible, because he believes that effort is wasted. In contrast, Greg pushes himself to do the extension questions and spends an extra five minutes to check his work. Greg knows that his effort will pay off in the future. He believes that he can improve his skills because his ability isn't fixed.

As a result, Greg is more likely to reach his full potential than Phil. More 'Gregs' will achieve great things than 'Phils'. And by my observations, Gregs seems to be happier learners, as well.

Are you a Phil or a Greg[11]?

If you're still not sure whether the fixed or growth mindset is better, ask yourself: Did Roger Bannister believe he could run a sub-4 minute mile? Did the scientists working at NASA believe they could put a man on the moon? And did Martin Luther King have a dream he believed in?

You bet they believed. They all struggled. They were criticised, struck back, and more. But they all learned, believed that their effort was not in vain, and achieved amazing things.

Remember Joe? He had a growth mindset too. Everyone expected him to perform well in his exams, and he failed to do that. But he didn't give up, because he didn't think his ability was permanently

fixed. And that's why he could achieve the results he did a year later.

Be like Greg and Joe, and you too can do amazing things! It starts with your mindset. When you have a growth mindset, you understand that your abilities can grow with your hard work and effort[12,13].

Establishing a growth mindset takes time, and effort. After all, it's difficult to reshape the way you see the world. But here are a couple of ideas to get you started.

Ask for feedback about some work you have done, or about anything else. Listen to the feedback, and try to take on board some of the suggestions that are made. If they are helpful - great. If not - maybe it wasn't the best advice, or maybe you just need a little more practice.

How do you know if feedback is helpful? The truth is that it's difficult to know, but a good rule of thumb is that you should start by assuming that feedback from people who want to help you and have some relevant experience will be useful. You might later decide that it isn't. But it's easy to dismiss feedback, particularly when it's honest (and perhaps a little painful). So it may help to have a bias towards accepting this sort of feedback.

Another of avoiding the temptation to ignore criticism is to integrate the feedback into your goals. To do this, it can help to note down and keep track of any constructive criticism you receive.

For whatever you're learning now, choose a topic, theme, or concept that is above your realm of understanding. Find a question in that realm, and try to answer it. You won't get it straight away - but that's great. You learn from failure. Examples might be a difficult mathematical problem or a question about a poem that you don't understand.

Quick Task #3

Do something you find hard for 10 minutes - whether it's maths, reading a book, practising the trombone or doing handstands. It doesn't matter what it is. It only matters that you struggle and you learn - because in your growth mindset you like a challenge, after all.

Summary

What you achieve depends on your mindset.

- ***Fixed mindset**: the view that your ability is permanently fixed; failure shows you're just not good enough, and trying is usually a waste of time. **Avoid this mindset.***
- ***Growth mindset:** the view that your ability can grow with practice; failure is a way to learn and improve, and your effort is an investment in your future self. **Aim for this mindset.***

Where Next?

- ***Chapter 4: Goals***
- ***Chapter 6: Routine and Planning***

- ***Chapter 7: Tips for Getting Started***

---

[8] Kruger, Justin and David Dunning 1999. "Unskilled and Unaware of It: How Difficulties in Recognizing One's Own Incompetence Lead to Inflated Self-Assessments". Journal of Personality and Social Psychology. 77 (6): 1121–1134. CiteSeerX 10.1.1.64.2655. doi:10.1037/0022-3514.77.6.1121.

[9] An estimated 70% of people have felt like impostors at some point. Matthews, G., & Clance, P. (1985). Treatment of the impostor phenomenon in psychotherapy clients. Cited in Gravois, J. (2007). You're not fooling anyone. The Chronicle of Higher Education,54(11)

[10] Dweck, Carol S. 2015. *Mindset.* Clitheroe, United Kingdom: Joosr.

[11] Here's the fun part: If you're a Greg, you believe you can choose! It's a self-fulfilling prophecy.

[12] Dweck, Carol. 2014. *Developing A Growth Mindset With Carol Dweck*. Accessed 20 May 2020. Video. https://www.youtube.com/watch?v=hiiEeMN7vbQ.

[13] Sometimes people think that the growth mindset theory implies that anyone can do *literally anything*. This is false, and Dweck's theory never makes such a claim. Instead, the central concept is that greater achievements can be reached when one cultivates a growth mindset.

4

Goals

Let's talk more about *goals*. Goals can come in lots of different shapes and sizes, but some are well-designed and others aren't.

Why set goals in the first place?

Imagine you go for a walk, but don't decide where you want to go. You keep walking, in any direction you feel like, and eventually find yourself in the middle of nowhere. This isn't very surprising. You never had a destination in mind, or even a direction of travel. That wouldn't be a problem if you just wanted to go for a stroll. But if you had some other motivation for walking, like trying to hike from A to B, you'd probably be a bit disappointed with this outcome.

A meta-analysis - that's a study of scientific studies - found:

> Across 384 tests … goal setting had statistically significant effects on behavior[14]

That means that people achieved things more often when they set goals than when they didn't - and that this effect was strong enough that it's very unlikely it was down to chance.

'But I know that! I already have goals!' You probably didn't need a meta-analysis to make you believe that goal-setting helps people achieve things. It seems quite obvious. What is perhaps less obvious is how to set goals in the best way for you.

Why 'goal' talk can be annoying and confusing

When I (Peter) was in secondary school, I kept being asked to write down goals. I think we had to do it at least once a year. This was well-intentioned. Our teachers wanted us to achieve big things, and thought that writing down goals would help. But I can't confidently remember even *one* of those goals now. What went wrong?

For one, we were asked to write down goals at a specific time, whether we felt like it or not. A useful behaviour hack would be to write down goals when you actually feel motivated. It's like deciding what you want to eat when you're not hungry - it's difficult to really care at that time.

If you're not feeling motivated when you write down your goals, it's probably going to be a half-hearted exercise - you just fill out some worksheet called 'My Personal Goals' and forget all about what you wrote within an hour.

I think another issue was that I didn't understand what goals really were. And, honestly, I don't blame myself much for that. The word 'goal' is super broad and we often hear conflicting messages about how you should set goals.

On the one hand, there's the classic 'SMART' goal system, which says that the best goals are Specific, Measurable, Achievable, Relevant, and Time-Bound[15]. On the other hand, you might have heard of other goal systems like 'BHAGs': 'Big, Hairy, Audacious Goals'[16]. But 'hairy' and 'audacious' don't easily sit together with 'specific' and 'achievable'. 'Specific' and 'achievable' encourage you to think small and detailed, but 'hairy' and 'audacious' cry out for BIG thinking. There's an obvious tension here.

Simplifying things: the Spectrum of Goals

So do you 'dream BIG' or 'start small'? Trick question. The answer is to **do both**.

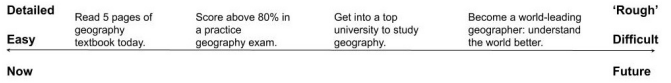
Goals have different purposes. Small goals and huge goals can both be effective, and they're most effective when used together. But there are a huge amount of different goals you *could* set. Besides some general idea of what you want, how do you design the *best* goals?

The key is to recognise that useful goals lie on a spectrum. There are three main aspects of a goal to think about: detail, difficulty, and time. When these fit together, you probably have a well-designed goal. When they don't, maybe it's time to rethink a little.

On the one side, there are small steps: detailed, easy goals to reach right now. On the other side, there are big dreams: rough outlines of difficult-to-achieve goals for the future.[17]

The further in the future the goal is, the more it makes sense for it to be general and difficult: you have time to clarify exactly what you want, then achieve it. Small steps, on the other hand, should be specific and easy enough to do.

Say you're studying Geography. Here's what that spectrum might look like. A good goal for today might be to read 5 pages of your textbook. It's hard to go wrong, and you'll know when you've achieved it; that's because it's fairly *easy* and it's very *specific*.



(The Spectrum of Goals)

But another good goal might be this: 'Become a world-leading geographer: understand the world better.' Obviously, this is *much* more difficult than reading a few pages of your textbook. It's also much less detailed: I know exactly what it means to read 5 pages of a geography textbook, and I know how to do it, but I couldn't say the same about becoming a world-leading geographer. But this vagueness is not a problem here, because it's far enough into the future that being specific would probably not be very helpful.

In between these two extremes are many more good goals. It's certainly harder to score above 80% in a practice exam than it is to read a few pages of your textbook. It's also less detailed than the

textbook-reading goal: an exam score target doesn't specify a particular exam paper, and it gives you less information on how to go about getting that high score. There are many more ways to score above 80% in an exam than there are to read 5 pages of a textbook.

Similarly, the goal to 'get into a top university to study geography' is a bit less detailed and more difficult to achieve. What exactly is a 'top' university? You might not have decided exactly, but that's fine if you're years away from university.

Both of these examples are easier and more detailed than the long-term goal of becoming a world-leading geographer. And that makes sense, because your long-term goal is far further into the future.

Quick Task #4

If you're feeling more motivated than usual (your motivation is spiking), come up with three goals. Draw out the Spectrum of Goals, like in our geography example, and place them in the position where you think they sit on the spectrum.

For each goal, go through the 3-step process to strengthen your core motivation:

- ***Understand** it.*
- ***Feel** it.*
- ***Remember** it.*[18]

If you're feeling less motivated than usual right now, that's OK. Come back to this task another time.

Summary

Setting goals makes you more likely to achieve them.

- *Find a time when your motivation is high to design some goals.*
- *Goals lie on a spectrum. Well-designed goals tend to involve a snug fit between detail, difficulty, and time:*
- *Small steps (short-term goals) should be easy and specific.*
- *Big dreams (long-term goals) should be difficult and 'rough'.*

Where Next?

- ***Chapter 2: Dealing with Motivation***
- ***Chapter 5: When Things Go Wrong***
- ***Chapter 7: Tips for Getting Started***

---

[14] Epton, Tracy, Sinead Currie, and Christopher J. Armitage. 2017. "Unique Effects Of Setting Goals On Behavior Change: Systematic Review And Meta-Analysis.". *Journal Of Consulting And Clinical Psychology* 85 (12): 1182-1198. doi:10.1037/ccp0000260. p.1187.

[15] Doran, G. T. (1981). There's a S.M.A.R.T. Way to Write Management's Goals and Objectives. Management Review, 70; updated in places like Frey, Bruno S.; Osterloh, Margit (2002). Successful Management by Motivation : Balancing Intrinsic and Extrinsic Incentives. Springer. p. 234.

[16] Collins, James C. 1958- and Jerry I. Porras, Built to Last: Successful Habits of Visionary Companies. New York: HarperBusiness Essentials, 2002.

[17] There are also goals, like 'be a kinder person', which can never be (completely) reached but are always aimed for, although we won't be focussing specifically on this kind of goal here.

[18] This task might look familiar if you've read Chapter 2, but it's subtly different: Here, we're doubling down on goals and talking about how to

motivate yourself specifically to pursue those goals.

5

When Things Go Wrong

However much you get out of our tips and tricks, one thing will remain true: This isn't going to be easy. In any area of life, things can go wrong even when you take all the right steps. (Try walking up a 'down' escalator!) Studying is no exception.

It might be a small hiccup: Maybe you sleep through your alarm or spend a few days completely unmotivated. Or it could be something pretty big, but at some point you're going to be stopped in your tracks. Things go wrong, so we have to figure out how to get back up again.

Personal story

You might say that I (Scarlett) haven't always had the best luck (or am just generally clumsy!). Some of this might be due to my own choices, some to simple misfortune. When things have gone wrong because of your own choices, you might be able to identify behaviours to avoid repeating. Otherwise, there's no real difference. What matters is how you get back up.

My own A-Levels were a bit of a state. When I was 11, I was diagnosed with Type 1 Diabetes. This caused all sorts of lifelong difficulties for managing exams and heavy workloads. I have also struggled with serious mental health problems. This makes self motivation a very particular issue of mine.

My school often struggled to hold onto teachers, so I ended up teaching myself a large portion of each A-Level and supporting myself through entire GCSE courses. This became particularly problematic when I very seriously broke a leg (not such good luck). I couldn't walk for 4 months: over the end of my courses, the whole revision period, and then A-Level exams.

It has been difficult to manage severe pain, both mental and physical, across times in my life when it has felt important for me to succeed. There have been many moments where I felt completely hopeless.

Despite this, I have managed to achieve many of my goals and successfully self-teach. Most importantly, I have learnt how to not blame myself when things go wrong and to accept that there might be days when it's impossible to make progress.

Getting back to work

Here are our top tips for getting back to work. We recommend reviewing these tips when you're wondering how to get going again.

Do something, as soon as possible. Get back on track as soon as you can. A very important part of working towards a goal is establishing a habit[19]. If a setback knocks you out of this routine, try and get back to it quickly! The more 'bad days' you've had in a row, the more likely it is that tomorrow will be a bad day.

Accept your limitations. Although it's important to get back to work quickly, it's key to know your limitations. But, particularly with large setbacks, it's worth pacing yourself! Getting back on track with a goal can be tricky. So learn to listen to yourself. Pushing your boundaries can be great, but it's also important to practise self-care and accept when it's all a little too much.

Take one step at a time. Combining these two points, try and make a small amount of progress every day. Progress might just involve doing something which is going to make tomorrow a little easier, like getting up earlier or making a short list of specific things you want to achieve. Every day, try to identify something which you could do to contribute to your goals. Even if your short term goal is just to get back on track with your longer term ones, that's great. Keep it up.

(A wise polar bear. Photo credit: Dan Bolton on unsplash.com.)

Be prepared to re-evaluate. Things going wrong can sometimes be related to the way you've been working towards your aims. Perhaps you've been sacrificing sleep for that little bit extra work you can cram into the early hours. Maybe you were overambitious with your planning or with the goal itself. Or maybe it's something else. But you're now in a position where you might need to re-evaluate.

Being flexible is of great value. We try to minimise the impact that large (or small) problems have on our long term plans, but this isn't always possible. Take another look at your plan. What are you working towards and how can you get there? What can you do to reduce the chance that you will stop working effectively again?

Stay positive. This is much easier said than done, but is probably the most important element of recovering from a setback. Take

each day, or even each hour, as it comes. Celebrate the small victories and be kind to yourself!

Quick Task #5

Look to the past and identify a time when things have gone wrong for you - a time when studying has been difficult. Try to answer these questions:

- *What was the cause of the setback?*
- *How did you deal with the situation well?*
- *How could you improve your response to this setback if it happened again?*

Summary

Even when you do everything right, things can still go wrong. So when things don't go to plan, it's important to try to get back on track. Here's 5 top tips to doing so:

- *Do something, as soon as possible.*
- *Accept your limitations.*
- *Take one step at a time.*
- *Be prepared to re-evaluate.*
- *Stay positive :)*

Where Next?

- ***Chapter 3: Mindset***
- ***Chapter 6: Routine and Planning***
- ***Chapter 7: Tips for Getting Started***

[19] See also ***Chapter 8: Habits and Environment***.

II

Getting Down to Work

6

Routine and Planning

Hopefully, you've managed to find what motivates you, and identified some goals. But now what? How do you put it all into practice?

Maybe you find yourself on a Youtube marathon, or playing a video game you don't really care about. Maybe you get to your desk, pick up your pen, and suddenly remember 101 things you absolutely must do before getting started. Or maybe you just find it hard to get stuff done.

Whatever you're struggling with, that's OK. Nobody is perfect, and we all have things to improve.

That said, a healthy routine - and the habits that make up that routine - can help you reach your goals.

That's why this section focuses on creating a routine that sticks by building habits, timetabling, and optimising your environment.

Make a plan

(A very satisfied bear. Photo credit: Mark Basarab on unsplash.com)

What is a schedule, and why should I have one?

When you hear 'schedule', you might think of school, and of a schedule of lessons that you must strictly adhere to during the school day, telling you which teacher will teach you in which room and at what time for how long: just a list of instructions. But here's a challenge for you: Take a moment to relax, and imagine a school with no schedule - what comes to mind?

A schedule brings order to chaos. (What is a school without *some* order, anyway?) There's a reason we use calendars, wear watches, and set alarms - because otherwise nothing would reliably get done. More than that, it puts you in control of your time and your future. Your schedule can help you reach your goals.

A schedule creates accountability - it keeps you on track. You feel good when you've done what you planned to do, and not so good when you haven't. A schedule gives you a clearer perspective - you can see how many hours there are left before that deadline, or how long you have planned to revise for that exam. Lastly, a schedule can reduce stress. If you're more organised, you have less to worry about. And if you've written everything down then you don't have to worry about forgetting anything.

Schedules come in all shapes and sizes: for example, I often just pick two or three things I wish to achieve on a certain day, and work on them when it feels right to do so. For me, that's enough. Alternatively, you may find it's better to designate certain time periods for different tasks - maybe starting with the easiest or hardest task works best. We'll investigate this further throughout the section.

Whether you write a schedule or not, you'll find you can't do everything you might want to do. But writing a schedule forces you to get clear on this, rather than fooling yourself into thinking that you can do whatever it is you want to do *right now* and everything will be OK. (It might be OK, but it won't be anywhere near as good as it could be - and you want better than 'just OK', right?)

A schedule is what puts you in control of your learning and your time, it helps you be more efficient, realistic, less stressed, and more organised.

How do I make a schedule?

Let's step through the creation of your new schedule together. We will start by listing out all the things we want to do and then we'll put them in our schedule.

Step 1: Make a list

First, grab a pen and paper and write a list of all the tasks you need, want, and could do. Write them all - maybe "make revision notes for present tense Spanish verbs" or "complete geography homework for Mrs Smith".

Try to be specific when you write these tasks. Make sure they have measurable outcomes. "Do better at revising" is too ambiguous and hard to act on, while "complete 5 past exam questions" is easy to act on and you'll know when you've done it. (Remember ***Chapter 4: Goals***?)

Now, order these items by priority - maybe '1' is the most important item that you have to do today, and '5' is the least important task. A task with priority 5 is one that you don't really care about and don't need to do.

If you've got deadlines, you need to consider those too, so write dates and times next to the relevant tasks.

Step 2: Take your pick

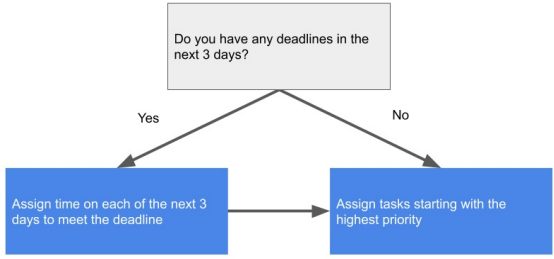
When it comes to your schedule, you need to decide if you'll use a spreadsheet, a piece of paper, a physical calendar, an electronic calendar, a phone app, or whatever else. Our advice is to stick with

the tools you're comfortable with *and* can use effectively. But that second part is key: if what you're currently using isn't working, then don't keep doing it! Try something new.

Personally, I (Tom) use Google Calendar and Google Sheets to track and schedule my work. I've also found that, for longer-term planning, a piece of paper on a notice board or the fridge works well.

Step 3: Assign tasks

Your first three days with a new schedule really matter.[20] So it's important you work effectively and get stuck into some important work. This is where the list comes in. Use the flowchart below to assign items to your first 3 scheduled days.



(Flow chart to show how you might assign tasks.)

However, it's important not to assign too many tasks to one day, as this will often make you feel demotivated and that you are behind. So be realistic. If you haven't learnt anything for the past 3 weeks then don't set yourself 8 hours of work tomorrow. The first

3 days of the schedule are as useful in building a good routine as they are in learning!

You might want to start planning more than 3 days in advance, and that's great. By all means, add any deadlines you know you have, or any tasks you have to do on a certain day. I'd even recommend having a **rough** idea of what you'll do on each day.

But things change.

Perhaps you make a detailed plan for the next 6 weeks. Now, let's say you don't get as much done as you thought you would on day 3. Then what happens on day 4? You should get caught up, right? Or should you do what you had planned on day 4?

Maybe on day 5 you're studying 'Rainforests'. But you realise you need to put more work in over the next few days for a test at the end of the week. What happens then?

We can't predict the future perfectly: There are just too many things that could change. That's why I'd suggest you plan 3 days in advance, and have only a rough idea of the next couple of weeks, as well as being aware of any deadlines. But, of course, feel free to figure out how much advance planning works for you by experimenting.

Step 4: Kaizen

Kaizen is a Japanese term. It refers to the concept of continuous improvement and refinement. That's very relevant here.

I would recommend reviewing your schedule, updating your list of tasks, and contemplating your progress in work *as you go*. This allows you to **refine** your schedule so you can stay on top of things. And so you can stay in control.

If things aren't working, then try to figure out why. Maybe you need to allocate more time to a topic or work at a different time of day.

It's difficult to know the plan two weeks in advance. But it's easy to spend 5 minutes a day figuring out what you should do.

How detailed should my schedule be?

We've already discussed how far in advance you should plan. But, for today, tomorrow, and the next day, how much detail should you put into your planning?

(Want the short answer? It's somewhere in the middle.)

Too much detail and you'll not only be spending too much time planning, but you'll also be confined to that schedule with little flexibility. You won't be able to spend more time on the hard things and skip over the easy ones.

Too little detail and you may find yourself without direction. That means you won't be sure what's best to work on. When I (Tom) forget to plan out my day, I often find myself putting off tasks

until the evening, then feeling stressed (and a little guilty) that I haven't done anything all day!

So you need to be somewhere in the middle.

Here's how I'd define the middle:

- Knowing what tasks you want to start, make progress on, and complete on a given day. But ***not*** knowing exactly how long you'll spend on each of those tasks.
- Having the flexibility to change a task halfway through the day. But ***not*** being so flexible that you don't learn anything all day.

Quick Task #6

Let's make a simple schedule:

1. *List all the things you want to get done today*
2. *Rank them by priority*
3. *Bonus: Guess how long each task will take. How close were your guesses?*

Summary

Planning starts with finding out what tasks you have to do. Once you have done that, you can create a schedule to make sure you complete them on time. When making a schedule, it's important:

- ***not to spend too long*** *planning your work*
- *to be* ***flexible*** *with how much time each task will take*

- *to plan in **less detail** the **further into the future** you're looking.*

Where Next?

- ***Chapter 3: Mindset***
- ***Chapter 7: Tips for Getting Started***
- ***Chapter 9: Effective Study***

---

[20] If you feel like they've gone really well, you're much more likely to feel optimistic about study in general and so do better after the first three days too.

7

Tips for Getting Started

I don't know about you, but I (Tom) can't remember how many times I've been way too ambitious with something new. I have often planned out far too much work per day, for the next 2 weeks including weekends, and proceeded to wonder why I never got everything done.

Can you see the problem?

I never built a habit around my schedule, and I was way too optimistic - I can't focus on learning new things for that long! That's why it's important to start small. If you just do a little every day for a week or two, you'll likely be surprised how much you've achieved.

When you're having 'one of those days' and you don't feel as motivated as you sometimes do, starting small can reduce the pressure you feel and make finishing your scheduled activities seem more achievable.

Often, procrastination seems to be rooted in fear: People procrastinate tasks because they worry that they are unable to complete them successfully, and procrastination lets them avoid having to tackle the task. You can avoid this pitfall by starting small - and you're more likely to be consistent when you're just getting started in a new routine.

But what does starting small look like in practice?

For me, it's promising myself I'll do 20 minutes of focussed work with no distractions. That's all. It always amazes me, however, when I check the time and find an hour has passed. Maybe it shouldn't surprise me so much - it is hard to get started.

But more than that: getting started is often **the hardest** part.

Here are some suggestions on how you should get started. These can be useful if you're trying to build a routine, but also if you just want to get the day off to a good start.

1. The Pomodoro technique

If you haven't heard of it, the Pomodoro technique was created in the 1980s and 1990s by Francesco Cirillo[21] to improve productivity.

The idea is simple: Split work into 25 minute segments, with short 5 minute breaks in between. Every couple of hours (after 4 repeats), take a longer break - normally 15 to 30 minutes. Typically, each segment is assigned a task, and you work on that

task for only that amount of time - even if you don't finish it. However, I'd recommend relaxing this 'rule' when studying and that you allow segments at the end of your study session to finish up incomplete tasks.

If you're wondering why there are so many short breaks, we're getting there! I'd recommend jumping ahead to the 'Take a break' section.

If you want to give the Pomodoro technique a go, there are plenty of apps and websites that can help. Here are a few (available at the time of writing):

- https://tomato-timer.com/ - simple and ready to use
- https://pomodoro-tracker.com/ - incorporates a simple to-do list with the timer
- 'Focus Keeper - Time Management' app for Apple devices
- 'Focus To-Do: Pomodoro Timer & To Do List' app for Android devices

2. Take 20 (minutes):

As I mentioned above - this is my 'go to' technique. I like it because it requires no planning except for the one task you're going to start with. Just remove distractions, pick a task, and set a timer.

I would recommend using an app like 'Forest: Stay focused'. You can start a timer which grows a virtual tree. But if you go out of the app when the timer is on, it kills the tree! If you make it to the end of the timer without using your phone/device, then that tree

is added to your forest. And if that's not enough, when you stay focused for long enough, you can plant a real tree to combat deforestation across the world.

3. Chunks

Instead of setting a timer, this method of getting started has three steps to follow:

- Divide tasks into small, achievable chunks.
- Start working on the first task.
- Take a break when you finish that task.

Chunks have the advantage of motivating you to finish each task (because you get a break! 😀) On the other hand, it could cause you to rush your work in an attempt to get finished more quickly. As a result, your work / learning quality could be lower.

Make sure to divide tasks appropriately (all tasks should take between 20 minutes and 1.5 hours) and be self-aware. If you're rushing to get through each chunk as quickly as possible, try a different strategy.

Remember that getting started can be the hardest part. If you can find a learning strategy that works for you, then well done: you're well on your way to learning more efficiently. If not, keep going - and find what works for you. If you're still struggling, you might also find ***Chapter 8: Habits and Environment*** useful.

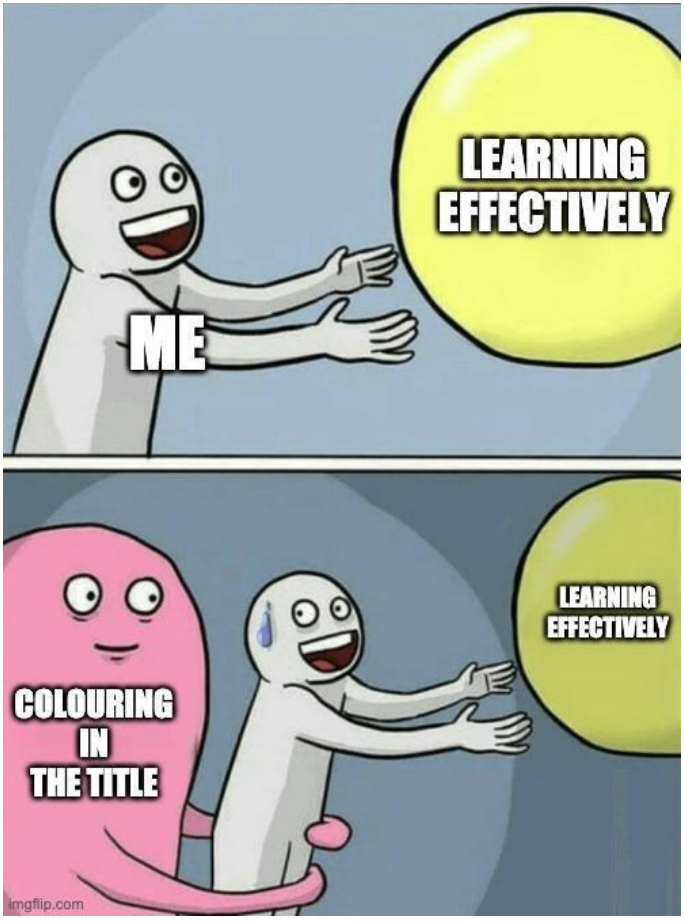
How long should I work for?

The title of this section is quite ambiguous (it can be interpreted in different ways), but it's like that on purpose. This is because it's important not only to consider how long you spend learning per day, but also how long you spend studying without a break.

First, we'll consider how long you should study / learn for each day. To do so, we must be clear with what we mean by studying / learning.

Here's what it isn't:

- Sitting at your desk / place of work with a textbook open.
- Watching an educational YouTube video while texting your friends.
- Spending 15 minutes colouring in a beautiful title for your revision notes.



(With permission from SuperElmer, the original designer of this great meme.)

And here's what it is:

- Thinking deeply about the material you're learning in a distraction-free environment.
- Trying to explain something that you don't understand

very well in simple terms with some quiet instrumental music in the background.

- Reading a section of a book, then bullet-pointing key points from that section.

I find that if I'm studying/learning in this way, it's difficult to focus all day. You can learn a lot in a 'thinking day'[22], but it's also hard work.

Learning is difficult. Learning strains your mind. It can be intense, frustrating, and even infuriating. You can only learn so much per day.

To make things easier, be purposeful. Don't sit at your desk if you don't intend to study. Rather, take a moment to compose yourself, and get to work. Otherwise, you'll spend a lot longer than the time you're learning for every day sitting in the same chair - and that can be uncomfortable.

Also, you need some rest. Take a day or half a day off per week to do whatever else you want - anything that isn't studying. Your body needs time to recover, and you may find that a longer break helps you retain motivation in the longer term.

Folk wisdom suggests 6 hours per day is about the most revision that most people can do *consistently*, day after day. This seems about right. But don't worry if you don't get 6 hours done. Even an hour or so per day can make a real difference. Consistency is key - small changes really add up over time.

But how long should you work without a break?

The Pomodoro technique, as outlined in the last section, suggests you study for 25 minutes and then take a 5-minute break. I've also found that 45-50 minutes followed by a 10 minute break works well. Overall, I avoid studying for over an hour without a short break.

A short break may just involve going to the toilet, grabbing a drink, or standing up and walking around the room. A key tip is to separate short breaks from longer 'reboots'. To avoid making your 2-minute break a 2-hour one (easily done!) make sure your short breaks *aren't too much fun*[23].

What does that mean? It means doing things like going to the toilet, getting a drink of water, or meditating for a couple of minutes - ***not*** checking your phone!

And if you feel like you just need to go outside and take a timeout - do it. The human body is quite good at telling you what it wants, so see if you can notice when you have lost focus, become unsettled, or feel tired. And take a break.

Be accountable

If you want to be in control of your learning, then you must become accountable for your actions. That means you have to be disciplined with yourself, complete tasks on time, and be realistic with what you plan to achieve.

Making and maintaining a schedule is the first way in which you become accountable.

But there's more - to be accountable, you must be aware of your progress. You should look back on what's been working and what hasn't, especially in terms of:

- How long you've been working for,
- How long your breaks have been,
- What strategies you've used to learn (e.g. Pomodoro technique),
- How effective your scheduling has been, and
- How efficient your work is at different times of day.

Ask yourself questions like: "why haven't I completed my work today?", "why did I only start work at 5pm?", and "I spent 2 hours on that topic, but what did I achieve? What worked and what didn't?"

Be prepared to accept that not every learning strategy or study session will go to plan. More importantly, be prepared to acknowledge why that was the case. Once you've done that, figure out how you can take steps to improve things.

A lot of the time, the issue may be a sub-optimal working environment, sleep schedule, or planning that could be improved. It may be a combination of these factors. I'd encourage you to look back at this section when you're next struggling with learning effectively. Maybe, you'll find a simple solution. Hopefully, a few small changes will allow everything to fall into place.

Quick Task #7

Choose one of the 3 methods of getting started (Pomodoro, Take 20, or Chunks):

- *Give it a go!* :)

Bonus: Repeat this quick task for the other two methods! Which was your favourite?

Summary

Getting started can be one of the hardest parts of studying. As well as using strategies to get started (e.g. Pomodoro, Take 20, or Chunks) you should remember to:

- *make sure you're studying smart -* ***be focussed***
- *take* ***short, regular breaks*** *with* ***fewer, longer breaks*** *to split up study*

Where Next?

- ***Chapter 2: Dealing with Motivation***
- ***Chapter 8: Habits and Environment***
- ***Chapter 9: Effective Study***

---

[21] Find his website here: francescocirillo.com. He's also written a book called 'The Pomodoro Technique'.

[22] A 'thinking day' is like a 'working day', but for (careful) thinking. Thinking hard is difficult, so you should expect a thinking day to be shorter than a typical working day.

[23] A common mistake is to convince yourself that you'll start at precisely 10 minutes past the hour (for instance) and waste time waiting when you miss that time.

8

Habits and Environment

Build Habits

You may have heard of people say they're "getting into a routine" before. But really, what do they mean? They probably mean that they want to build a habit, whether it be getting up every day at 8:30 a.m. to walk the dog or going for a run in the mid-afternoon.

A habit is just an action that you repeat frequently. Habits are often hard to break, but not always.

It should be quite obvious that making learning a habit is of great benefit if you want to learn. After all, learning is easier if you're used to it.

But how can you build a habit? Well, it's not always easy, and can sometimes take a long time. If you want to make keeping a diary a habit, you need to keep a diary regularly and consistently. But you don't need to write an essay in your diary every evening. More important is that you write *something*.

Small habits can drive very large changes, because the small changes they produce grow over time. They build on each other.[24] That's why in the 'Getting Started' section we suggested 'start small'.

Your study space

This section focuses firstly on how you can improve your environment in order to make building good habits easier. Next, it looks at how building healthy habits can influence your learning.

(*Apps for Good, Google London Office*[25])

Why do companies like Google, Amazon, and Facebook spend so much money trying to make their working environments as productive as possible? It's because your environment is important - it really can affect how well you work.

Your study space is wherever you study. Maybe it's in the kitchen, your bedroom, or elsewhere.

Is your current study space the most effective space for you to learn in? Is there somewhere that you feel you can focus more?

If so, it's time for change. And if that means you have to move from the sofa/bed to your desk, then - I'm afraid - that's what you have to do!

Even if things are going quite well, it can be very useful to switch around your study space if you can. This might involve working in a different room, working outside, or (if you're not on lockdown) heading to a local library.

Next: Be clean and organised. Try not to pile up cups and plates on your desk. Try clearing your workspace each evening or morning. Recycle or throw away what you don't need and minimise the clutter. Less stuff means fewer distractions, after all.

If you're not organised, you can't find things and you waste time. If your workspace is cluttered, then you won't be able to focus on what you're trying to learn.

Try to find a quiet place, or the quietest place you can. Some background noise can be nice, and even soothing, but if people are walking past and making a lot of noise it is difficult not to get distracted. If you can't get somewhere quiet, it can help to use earphones, headphones, or ear defenders. This is especially useful

if you're able to access noise cancelling technologies or play some quiet instrumental music.

Distractions

Distractions can be managed in two ways: by avoiding them and by ignoring them. You avoid a distraction when you turn your phone off or put it on silent mode. You've successfully ignored a distraction if you carry on working after being notified of an email. But it's much harder to keep ignoring distractions than to avoid them in the first place!

That's why you should get in the habit of removing distractions if you can. And that includes your phone, the radio, and the TV. Switch them off and put them away - Candy Crush will still be there this evening. Close social media tabs on your computer, along with anything else that could be distracting. Maybe you also need to draw your curtains or close your door. Make your study space as *zen* as possible!

Lastly, and yet again - it's personal. Find and then create a study space that allows you to feel relaxed and comfortable in your environment, so you can put all your energy into what you want to learn.

Sleep

(A revelation. Photo credit: Jack Catalano on unsplash.com.)

The benefits of a good night's sleep are clear[26]. You'll be able to focus for longer, retain more information, and have an increased cognitive ability after a full 40 winks. You're also likely to feel happier and more motivated throughout the day. Everything just seems a little bit easier after a good night's sleep.

What is a good night's sleep exactly? I'd suggest it's at least 8 hours of undisturbed sleep. Maybe more: I certainly notice the difference between 8 hours per night and 9 hours per night, and maybe you would too?

So, now we know what we're aiming for, we need to create a good sleeping habit. And that starts with time. I suggest setting an alarm for when you want to wake up, and working back from there to

get your (minimum of) 8 hours. I'd also suggest setting a reminder close to your planned bedtime.

The primary purpose of your bed is to enable you to sleep - not watch films, Youtube, or play video games. Nor is it a place for you to eat or text. Try to keep it that way. And if you work in your bedroom, then just avoid spending time in bed when it's not bedtime. If you associate your bed with activities and being awake, chances are you might not get the best night's sleep.

Most of us have a bedtime routine already - brush teeth, wash, get changed, etc. With a few minor changes, this routine can help improve our quality of sleep and our ease of waking up. Here's what we'd suggest.

To help you improve your sleep quality/get to sleep more easily:

- Light is important. Make your room dark when you want to sleep, and reduce the amount of blue light from screens in the evening time.[27]
- Make sure you're comfortable with the temperature of your room - you don't want to be too cold or too hot: somewhere in the region of 16-18℃ seems to be about right.[28]
- Try to relax - if that means taking a bath, reading a book, or taking a few deep breaths (try services like *Headspace* or *Calm*), then that's OK. Do whatever works for you. Sometimes I (Tom) use a notepad to jot down anything that's on my mind.

Better sleep is easier to achieve in a bed you are comfortable in. That means a comfortable pillow, mattress, and regularly cleaned sheets. If it didn't matter, we'd all just sleep on the floor!

To help you get up more easily:

Put your phone/alarm on a surface away from your bed. That way, you have to walk to turn off your alarm. It's much easier to get up in the morning if you're already out of bed.

Place a glass or bottle of water next to your phone. When you wake up, drink it. This will help your body wake up more quickly, ready for the day.

If you're sleeping better, you're probably learning better - so it only makes sense to make a few small changes to build the healthy habit of a regular and full night's sleep.

Stay Healthy

Every car must be refuelled (or charged up) and often cars that aren't driven for a while develop flat batteries and lose their tyre pressure. The thing is, a car is a lot like you, really. We just call refuelling 'eating' and 'drinking'. We call driving 'exercise'.

And, like a car, if you don't put in the right fuel then you don't function as well. You might even fail to get started!

Clearly, there are also a lot of differences between cars and humans, but that is besides the point. Regular exercise, enough

water, and good food all help us to grow, develop, and maintain our bodies.

That means a stronger immune system, so you're less likely to get ill. A broken down car can't drive properly, and you can't learn much when you're ill.

Exercise

Even a minimal amount of exercise can help you relax, relieves stress and anxiety, and is a great way to take a break from work. Exercise has also been shown to improve memory in older adults[29], and we see no reason to believe it harms your memory if you're younger.

For some of you, exercise is and has always been enjoyable. For others, this won't be the case. Either way, it's important to try and stay active.

Whether you would prefer to walk, run, cycle, skip, or follow video workouts - that's OK. Your exercise doesn't have to be super intense, either - just enough to raise your heartbeat.

Worried about how long it takes? Well, there are two key things to remember.

First, the benefits to your learning (for instance, I feel more focussed if I'm regularly exercising) will often outweigh the loss of potential learning time - especially since we can't work all of the day.

Second, it doesn't take that long. 20 or 30 minutes for 3 or 4 times a week may be enough if that exercise is intense. (For instance, running, skipping, or interval training.)

My recommendation is to try to be active every day (e.g. take a short walk) but exercise more intensely from time to time if you can. So, if you haven't already, try to make a habit out of exercise in whatever form you prefer. You might just find you like it!

Food & Water

Oddly enough, food and water are also crucial! But there's slightly more to it than that.

First, let's talk about water. I don't know about you, but I can't remember how many times I've been reminded to 'stay hydrated' during exam season. It's not just a gimmick - being hydrated allows the body to function optimally. Being hydrated helps maximise brain performance, reduces the frequency of headaches, benefits memory, and decreases anxiety[30]. All these things help us learn better.

That's why it's vital to stay hydrated and drink water. But how much should you be drinking? The NHS website recommends 6-8 glasses of water per day, and more if you're in a hotter environment or exercising.[31]

Why not try to build a habit around drinking water? Consider having a glass or bottle of water as soon as you wake up (see also

the section 'Sleep'). Maybe you are going to carry a water bottle and try to finish it twice per day. There are also several apps out there that can help you track your fluid intake. *MyFitnessPal* is one example[32].

We're always told to have a balanced and varied diet. Again, it's for good reason: what you eat influences your health, which in turn affects your ability to focus and learn. With that in mind, I have a few simple tips:

- Breakfast: Have some! Get your day off to a good start. Build a habit around enjoying a nutritious breakfast that will really set you up for the day.
- Chocolate: Have some! Dark chocolate contains antioxidants and flavonoids which can (in *small* amounts) enhance your memory.[33] But of course, be reasonable with how much you're consuming.

Vitamins and minerals allow your body to operate properly, so try to have fruit and vegetables when you can. With a varied and balanced diet, you should get all the vitamins and minerals you need to learn effectively.

If you put good stuff in, your body's more likely to give you good results. Be aware of your 'fuel' and don't forget to drink water!

Quick Task #8

Make a list of 5 things that distract you. Make a list of which ones you can get rid of next time you're studying.

Summary

Habits are actions you do repeatedly. You're in control of your habits, and making them good ones will help you hugely in the long term. ***Think about building healthy habits around your study environment (including avoiding distractions), your sleep, and staying healthy.***

Where Next?

- ***Chapter 2: Dealing with Motivation***
- ***Chapter 5: When Things Go Wrong***
- ***Chapter 9: Effective Study***

---

[24] For more information on this, check out James Clear's 'Atomic Habits'

[25] This image is covered by an Attribution-ShareAlike 2.0 licence. Here's some super-exciting licensing information we legally have to include. Excellent night-time reading! https://creativecommons.org/licenses/by-sa/2.0/

[26] Walker, Matthew P. *Why we sleep*. New York : Scribner, 2017.

[27] See this article by the Sleep Council: https://sleepcouncil.org.uk/advice-support/sleep-hub/sleep-matters/blue-light-and-sleep/

[28] See this article by the Sleep Council: https://sleepcouncil.org.uk/advice-support/sleep-advice/perfect-sleep-environment/

[29] Erickson, K. I., M. W. Voss, R. S. Prakash, C. Basak, A. Szabo, L. Chaddock, and J. S. Kim et al. 2011. "Exercise Training Increases Size Of Hippocampus And Improves Memory". *Proceedings Of The National Academy Of Sciences* 108 (7): 3017-3022. doi:10.1073/pnas.1015950108.

[30] Ganio, Matthew S., Lawrence E. Armstrong, Douglas J. Casa, Brendon P. McDermott, Elaine C. Lee, Linda M. Yamamoto, and Stefania Marzano et al. 2011. "Mild Dehydration Impairs Cognitive Performance And Mood Of Men". *British Journal Of Nutrition* 106 (10): 1535-1543. doi:10.1017/s0007114511002005.
Armstrong, Lawrence E., Matthew S. Ganio, Douglas J. Casa, Elaine C. Lee, Brendon P. McDermott, Jennifer F. Klau, Liliana Jimenez, Laurent Le Bellego, Emmanuel Chevillotte, and Harris R. Lieberman. 2011. "Mild

Dehydration Affects Mood In Healthy Young Women". *The Journal Of Nutrition* 142 (2): 382-388. doi:10.3945/jn.111.142000.
See also https://www.healthline.com/nutrition/7-health-benefits-of-water#section2.

[31] "Six To Eight Glasses Of Water 'Still Best'". 2011. *NHS UK*. Accessed 22 May 2020. https://www.nhs.uk/news/food-and-diet/six-to-eight-glasses-of-water-still-best/.

[32] There are plenty more - try searching "Water Tracker" or "Hydration Tracker" online or on your app store.

[33] Scholey, Andrew, and Lauren Owen. 2013. "Effects Of Chocolate On Cognitive Function And Mood: A Systematic Review". *Nutrition Reviews* 71 (10): 665-681. doi:10.1111/nure.12065.

III

Working Effectively

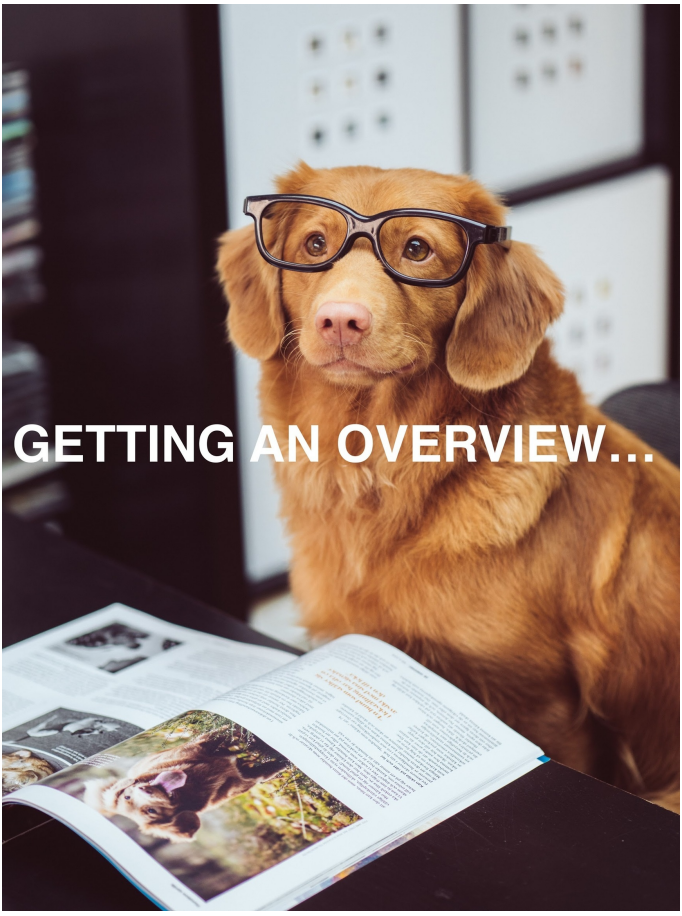
9

Effective Study

The 5 stages of effective study

There are five key stages to effective study:

1. Getting an overview
2. Finding useful resources
3. Understanding
4. Practising
5. Reviewing and revising



(A studious dog. Photo credit: Jamie Street on unsplash.com.)

We'll guide you through each one. The exact details will be different depending on your subject, goals, and personal preferences. Despite that, the general ideas here are a useful basis for anyone studying any subject.

We will start with a general outline of each stage, and then get more specific. To get as close as we can to providing something for everyone, the next three chapters will talk about what these stages might look like for three different subjects: maths, English literature, and chemistry.

Getting an overview

A key first step is figuring out what you want or need to study. That way, you can focus on studying what matters. Whether you're prioritising examinable topics or hoping to get a deeper understanding of a particular area, it's useful to have some idea of what you're trying to learn.

There's nothing wrong with unstructured learning, as long as that's what you intend to do (for example, if you intend to learn more about a subject for fun). But it's important not to fall into the trap of lacking structure where structure would be useful, like if you're preparing for an exam.

If you're studying a course, knowing what you need to know is relatively straightforward. For big public exams like GCSE, A-level, AP, or IB, you will be able to find a detailed syllabus online by Googling

> *[exam board] [qualification] [subject] syllabus.*

A syllabus (or 'specification') is a document that tells you what is covered in a course and indicates the topics you could be asked about in an exam.

If there's more than one exam board for your subject, like in the UK, make sure you are looking at the syllabus for the right exam board! You can ask your teacher if you're not sure.

For example, you might search for

Edexcel GCSE Maths syllabus.

Be sure to check that you're looking at the latest syllabus. (Often, a syllabus will change slightly every few years.) Also, check that you're definitely looking at the right qualification. For example, the IGCSE (International GCSE) exams are similar to the standard GCSE, but can have slightly different content.

Sometimes, for example at university level, the syllabus is less well-defined. It might not be detailed in one document. For these courses, use any other resources you might be able to access: lecture notes / slides and past exam papers can be a good place to start. If you're taking an internal exam at school, you should ask your teacher which topics will be examined.

If you're not learning with a particular exam in mind, then consider looking at the Contents page of a textbook or the 'Syllabus' page of an online course. For example, courses on MIT's OpenCourseWare (OCW) usually include an outline of what will be covered.

Go through the syllabus (or makeshift syllabus, which might be a list of concepts that appeared in the lecture slides or textbook). It might be worth printing it out if this helps you. Don't be afraid to

Google terms that you don't understand. If you're still unsure what they're talking about, you could ask a friend or teacher. Add notes as you look things up. You can then figure out what you think you know and what you don't.

A popular way of doing this is to grab three highlighters: red, yellow, and green. Highlight the topics you're confident you know in green, the topics you have no idea about in red, and the topics in between in yellow. (You can do this digitally if you don't have a printer.) You can repeat this process again and again as you progress.[34]

This might sound like hard work. And it's true that it might take some time. But it can really help you understand where to focus your time and energy, so it will probably save you time in the long term. And besides, studying isn't always easy. But you're willing to work hard to become better, right?

Not only does this process help you save time, but it brings you peace of mind. You can be more confident that you've covered everything. Then you don't need to worry about not knowing *what you don't know*.

Although you may want to go beyond your syllabus, you can only do that if you first know that you've covered all of the fundamental, necessary topics. Getting an overview means you can be sure your knowledge base is strong, so you can go above and beyond without worrying that you're missing something.

Finding useful resources

Now you know what you want or need to study, it's worth pausing to collect useful resources. In particular, there are often a lot of carefully-crafted resources available for free online that target your subject. These online resources should be used alongside any textbooks and notes you might have access to. If you're studying for a specific exam, it *may* also be worth trying to get hold of a revision guide specifically designed for that test.

With useful resources by your side, you're not only more likely to be able to study effectively, but also more likely to feel confident in your ability to self-study. Don't go overboard, though! You can add useful resources to your collection as you study. Try to avoid using the search for useful resources as procrastination for real study!

The types of resources that are useful will be different from subject to subject. We'll give subject-specific examples in the chapters after this.

Understanding

Understanding is the most important stage of effective study. Sure, you might be able to pass a poorly-designed exam without really understanding the material. But it usually helps to know why you're doing what you're doing. And besides, we hope you're learning because you want to understand. It's much more fun that way!

Practising

To become good at something, it helps to do that thing many times over. This is true for pretty much everything, and applies just as well to study.

Practising is sometimes indistinguishable from understanding. That's because the two go hand in hand. Ideally, practice improves your understanding over time, because every time you practice you reinforce what you know to be true.

You can practise lots of different things, from solving maths problems to memorising chemical mechanisms or quotations. All of these are skills, and you are likely to get better at them by repeating them. This is basically all that practice is. There is already a lot you can find online about different methods of learning and practice, so we'll just be adding a few extra tips in the next three chapters.

Practising is not as easy as you might think, since you'll want to be doing the **best** possible practice given your current abilities and goals. In particular, the best way for you to practise will depend on the type of information you are trying to learn or understand.

If you're feeling comfortable with a certain type of practice (say, practising one maths technique), it might just be time to move on. A key thing about learning, but also about growing in any way, is that it usually feels quite uncomfortable because you are trying something new. 'The struggle' is good, and the comfort zone is dangerous!

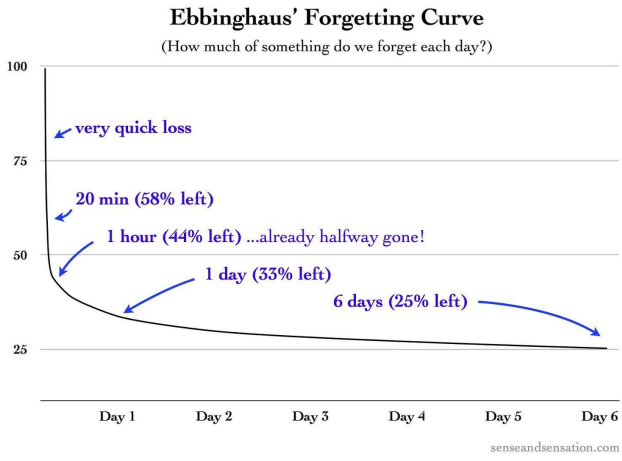
You'll also want to practise consistently, even if it's not always that exciting.

Reviewing and revising

Having worked through the four stages above, you're done - right? Not quite - memories fade over time, so you'll want to review what you've covered even if you're not taking an exam.

There are two core principles you should follow to remember information well: spaced repetition and active recall.

Spaced repetition[35] is the process of repeatedly recalling information, but with longer spacing between each repetition. New information is therefore practiced more often than information you first practiced 6 months ago. One way to implement this effectively is with the 'Anki app, which I mentioned earlier. Anki will show you cards that you struggle with more often.



(We forget things very quickly, but we can reinforce them by spaced repetition. Source: Wikimedia Commons.)

Active recall[36] is the process of stimulating your memory to learn information. If you are asked to define a mole, and then you write down your answer, then that is active recall. On the contrary, if you are scanning over the textbook, you are not actively recalling information. Just as important as recalling the information is reviewing your answer. Again, I would strongly recommend the Anki* app for this. Flashcards are one of the simplest but most effective tools you can use to practice active recall.

If you're taking an exam, you'll want to prepare for that test. Exams are imperfect tests of ability, so you'll want to work on exam skills. In the UK, we call this preparation 'revision'.

Just as understanding and practising are similar, so are practising and revision. You should continue to complete textbook and

exam-style questions, as well as trying to remember those key mechanisms or processes.

Often, it just helps to have some stuff memorised, whether that's a list of useful quotations, important maths formulas, or chemistry mechanisms. There's plenty to learn about memory techniques, and the key is to find what works for you. Here, we give four examples:

Mnemonics: "Richard Of York Gave Battle In Vain" is a mnemonic used to remember the colours of the rainbow (Red Orange Yellow Green Blue Indigo Violet). Mnemonics help by simplifying the information you are trying to remember. They can also make the information more fun / rude / relatable - whatever makes it more memorable! Create a link between the thing you are trying to learn and something else that might be easier to remember.

Repeated writing / chanting: For short-term memory at least, it can often help to write or chant a fact repeatedly. Depending on the way you learn best, this can really drill something into your mind, and can be helpful for, urm, cramming (last-minute exam revision!). But beware: I (Peter) have found that this method doesn't always help me remember things for very long.

Understanding: Real understanding can also create links between related concepts (just like mnemonics!). But the advantage of really understanding the material is that these links aren't made up (unlike mnemonics!). They are actually logical links that explain something, and so they're often much easier to

remember than made-up mnemonics. But sometimes it helps to just memorise some facts. Sometimes you might need to have things memorised in order to form that real understanding in the first place.

Repeated summary: Why memorise lots of things when you could memorise just a few? Try writing down the key material you need to know for a topic. Then summarise it. And keep summarising it until you really can't summarise it any further. In the process, you'll test your understanding and you'll probably remember a lot of the material. When you review it later, you'll have a convenient 'crib sheet' to quickly remind you of the key points.

It can also be useful to review what you've studied even if you're studying for fun and won't have to take an exam at all. But this part will focus on exam revision, since we think that's what most of our readers will be facing.

It comes down to knowing what you need to know by using your textbook and syllabus, and then practising and revising the information.

Quick Task #9

Explain the 5 stages of effective study to someone who hasn't read this book.

Summary

*Effective study involves **5** key stages:*

1. ***Getting an overview**: understanding what you want or need to learn*
2. ***Finding useful resources***
3. ***Understanding**: getting your head around concepts*
4. ***Practising**: becoming better and better at anything by repeated tries*
5. ***Reviewing and revising**: putting all the relevant information together in your brain and getting it ready to spew out onto an exam paper (if you're taking an exam).*

Where Next?

- ***Chapter 10: Maths***
- ***Chapter 11: English Literature***
- ***Chapter 12: Chemistry***

---

[34] Top tip: Try using a spreadsheet to track your progress!

[35] https://en.wikipedia.org/wiki/Spaced_repetition. Accessed 22 May 2020.

[36] https://en.wikipedia.org/wiki/Active_recall. Accessed 22 May 2020.

10

Maths

Getting an overview

Even with a detailed syllabus, it can sometimes be tricky to decipher what you actually need to know.

Here is an example from Edexcel's GCSE (9-1, 2017-) Maths specification:

> Mensuration and calculation …
>
> G16 know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids and other right prisms (including cylinders)[37].

Although it's precise, there are quite a lot of terms here you might be unsure about. Don't worry about this. It's worth taking the time to figure out what they mean.

Firstly, 'mensuration'. It turns out it's just a fancy term for 'measurement', and you can find that out with a quick Google search. You could also search for terms like 'parallelogram',

'trapezia', and 'right prism' if you were unsure of these. If you're using this as a revision method for an internal 'midway' exam (e.g. in Year 10 for GCSE), you can choose to ignore topics you're confident that you haven't yet covered.

(Photo credit: Andreas on unsplash.com.)

What if you think you understand a topic, but you actually don't? This is an 'unknown unknown'. You didn't know that you didn't know something! Or perhaps you understand a topic, but aren't confident about applying that understanding to solve problems. In maths, this can easily happen.

A good way to find out how much you can currently do is to try some questions and see how you get on. These might be relevant questions from the textbook or from an online source. But, if you're preparing for exams, a past paper would be the best resource here. That's because it will cover a variety of topics and require a few different techniques. If you're in the middle of a

course, we'd recommend choosing a fairly old past paper (to save the new ones for just before the exam) and answering only the questions on the topics you think you've covered.

Carefully mark your answers using the mark scheme or solutions provided. Mark yourself harshly. Be as critical as possible. Make a list of the places where you lost your marks or made mistakes, including any silly arithmetic or algebra errors. Were there any surprises? You can compare the list you've just made to your colour-coded syllabus.

If you're studying maths for an exam, it's also worth learning about how the grading system works. For some exams (like GCSEs), you will need to know most or all of the syllabus to get a top mark. But for others (like IIT JEE, a ranked university entrance exam in India) it's possible to score highly without covering every topic. So, by figuring out how your exam works, you can come up with the best strategy for you. And the overview is the start of that journey.

Finding useful resources

Alongside your textbook, there are often useful resources online to explain mathematical concepts. But sometimes these will be too advanced for your current level or may even contain errors, so be careful!

That's why it's important to be specific in your search terms. If you're working towards a specific qualification, it's worth

including that in your search term. For example, you might search for 'GCSE statistics'.

You may find that the first resource you come across (whether it's a video, article, or something else) just doesn't really make sense for you. If this happens, look again. Particularly in maths, there are often loads of resources available. A second point of view or alternative explanation may be readily available and might just help things 'click'.

Understanding

As we saw earlier, you often need to understand a lot of basic maths concepts to understand a more advanced concept. Don't shy away from reviewing the very basics, even if they're from as far back as primary school. If you're struggling with a topic in maths at school level, it's quite likely that you just didn't quite understand or can't quite remember one of its more basic building blocks.

Happily, there are loads of great videos online to explain basic maths. You can search for topics (e.g. 'ratios and proportions') on YouTube. Adding something like 'GCSE' or 'CBSE' might help if you're studying with a specific exam in mind, but that isn't always necessary.

As you go through the videos, keep asking yourself 'Why?' at each step. If you don't understand, rewind and watch it again. If you still don't understand, try to find another video. Note down any important new points or concepts you come across.

If you're still having issues understanding concepts, there are a couple of things you can do:

- Talk to someone else - discussing concepts with someone else can really help both of you!
- Make good use of the internet - it's full of great resources, especially websites where people ask questions and volunteers answer! This is very useful because another person's explanation of a concept may really be able to teach you.

If you're a bit more confident, try deriving the results and facts that you need to know. This will help strengthen your understanding of where they come from, and will mean that you have fewer things to memorise (or mis-remember!).

A very common complaint is that it's hard to remember formulas. I agree. You know what would be ideal? To not remember any of them! You may wonder if such a thing is even possible, and I'll tell you that it usually is. I struggle, personally, with remembering stuff (not just formulas!) but what I don't usually forget is **how** to get some formula.

I (Tejas) can confirm, after being at university for 2 years now, that memorising a bunch of formulas is pretty much useless. It'll save you time in exams, but usually not that much. It is much better to learn the logic and appreciate the thinking behind the maths. This is especially useful for university exams, because so many questions are 'non-standard' and you really need to think rather than just remember.

That means that learning formulas becomes less and less valuable the further you go in mathematics. Being able to derive those formulas, on the other hand, becomes more and more valuable. But feel free to derive the formulas later if you're focussing for now on nailing the basics.

When you read textbooks, some parts can be hard to understand - concepts aren't always explained well, steps are sometimes missing, and occasionally there are even typos! It can still be useful to spend a reasonable amount of time using the same book.

If you can logically proceed and figure out what the author might be trying to do, then congratulations! If, however, it's getting way too hard and it seems impossible to follow, don't worry - this is how I (Tejas) feel sometimes too! Try using the internet or an alternative book - a change of perspective can be extremely helpful.

Think about it this way: mathematics is all in your head. If you understand the starting points then you are, in principle at least, equipped well enough to continue the theory by yourself and use it to solve problems! This doesn't mean you'll be able to do it immediately. That's why there are books, after all! But just knowing that nothing in principle is stopping you from being able to build the theory on your own is, at least for me, highly motivating.

Practising

You might have heard that, for mathematics, practice is key. This is true when it comes to (school) exams, but you should make sure you're practising in the way that works best for you.

That's because practice isn't just useful for nailing standard techniques. It's also how you get better at problem-solving in general. Repeated 'drills' for basic techniques can be very useful, but they can also be a waste of time if you're already proficient in a certain technique. At this point, you may want to move on to harder, problem solving questions. Good textbooks will include both of these question types.

But take your time with drills: nailing the basics is often key. Remember that maths is cumulative.

To find out more about problem solving, including an example of a problem that looks scary but is actually alright, check out ***Appendix 1 (Problem-Solving in Maths)***.

Reviewing and revising

The focus of this section is on revising for exams. If you don't have to take an exam, focus on the *Understanding* and *Practising* parts instead.

If you are studying on your own for exams, it's very important to be able to schedule your studies well. It's likely that you have more exams than just maths, so it's important to not spend so much time with maths that you lose track of your other goals (I agree

that maths is great, but be careful!). One tip is to keep a tab of your common mistakes - keep the 'silly' errors and conceptual misunderstandings in separate lists. If you've discovered a misunderstanding that you had before, note it down. If you learn to look at some concept in a better way, note it down. These are achievements! The more of these notes you have, the better you are becoming at the subject!

If time management is an issue for you in exams, it is useful to know that the exam questions you are required to do will be in 'standard formats'. This is a very useful hack, since this means there are only a limited number of types of problems you need to know how to solve in order to do well in the exam! This number is usually neither tiny nor huge, so practising and keeping a record of the question types is the most efficient way to beat the system.

Personally, I don't like it when exams ask you to remember many standard (but hard to remember) results. (But you can't complain - at least not until acing the exam!) So what I'd recommend here is to keep a list of things that you think are worth remembering and also have a proper strategy for writing the exam: Check what the 'grade boundaries' are or how highly you need to score to get the result you want, because it's often the case that you don't have to get all the answers right!

For example, to be able to study Physics at one of the top 3 universities in India, it is enough to get about 65-70% in the IIT-JEE entrance exam. Once you know this, you can do some mental preparation and choose to **leave out** some questions in the exam! (Time pressure, remember?) If you have a solid understanding of

the material, a good strategy, and a bunch of facts memorised, you should be off to a great start!

Sometimes, maths problems will be buried in an avalanche of words. Try to stay calm if you have to face one of these problems in an exam. If it helps, force yourself to read just half a sentence at a time. Don't look at the next part until you have understood each previous bit. It might also help to underline any key terms as you read.

A final tip: In stressful situations, feel free to outsource the calculations to your calculator if you can. It's easy to make arithmetic mistakes, so I'd recommend taking the time to check even fairly basic results using your calculator. (Also, make sure you're entering everything carefully - it's surprisingly easy to make mistakes keying numbers into your calculator!)

I (Peter) have a friend who was invited to interview for a place at Cambridge to study Engineering. During the interview, he typed '6 + 7' into his calculator. The interviewer stared at him and asked if he really needed to use a calculator for that. 'Honestly, I'm pretty nervous, so I think I do,' he said. He got the offer! Be like him.

Quick Task #10

Pick a mathematical technique and teach it to one of your parents / guardians. What do you notice about this experience? Was it easy or difficult?

Summary

- ***Getting an overview***
    - *Search the meanings of unusual terms you might find in your exam syllabus.*
    - *Annotate your syllabus and/or take a test to figure out what you know and don't know.*
- ***Finding useful resources***
    - *Start with textbooks and revision guides.*
    - *When using the internet, be specific in your searches.*
    - *A second source of information might help you understand a difficult topic.*
- ***Understanding***:
    - *Videos can help explain maths topics, and may be particularly helpful for basic ones.*
    - *It may be worth talking to friends about topics you find hard.*
    - *To check your understanding, keep asking yourself 'Why?'*
    - *If you can't teach a topic to someone else, you just might not understand it - yet!*
- ***Practising***
    - *For topics you're weaker at, it is important to do repeated exercises.*
    - *As you get better at a topic, try more challenging 'problem solving' style questions.*
- ***Reviewing and revising****:*

- *Make a list of the errors you have made in past exams.*
- *Figure out which standard types of questions tend to get repeated in exams.*
- *Remember that you might be able to leave out some questions in the exam and still do fine.*
- *Read wordy questions carefully and slowly. They're usually not as bad as they might seem!*
- *Take advantage of your calculator if you're allowed to use one.*

Where Next?

- ***Chapter 9: Effective Study***
- ***Chapter 11: English Literature***
- ***Chapter 12: Chemistry***

---

[37] *Pearson Edexcel Level 1/Level 2 GCSE (9–1) In Mathematics (1MA1), Specification, First Certification 2017*. 2015. 2nd ed. Accessed 22 May 2020. https://qualifications.pearson.com/content/dam/pdf/GCSE/mathematics/20 and-sample-assesment/gcse-maths-2015-specification.pdf.

11

English Literature

Like with many other arts subjects, English literature courses usually ask you to revise large amounts of information - much more than you'll actually be using in the exam. But don't let that put you off!

All this means is that working towards this kind of qualification is reasonably similar to studying the subject outside of an examination board: setting out to work on the related skills, or maybe just for fun. You'll want to develop a wide variety of specific skills. You'll also want to take in quite a bit of information, but that isn't so bad either, because:

- If you've chosen to study English literature, you probably enjoy reading literature,
- If you're working towards a goal in another humanities subject, ideally you have an interest in the content (however small),
- Even if neither of the above is true, hopefully we can show you that learning the stuff you need to pass your exams can be fun, or at least not so daunting.

It's also important to remember that everyone has their own 'best' ways of understanding and remembering information. This is particularly apparent with humanities subjects!

Getting an overview

The course

If your goals are exam-focussed, it's wise to have a good read of the whole section on your exam board's website. This is especially helpful if you're doing the course completely solo. But by far the most important resource is the document that lists every examinable topic (often called a 'specification'). This will give you an in-depth view of the course structure: which texts you're going to need to read (in the case of English), what type of questions you'll be asked in the exam, and so on.

Most English exam boards split the course up into Drama, Poetry, and Prose (with A-level there is usually an exam for each), and these sections contain a combination of open/closed book, comparison, and unseen extract questions.

Examinations in other humanities subjects will also contain a range of different types of questions, requiring specific skills. For example, history questions may range from unseen sources, comprehension, and comparison to evaluating broader thematic issues.

Broadly, if you're sitting English exams, you'll be asked to write about texts, both in isolation and comparatively. You'll need to

know quite a lot of concepts and how they overlap. For each text you'll want to understand the plot, its historical context, the author's intent, and the key themes.

A-Level courses also tend to have coursework (non-exam assessment). In English you could be asked to compare two texts completely of your own choosing (hooray). If you're doing the course solo, or have been given a bit of free rein, you'll also need to choose which texts to study across the course, from a list of options provided by your exam board. This will all be detailed in your exam specification.

The texts and topics

As well as looking at the overall structure of the course, a broad review of each text itself is also essential. When reading a piece of literature for the first time, think about which bits are jumping out at you as key themes and important parts of the plot. This also sets you up to be able to understand how more specific points of analysis relate to the rest of the text and function within the larger narrative.

It may sometimes be tempting to get down to the specifics of interpretation, language analysis and considering the writer's method. But, to do this well, it is important to understand the text as a whole, and its main ideas.

Online summaries are also a useful resource when first approaching a piece of writing, theme or historical period. Most

of the texts specified on your syllabus will be well-known enough to have lots of online resources.

But it's still key to closely explore the text yourself. That way, you can improve your understanding and your marks.

What if I'm not sitting exams?

You don't always have to do things this way: starting with a broader overview before diving into the details. A reader-response approach (prioritising your own interpretations of the literature rather than what the author meant), is a perfectly valid way to engage with a text[38].

Also bear in mind that, if you *are* sitting English Literature exams, you'll have to interpret at least one text, usually poetry, that you haven't seen before, without any explicit information about its background[39]. Being able to analyse language without reference to its wider context is a separate and valuable skill.

More broadly, if it isn't an exam grade, decide what you want to get out of this subject and why. Your wider interests are going to impact how you go about your studies, including any emphasis you place on particular types of literature.

Finding useful resources

Whether or not your text choices are limited by an exam specification, take a bit of time to think about your options. Read some plot summaries online, have a look at the themes, and a few different styles of writing. See what jumps out at you! At this

stage, it's all about what you think you might enjoy. Don't worry too much about how easy a text might be to interpret. If you're choosing from an exam-specific selection, they're all going to be roughly the same level.

Besides, the beauty of English is that there are countless ways to explore every text you come across. Don't see anything as out of your depth.

When you've got started, there are a few different places you might want to go for support.

- ***Online summaries***: These are great for getting to grips with the context and thematic features of a text. They often have examples of closer language analysis as well, so this will help you get comfortable with thinking about literature a bit more deeply. (See the next section.)
- ***Revision guides***: These are often exam-board specific but, as long as you're looking at the right text, this doesn't really matter. They will contain roughly the same content as online summaries, but with a bit more emphasis on how to go about writing an essay.
- ***Reader's guides***: These are text-specific, and tend to go into a lot more depth. Great for sinking your teeth into some interesting interpretations and starting to come up with some of your own (this is going to be important).
- ***Student and academic essays***: These can also be found online. Useful for when you've got to grips with a text already, and want to mull over some others' opinions. With student essays and online summaries, if you haven't had

time to explore a text yourself, it can be hard to know if an online resource is any good! Try to strike a balance between measuring your own interpretations against those of others, and sticking with your gut instinct![40]

- ***Talking to peers***: If you know someone who's studying the same subject, this can be very helpful. Exchanging essays and resources can give you valuable feedback as well as save some time!
- ***Talking to friends***: Even if someone isn't doing the same course as you, or even the same subject, chatting to others about a text can be a great way to bounce around some ideas. Reading between the lines, deciding what you think the author might have been trying to say, and finding linkages across a text aren't just English-specific skills. Moreover, talking to others about literature you're enjoying is fun, helps you piece ideas together, and is good revision.
- ***Examiner's reports***: It can be useful to see the positives and negatives that have been identified from past years. A prime insight into what it is the examiners are looking for!

I (Scarlett) would give similar advice to someone looking to study any humanities subject. Alongside looking at an exam specification to gauge the types of questions you're going to have to answer, it's important to remember that there are all sorts of resources out there to help you engage with the content and know what to do with it in an exam. You're not alone!

Understanding

Alright, so I've been going on about how to set yourself up with a text, and where to look for more information about that text. But how are you going to make sure you understand the literature, can revise it, and know what to do with it in an essay? Let's get a bit more specific.

As I've touched on briefly, you're going to have to get a good understanding of both the 'macro' and 'micro' features of a piece of writing (a little more simply: the general and specific features). This is going to require two different types of approach.

I'm going to focus on examinable skills for now, in order to give us some structure, but they can also be used when you're reading for enjoyment or personal study, in order to get as much as you can out of a text.

Read, read, read

This may seem blindingly obvious, but we all know someone with a horror story about trying to get through an English course without actually reading the texts. This isn't to say it cannot be done, but your essays probably won't be much good. They're likely to be messy and lack real understanding. You want to spend enough time with each text that you can deal with any question the exam throws at you. You're going to need to read, read, read!

Something I found when studying both GCSE and A-Level , is that lots of my peers were concerned about the time it took to read each text.

They felt they should be spending most of their study time preparing for specific exam questions or looking at summaries (to develop a general knowledge that could be applied to a range of questions in an exam setting). These techniques are all well and good, but if you want to ace that English literature paper, you're going to need to show you really understand the book.

As I said before, you should try to strike a balance between widely accepted interpretations of a text and your own ideas. By becoming very familiar with a particular text, you can start to come up with your own points and interpretations and get the examiners thinking. This isn't as tricky as it sounds! If you know a piece of writing really well, your background knowledge ends up doing most of the work.

Your personal response to a text is a valuable and useful resource. Furthermore, in an essay, as long as you can justify your beliefs with textual evidence then getting across your own perspective is very worthwhile.

> **Example**: You might be reading an online summary, or a student essay, describing how a particular piece of language (structure, rhythm etc.) contributes to the portrayal of a character's emotion in such and such a way. Let's call this character 'Betty'. The essay or summary is talking about how her hopelessness is being represented. All of a sudden you feel like this interpretation is a little iffy. "But what about the stage directions," you wonder

> "could they mean that this line should be read very differently? And I remember in Act 1, Scene 1, Betty's actions portray her as particularly headstrong, I doubt she would simply give up like this! I wonder if the language here is contributing to the plot in a more nuanced way?"

It's only by really getting to grips with a whole text that you can start making immediate connections in this way. Of course, especially when revising, you should try and focus on the chapters, sections and scenes which you think are the most important. You'll also want to spend more time on the important bits of a text when you're doing micro analysis; but your starting point should always be reading the whole thing and exploring it thoroughly.

To find out more about the difference between macro and micro analysis, check out ***Appendix 2 (Analysis in English)***.

Practising

The way you practise your skills will depend on what you want to be able to do with them. If you're aiming to sit humanities exams, this section is going to blend into the next section and will draw on resources that you might create in the process of revision. There are three main things you might want to practice.

Collecting content: In the case of English this is going to involve making 'macro' and 'micro' observations about a text. Keep reading and coming up with new interpretations and evidence related to your set texts as practice. That way, you won't just hone

your skills for unseen analysis: You'll also come up with even more insightful points to put in your essays! Get annotating!

Something I found really useful was going through each text and picking out important quotations that I could potentially use in an essay, whether the exam was closed-book or not. Not only did memorising some of these quotations save me a lot of time in the exam, but it really helped me develop a deeper understanding.

It's also a good idea to start sticking to the key scenes and chapters at this point. They're the ones you're most likely to use in an exam. But if you think you're onto something with a less-explored section of a text, stick with it! Keep exploring.

On top of this, pick some poetry and prose extracts that you haven't seen before, and see how quickly you can develop a good understanding of the themes, use of language, rhyme and message. Every minute is going to count in the exam, so *practise what you'll be expected to do*. This is a useful tip for any exam really.

If you're not sitting exams, this kind of training (e.g. doing increasingly harder stuff with less and less time) isn't going to be as important. But you can still practise in the same way.

Remembering content: Everybody has a different way of going about memorising and recalling content. Try a few and figure out what works best for you! Hopefully, you've started to build up a great bank of knowledge about the texts you've studied, but you're going to need to be able to remember lots of it in an exam!

Some options to try include mind maps, flashcards, and quick summaries (which you can write down). See how much you can remember about a specific theme or character. At this point, you might start looking at past exam questions and jotting down any ideas.

Applying content: What are you going to do with all this stuff? I suggest you practice writing essays. This will help you practise some general exam technique (see below) as well as getting used to writing about your texts. If you have access to teachers, practice writing essays, and send them off for feedback.

You don't always have to time yourself whenever you practise writing essays. It's incredibly important to express yourself clearly and get the content down. It won't matter much that your time management in an exam setting is spot on if your writing style is convoluted and messy! Don't skip this step!

Reviewing and revising

General exam pointers

Write essay plans! This is going to be very important, not only in terms of helping you remember content, but also because you might also be able to use them in the actual exam! This method works well for me, because my favourite way to memorise blocks of information is via cues.

Try taking a look at past exam questions and the specification. Make a list of all the themes and sections you might be asked

about for each set text. Then make a mindmap, list, or flashcards containing all the key points and examples you've come up with before by making notes on the text. Write a word or a couple of words that will trip your memory and remind you of each point. Write them down in a plan. Memorise it, and you're on your way!

Whether or not this is your *favourite* technique, try to write at least a few essay plans. And writing full essays is important too. Try to memorise your plans to the best of your ability. (Try taking away your plan and writing down what you can remember. It can be interesting to see what you miss.) Then, when an essay comes up in the exam, you will have planned and practised for hours already!

Even if you haven't actually written a plan for the specific exam question, you're likely to have lots of relevant information ready to apply! But make sure that *all* your points actually relate to the question being asked! Sometimes it's easy to run away with what you've revised and ignore the specifics of the question. Try to strike a balance between exploring the general topic of the question and making sure you actually answer it.

Be sure to do some timed practice papers as well. These can be daunting, and at times even downright boring. But you want to be as comfortable as possible with *all* the kinds of questions you could be asked. You're not going to have much time to write these essays in the exam, so do yourself a favour. Aim to be so familiar with the structure, setup, and timings, that the actual thing feels like a breeze.

By making yourself comfortable with exams, you'll free yourself up to take some risks on the day. A piece of relevant textual evidence suddenly occurs to you for the first time? The specific question gets you thinking about a character's role in a whole new light? Go for it! As long as you're sticking to the question, it's fine to play around with some new ideas in an exam. In fact, I (Scarlett) often find I come up with the best ideas under this kind of pressure. Don't worry if this feels like a long way off though. The most important thing is that you can demonstrate a clear understanding of the text, anything else is just extra!

Keep reading

Summarising what you've learnt and memorising it is going to be essential for a good exam performance, but don't forget to keep reading. Don't go too far from the actual text during your revision, keep relating your points to the text.

Make sure you know where each piece of evidence appears and what happens on either side of it in the story. This kind of awareness can help you reach the highest marks. So keep going back over key scenes and the text in general, alongside other revision, all the way up to the big day.

Quick Task #11

Find a past exam question on a text you have studied. Take 5 minutes to write down some ideas that pop into your head. This can be a first step towards planning great exam answers. (Feel free to skip this if you've just started studying English literature.)

Summary

Summary:

- ***Getting an overview***
    - *Find out which texts you want to cover and (for example) what sort of thing you might be asked.*
    - *Try to get an overview of the context in which each text was written.*
- ***Finding useful resources***
    - *If you have a choice of text, use online resources to figure out what you might enjoy.*
    - *Summaries, revision guides, and reader's guides can all be useful.*
    - *You could also read example essays or essays written by academics.*
    - *Talk to friends about books you like.*
- ***Understanding***:
    - *Read the text, ideally more than once.*
    - *Get both a high-level and a detailed understanding of the text.*
    - *When you're more familiar with the text, you'll be in a better place to come up with your own ideas.*
- ***Practising***
    - *Keep annotating your text with new thoughts as you go.*
    - *Try a few different methods of remembering content, and see what sticks.*
    - *If you're taking an exam, think about how you might apply your ideas in an exam essay.*

- ***Reviewing and revising**:*
    - *Write essay plans and essays, including under timed conditions, to understand what it's like.*
    - *Keep reading the text, always keeping in mind the broader context of the specific details you might mention.*

Where Next?

- ***Chapter 9: Effective Study***
- ***Chapter 10: Maths***
- ***Chapter 12: Chemistry***

---

[38] This can work well, at least to start with, although you might misunderstand key points if you don't have all the context that comes from understanding what the author was trying to do.

[39] Similar questions are also common in exams for other humanities subjects.

[40] These secondary sources may not be necessary for GCSE, but won't hurt! At A-level, they are very important. Remember to be careful about plagiarism when it comes to using others' essays as a resource.

12

Chemistry

Science is full of variety. At one end of the spectrum, you have a subject like Physics, which can be very mathematical. At the other end, you might have Biology, which may focus more on understanding (biological) processes, remembering important facts, and being able to explain phenomena.

Chemistry is somewhere in the middle, in terms of both mathematical applications and amount of content. Chemistry is a broad subject - from the calculations involved in understanding chemical reactions to understanding how atoms bond together to form materials. This breadth means you can apply some of the ideas and themes of this section to physics, biology, or any other subject really.

Getting an overview

As with anything you're learning, it's vital to first understand what you are trying to achieve. In this case, maybe you are studying for chemistry GCSE or A-Level. Or maybe you are just really

interested in batteries and want to understand how they work in more detail.

If you're studying a course, knowing what you need to know is relatively easy. You can find this out by looking at the following.

The official syllabus: In the UK, exam boards normally have an online syllabus that you can download. (Make sure you are looking at the right exam board!)

Textbooks: If you have a course textbook, this is a great place to find what you need to know. The 'Contents' pages are your friends here. I'd suggest that you take the time to read through them and familiarise yourself with the topics they cover overall. Seeing this 'bigger picture' can really help put together everything you're learning.

Online resources: Sciences in general tend to have a lot of great online resources, because (most of the time) everyone agrees on what is true and what is not. But it can be tricky to find resources specific to your level and your exam board - so make sure to search for something specific like "A-Level Chemistry AQA Syllabus". (See ***Chapter 9: Effective Study***.)

For example, ***Isaac Chemistry***[41] has a syllabus map section, which shows questions to practise for each exam board. If you're studying another science subject, maybe you can find something similar (e.g. Isaac Physics[42]).

And if you're not studying for an exam, I can't recommend the Khan Academy[43] enough. They set out general topics for each science subject in a logical order. So if you want to learn about batteries, you could focus on their "Electrochemistry" section, for instance.

Whether you are learning a science subject for enjoyment or for an exam, it's important to create structure. That's what getting an overview allows you to do. It means you can start to plan your learning, make sure you're on track, and understand where your strengths and weaknesses lie.

Although you may want to go beyond your syllabus, you can only do so if you first know that you've covered all of the fundamental, necessary topics. Getting an overview means you can be sure your knowledge base is strong, so you can go above and beyond without worrying that you're missing something.

Finding useful resources

As I mentioned before, free content to help you learn Chemistry and other science subjects tends to be plentiful online. But there is certainly also value in physical resources like textbooks and revision guides. The following are a few good resources that I've used to learn from in the past.

Textbooks: These may be produced by the same company that hosts your exam, or someone else. When I was studying for A-Level Chemistry, there were at least 2 different popular textbooks covering all the necessary information. If you can, then it's

definitely worth investing in a textbook. You can take your pick as to which you choose, but if you know someone who has studied the subject before - it may be worth asking to see what they recommend. (They may even be able to sell you their old textbook at a discount!) Good textbooks include quizzes, exercises, and exam-style questions, as well as explaining all the fundamental concepts. There's more than enough content in most textbooks!

Revision Guides: Most useful for - you guessed it - revision, these guides have a lot of questions and practice that make sure you understand topics. For Chemistry in particular, I found these useful for seeing if I should practice more of the mathematics or the explanations for each topic.

Problem Solving Resources: Isaac Chemistry[44] is one such example. The website contains an alternative Chemistry textbook[45] with loads of online exercises that will really test your understanding. Try to find an equivalent for your subject. Maybe it's a problem solving book, or maybe it's online. Either way, these resources will help your understanding when you want to practise or revise.

Online Explanations: Resources like the Khan Academy, a-levelchemistry.co.uk, and Mr Rintoul's Chemistry channel (https://www.youtube.com/user/MrERintoul/videos) are excellent. They may explain topics in a different way, and that might just work for you. And a-levelchemistry.co.uk has great practice resources (at the time of writing). Find some similar resources for your subject: You can refer to these when you get stuck!

Finding resources shouldn't be an issue for most sciences. You'll notice that I've already mentioned a lot of these resources. It's common to keep using the same resources again and again.

However, it can be useful to do an extra search to find an article or video that explains the topic you're studying. That explanation might just give you an alternative viewpoint which helps things 'click'.

Understanding

You might feel confused after your first time looking at a new topic. I (Tom) know I did, in both Chemistry and Physics! So let's say that's just happened to you. Maybe you're studying acids and bases but you don't quite get it - yet. You feel like equations are being flung at you but you're not sure where they come from or what they mean.

What to do?

Firstly, you'll want to identify exactly what you're struggling with. Maybe you don't quite understand the difference between pH and pOH. Try to be specific about what you don't get and write this in the form of a question. For example, how is pOH different to pH? If the pOH is higher, why does that mean the pH is lower?[46]

Those questions need answering. Hopefully, searching those questions directly might get a reasonable explanation. If not, use your textbook, revision guide, favourite Youtuber and whatever

else to go over the topic again. You may need to read through the textbook more slowly, or it could be better if you look for a different point of view.

Now try to answer those questions - simply and concisely. If you can do that, you know what you're talking about.

But here's the tricky bit. After each sentence, ask 'Why?' Keep going until you can't anymore. This helps you to identify what you do and don't understand and therefore what to look at next.

Feynman Technique

Asking 'Why?' is related to the Feynman Technique. Famously used by the American theoretical physicist Richard Feynman, this technique suggests that if you are able to explain the topic you are learning to a child, then you might understand that topic. This means using simple terms to clearly convey what you are trying to teach (or really, learn).

But what if the topic is more mathematical? I found that I would be able to do some of the practice questions for mathematical topics but then failed when things got more complicated. However, it was the complicated questions that (once answered) allowed me to learn and understand more.

For that reason, I recommend using resources like *UK Chemistry Olympiad* questions as well as *Isaac Chemistry* to test your understanding of more mathematical topics in chemistry. For other science subjects, similar resources exist. Beware, though, the

questions are difficult. It may be useful to discuss them with a friend, but they'll definitely help you to improve your understanding of a topic.

Chemistry can often be broken down into very fundamental parts. For instance, understanding very clearly what it means to have a 'mole of atoms' or a 'mole of feathers' can make any calculation converting between molecular weight and relative masses much easier. So, learn the fundamentals.

In the case of chemistry, that means learning and understanding key definitions, equations, and reaction mechanisms. It may sound dull, but a little effort early on to get the basics right can save a lot of time and effort in the long run! So, get out some scrap paper or a whiteboard and test yourself - what is a mole? How do I convert between pH and [H+]? How does nucleophilic addition work?[47]

Practising

Practising is sometimes difficult to separate from understanding. And that's the point. Ideally, practising improves your understanding over time, because every time you practise you reinforce what you know to be true.

But how should you practise a science subject? What about chemistry in particular?

The ways to practise using science subject matter can be split into 3 main areas:

- Answering questions.

- Recalling simple information.
- Explaining and describing more complex derivations / mechanisms / processes.

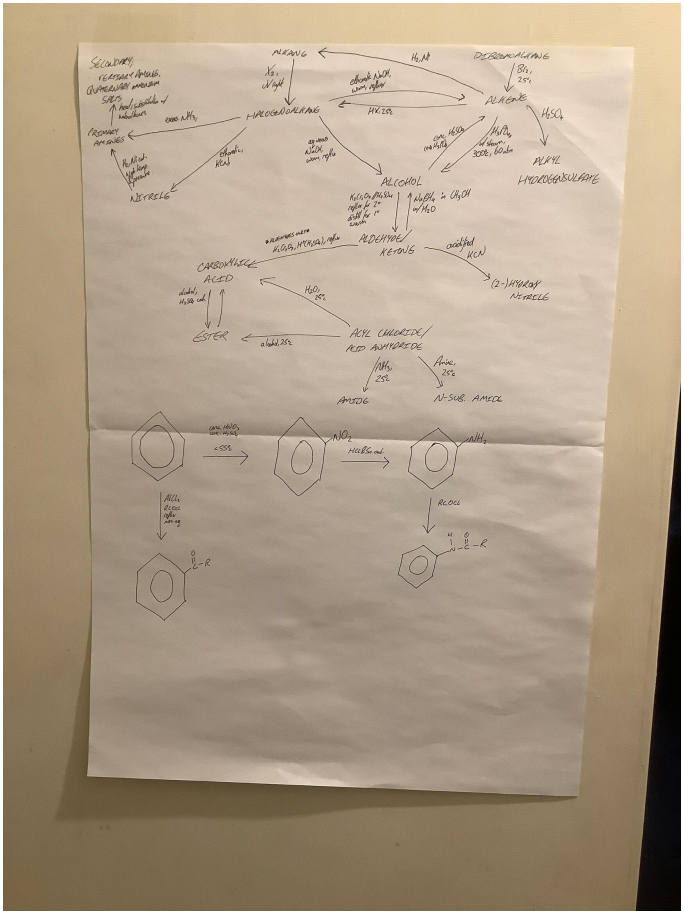
Here is what this looks like when applied to chemistry:

- Answering textbook review questions and past exam questions.
- Recalling the chemical reaction of different titrations, colours of different aqueous ions, and defining a 'redox' reaction.
- Making a map that shows how to react one type of molecule to form another (e.g. alcohol to carboxylic acid).

And here are some recommendations about how to implement these 3 different learning strategies:

- Use a mixture of the end of (textbook) chapter, exam, and more advanced questions. Again, see *Isaac Chemistry* and the *UK Chemistry Olympiad* for the more advanced questions.
- Use physical flashcards or an app like *Anki*. I'd recommend making your flashcards yourself. 'Chop your own wood and it will warm you twice.' In other words, the act of making the flashcards will help you remember what's on them.
- Make a list of what you need to practise, and try to do this often. This is often the most impactful practice, because you can choose a few key things to commit to memory. For A-Level Chemistry, knowing all the reaction pathways and conditions almost guarantees you a lot of relatively easy marks.

Try talking to yourself when you practise. It may sound silly, but it might help you to focus on what you're learning, while also testing your understanding. If you can't talk through the topic, you might not understand it, and you may need to focus on understanding before continuing with practice.



This is the diagram I copied out from memory every day leading up to my A-Level Chemistry exams. It gave me confidence in my

ability. Maybe you can create a similar diagram for your science subject?

Reviewing & revising

Firstly, continue your good work in practising with textbooks, flashcards, and anything else. In addition to this, it's worth trying to review past exam questions in more detail.

Once you have completed an exam question, spend time to understand the mark scheme and figure out where you can improve, and what is needed for more marks. Maybe you could try and be more concise in your answers in future (so you hit the key points and get the marks, but in less time.)[48]

It comes down to knowing what you need to know by using your textbook and syllabus, and then practising and revising that information.

The Pareto principle says that 80% of effects come from 20% of the causes - so 80% of our marks come from 20% of the information (in the textbook). Fortunately, it is often quite easy to see what that 20% is by just looking at previous years exam questions. This 80/20 rule is certainly something to keep in mind if you're feeling like there's just too much content!

Quick Task #12

For any science subject you're studying, grab a pen and paper. Make a list of:

- *your top 5 online resources*
- *the 3 most important concepts you need to remember*

Summary:

- ***Getting an overview***
  - *Start with the syllabus for your subject.*
  - *Textbooks and online resources are particularly useful for sciences.*
- ***Finding useful resources***
  - *As well as textbooks, try revision guides*
  - *Problem solving resources are available for most sciences*
  - *Be familiar with a few online resources. That means you know where to go for a second viewpoint.*
- ***Understanding***:
  - *Break down what you don't know into small questions.*
  - *Use your resources to try and answer these small questions.*
  - *Ask 'Why?' to check you really understand a topic.*
  - *The Feynman Technique asks you to explain a topic to a child. If you can do this, it shows you understand a topic.*
- ***Practising***

    - *Practising science subjects can be split into answering questions, recalling simple information, and explaining / describing more complex information.*
    - *Answer questions using your textbook or past exams.*
    - *Recall simple information using flashcards, mind maps, lists, or something else.*
    - *For more complex information, simplify it, and then repeat it.*

- ***Reviewing and revising**:*
    - *Understand the mark scheme. Where did you go wrong?*
    - *For a few practice questions, try being more concise in your answers. This saves time and shows understanding.*
    - *The Pareto Principle suggests that most of the marks available come from only a few types of questions.*

Where Next?

- ***Chapter 9: Effective Study***
- ***Chapter 10: Maths***
- ***Chapter 11: English Literature***
- ***Chapter 12: Wrap-up***

---

[41] https://isaacphysics.org/pages/syll_map_chem

[42] https://isaacphysics.org/pages/syllabus_map

[43] In particular, check out https://www.khanacademy.org/science/chemistry

[44] https://isaacphysics.org/chemistry

[45] The textbook is only £1 + P&P (which barely covers their costs!)

[46] Don't worry if you don't understand these terms - they're just here as an example!

[47] Again, you might not understand these examples. But don't worry, you don't need to!

[48] This also demonstrates that you understand the topic of the question. If you're concise, you can't just write a lot just hope that something is relevant!

Wrap-up

Congratulations on reaching this chapter! If you've read even a few of the chapters before this one, you've probably acquired new tools for effective study. That means you can be at the top of your game, whether your goal is to do well in exams or to explore a new subject.

In Part 1, we looked at motivation, mindsets, and goals. These are key tools to get you *wanting* to study.

Then, in Part 2, we talked about getting down to work. We discussed how to get started and create the best study space you can.

It's great to get down to work. And it's often the hardest part of studying. But once you're sitting at your desk, it's important to work effectively. That's what we discussed in Part 3 - how to study *effectively.*

This is still the beginning: It will take some time to work out what study habits and techniques work for you, and you'll still have plenty of places to improve. (We all do!) But this book will always be here for you, and we hope you keep coming back to it and learning more.

We want this book to help as many students as possible. So, if you have friends who you think would benefit from reading this, please send them to our website! We also really want to hear what you think, so please feel free to send an email to hello@learnbetterathome.com with a quick review. We want to hear honest comments and feedback.

You can also **review** our book by sending just a few sentences about what you thought to hello@learnbetterathome.com. Please do this. It helps others and it helps us. You can do this in less than 5 minutes.

Your journey has just started. We wish you every success.

You can find more resources for free at learnbetterathome.com/resources.pdf.

Bonus Chapter: Discovering Your Subjects

If you want to get good at a subject, it's usually helpful to have some understanding of what that subject *is* - what it *involves*. And, when studying, it can really help to enjoy your subject.

'But how can I do this when it's so *boring*?' you might wonder. It's true: Exam courses are often not exactly *fascinating*. But if you look a little bit beyond them, there's usually something you can find that can get you interested in any subject[49].

To do this, it might be worth talking to your friends or teachers about what they enjoy about a subject. You could also check out YouTube videos and other online resources that explore fun and interesting parts of the subject. These areas might be missed at school.

As well as these, there are plenty of good 'popular science' books, which you can use to explore some of the most interesting parts of scientific subjects without needing advanced knowledge.

You might find some surprises. And you might also get some tips on how your subject can be learned more effectively - even if you thought you were hopeless at that subject.

Maths is quite possibly the *most misunderstood* academic subject, at least out of the subjects you might study at school. So we'll use maths as an example. By looking at what maths really is and how it's misunderstood, we'll arrive at a new perspective.

If you don't much like maths, or don't think you're a 'maths person', **please read this part**. We think it will be especially helpful for you.

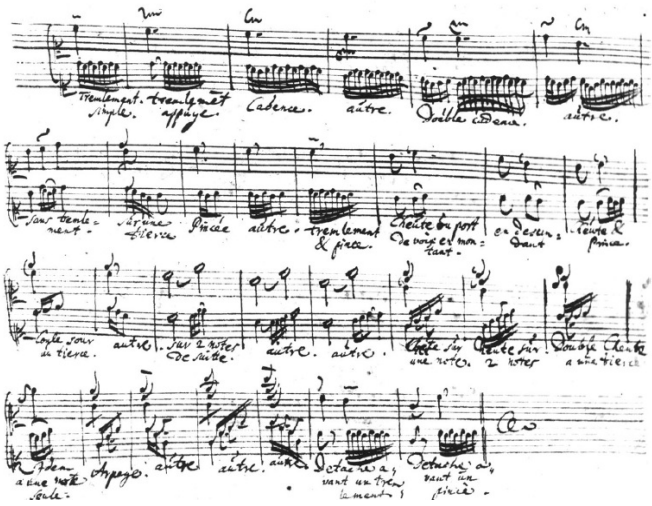
But the idea of digging deeper into your subject isn't specific to maths. If you can really find out what *any* subject is about, you're much more likely to appreciate it and learn more effectively.

What is maths?

Maths is beautiful, useful, and learnable.

There - I said it. But maybe you don't believe me. And I wouldn't blame you.

Beautiful?



(Source: Wikimedia Commons)

Here's a part of JS Bach's Clavier-Übung, considered one of his greatest works for the organ. It is a very beautiful piece of music - but you would have no idea of that just by looking at this picture!

And if you haven't read music before, the picture just shows a load of lines and squiggles, along with some difficult-to-read handwriting in another language. No society would dream of teaching music just by getting kids to read and write dots and squiggles on a piece of paper. You have to hear it to appreciate it.

And yet this is exactly how we are often taught maths in school.[50] I don't really blame teachers for this. The exam syllabus just doesn't leave much time for real maths. Instead, we're asked to draw lines and squiggles, following a set of rules and methods. We're also

asked to do plenty of calculations, which turn out to be less and less relevant the further you go in maths.

But this isn't what maths is about. As research-mathematician-turned-maths-teacher Paul Lockhart points out, maths is about creating something in your imagination, then seeing what it means and what it does:

> Even the most carefully made physical triangle is still a hopelessly complicated collection of jiggling atoms; it changes its size from one minute to the next … That's just not simple, and consequently it is an ugly question which depends on all sorts of real-world details … The mathematical question is about an imaginary triangle … The edges are perfect because I want them to be - that is the sort of object I prefer to think about … You have endless choices; there is no reality to get in your way.
>
> On the other hand, once you have made your choices (for example I might choose to make my triangle symmetrical, or not) then your creations do what they do, whether you like it or not. This is the amazing thing about making imaginary patterns: they talk back![51]

Here are pictures of two vegetables: the common cauliflower and the not-so-common Romanesco. In some ways, they're different. They are each a different colour, and the Romanesco has a more spiky structure than the cauliflower.

But in other ways, they are the same, or at least similar. Their *natural* designs are very mathematical. The florets of both vegetables resemble 'fractals' (which means they appear the same at different levels of 'zoom').

When we slowly zoom into each vegetable, it can be difficult to know at what scale we are looking. Each ‘module’ (section) of cauliflower is similar to the entire cauliflower.

What is the scale of each image? We can only really tell because of the image quality!

Fractal design is deeply rooted in mathematics, and - as is evident here - in nature. Not only are these shapes beautiful for how they look, but mathematics is beautiful for being able to describe such detailed phenomena.

It's not just vegetables: pinecones, tree branches, shells, and galaxies all follow some form of mathematical pattern.

Take the Fibonacci sequence:

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, …

It's a simple sequence. Just start with "1, 1", and get the next number by adding the two previous numbers:

1, **1**, 2

1, **1**, **2**, 3

1, 1, **2**, **3**, 5

1, 1, 2, **3**, **5**, 8

1, 1, 2, 3, **5**, **8**, 13

…

This sequence describes how branches split as a tree grows, the size of the swirls of a shell, and even how spiral galaxies appear.

Nature is beautiful, and maths describes nature. But maths has much more beauty to offer: the elegance of a simple proof, the simplicity of revolutionary results, or the amazing effectiveness of applied maths in the physical world. Try to see the beauty in maths.

Useful?

Amazingly, this imaginative art often turns out to be incredibly useful.

I won't lie: There are some things you'll learn in maths at school that you'll probably never use again. (I'm looking at you, circle theorems!) But a lot of mathematical concepts are much more useful than you might think.

For example, here's the sort of question that someone might explore for fun in maths.

> Suppose you place a grain of rice on the bottom-left square of a chess board, then fill in each square with twice as many grains of rice as in the square before, so that the 2nd square has 2 grains, the 3rd square has 4 grains, and so on.
>
> How many grains of rice will you need to complete this pattern across the whole board?

(This picture is of wheat grains, but it's showing the same principle! Source: Wikimedia Commons)

You might not think you'd need much rice. You only started with 1 grain, after all. But, in fact, you'd need an astonishing **18,446,744,073,709,551,615 grains** of rice. That's a *huge* number! If a grain of rice weighs 0.02 grams, then this amount weighs **368,934,881,474 metric tonnes** - more than twice the estimated mass of Mount Everest.[52]

Let's take a look at the number of grains of rice needed for each square of the chess board.

Square 1 needs just **1** grain of rice.

Square 2 needs 1 x 2 = **2** grains of rice.

Square 3 needs 1 x 2 x 2 = **4** = 2^2 grains of rice.

Square 4 needs 1 x 2 x 2 x 2 = **8** = 2^3 grains of rice.

Square 5 needs 1 x 2 x 2 x 2 x 2 = **16** = 2^4 grains of rice.

If we keep going, we can find out how many grains we would need for last square of the chess board:

$$1 \times \underbrace{2 \times 2 \times \ldots \times 2 \times 2}_{63 \text{ times}}$$

So the last square *alone* would contain 2^{63} grains of rice: that's 9,223,372,036,854,775,808 grains, or, at 0.02 grams per grain of rice, a little over the mass of *Everest*!

But why am I telling you about this? How is this remotely *useful*?

Forget rice grains. Let's talk about people infected with a virus. Believe it or not, the mathematical principle of exponential growth that we just discovered can be used to learn about pandemics!

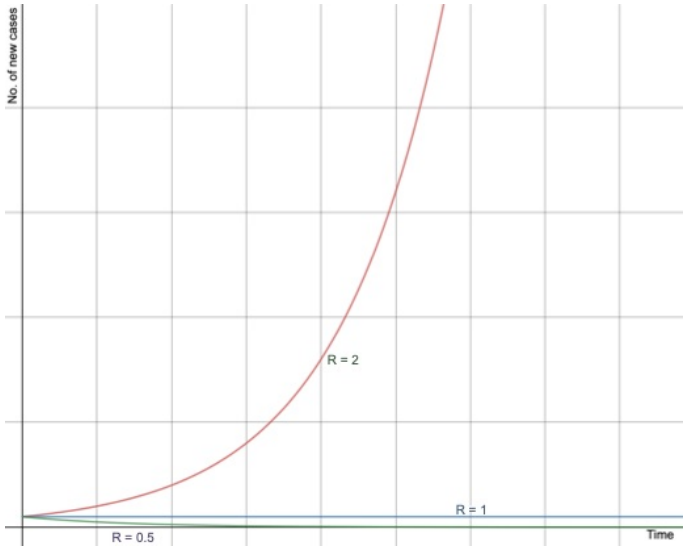
If you've been reading about the Coronavirus, you might have heard of a number called the *R*-value: it's basically an estimate (a good guess) of how many people someone infected with the virus will infect. And the number of people with the virus grows in a very similar way to the number of grains of rice on that chess board. It starts small but quickly becomes *huge*.

Before travel restrictions were introduced in China, the *R*-value was about 2.38: a person who had the Coronavirus was expected to infect 2.38 people[53]. You might not know if you have it. But that doesn't stop it from spreading fast and killing people.

Why? Picture the chess board again. Imagine that each grain of rice is instead a person with the Coronavirus. In the first square, we have just 1 new person infected, but in the tenth square alone we have over 1000 cases, and in the twentieth alone we have over a million! In our chessboard story, we have a rice mountain heavier than *Everest*. And right now (at the time of writing), we have over 3 million confirmed cases around the world[54] of a virus that started in one Chinese city![55]

Understanding this is not just interesting. It's vital in containing the disease.

The outbreak of Coronavirus looks a bit like the curve labelled 'R = 2' in the diagram below. Think of that curve as showing the number of new cases of the virus at any given time. In the real world, things are a bit more complicated, but this is a decent way to get an idea of how quickly the virus spreads.



When R is exactly 1 - that is, when each person infects, on average, exactly 1 other person - the number of new cases at any time is constant. Imagine putting 1 times as many grains as rice in each square as you put in the square before. You'd just keep putting the same number of grains of rice in each square.

When R = 0.5, for every 2 people who had the virus only 1 more is getting infected. It's like we're moving backwards through the squares in our chess board: each square has *half* as much rice as the square before. The amount of rice in each square gets small *fast*: in 64 steps, you've gone from *Everest* to a single grain! If R = 0.5, the number of new cases would eventually be so small it would be almost 0. That's why you can barely see the curve labelled 'R = 0.5'.

So here's the key: If we want to get rid of the Coronavirus, we have to find a way to reduce *R*: the expected number of people infected by each person with the virus. If *R* is below 1, the number of new cases tends to 0, but if it's greater than 1, it spreads *dangerously fast*. If people had really realised *just how fast*, they would probably have taken 'social distancing' measures much more seriously than they did.

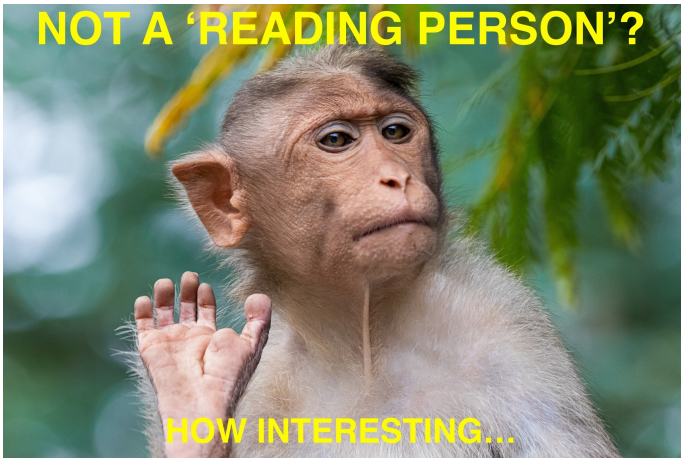
In China, the government introduced control measures including travel restrictions. By severely limiting the spread of the virus, the *R* value fell to about 0.98[56]. That's not far below 1, but it still meant that the new number of cases was *going down, rather than going up.*

So the story about a chess board wasn't just surprising. It taught us something *crucial* about the real world.

Maths saves lives.

It also powers computers, physics, chemistry, economics, and so much more.

Somehow, this beautiful process of the imagination has the power to explain things about the real world.



(Photo credit: Syed Ahmad on unsplash.com.)

So maths is beautiful and useful. But you still might wonder if *you* can learn it.

I don’t blame you. In the West at least, we’re very keen on putting people in boxes. Here’s the story you’ve probably been fed. There are ‘maths people’, who dance with algebra and solve calculus problems in their sleep. (They are a few, and they’re usually nerds. Why would you want to be one, anyway?) And then there are ‘the rest of us’, who hate(d) studying maths. We aren’t cut out for it.

I’m pleased to tell you that this is **wrong**. But this claim about maths has been repeated so often (“I’m not a maths person either!”) that it might seem natural - obvious, even. So let’s see just how absurd it sounds when we change things up a little. Imagine if someone said this instead:

> You know, I'm just not one of those **reading people.** I'm terrible at reading. I just don't get it. All those squiggles on the page are so confusing! Anyway, who cares? Why would I want to be able to read? Reading is for nerds with no friends!

Whoever said this would get an incredulous stare. To anyone in a literate society, it just sounds ridiculous. Why? It's not because the person who said this struggled with reading. If you think reading is easy, try picking up Shakespeare or Chaucer, or maybe a book in a foreign language.

They'd get a stare because they thought it was *OK to give up on reading just because they found it hard*. They'd get a stare because they thought they could just say they weren't a 'reading person' and stop there.

This example isn't meant to mock illiteracy. Reading is anything but a 'naturally easy' process. A lot goes on, from seeing some squiggles on a page to understanding abstract concepts and tiny nuances. But we expect people to be able to do it.

And, gradually, we've got better at realising that people can struggle with reading. And that's OK. For example, more and more people are understanding that dyslexia can make reading difficult but that dyslexic people certainly aren't any less intelligent.

Why shouldn't it be the same with maths? Many parts of maths are anything but naturally easy, and plenty of people struggle with the

subject (including professional mathematicians!). Albert Einstein famously said: 'Do not worry about your difficulties in Mathematics. I can assure you mine are still greater.'[57]

But the person who gives up on reading because they're not a 'reading person' gets laughed at. The person who gives up on maths because they're not a 'maths person' gets cheered on. "I'm not a maths person, either!" say the people around them. This makes no sense! Sometimes even parents say this, but this isn't the first mistake parents will make…

You might reply: 'But plenty of people can't do maths, and no-one I know can't read!'

There are, unfortunately, still plenty of illiterate people in the world. If you don't know anyone who can't read, that just shows how effective we've been at reducing illiteracy!

And we definitely didn't get there by telling people that it was fine to be unable to read. We didn't separate people into 'reading people' and 'the rest'. That would just be stupid. If someone couldn't *yet* read, why would we assume that they *never* could?

We told people that they *could*, not that they *couldn't*.

So why do people think they 'can't do maths'?

Well, aside from the indoctrination from society, there's something else: perhaps more than any other subject, maths builds upon itself. That means that you won't understand algebra if you

don't understand something about numbers, and that you won't understand calculus (e.g. differentiation) if you don't understand something about algebra. Here's what Steven Pinker, Professor of Psychology at Harvard, says about this:

> Mathematical concepts come from snapping together old concepts in a useful new arrangement. But those old concepts are assemblies of still older concepts. … Just as … recipes say how to make sauces, not to grasp spoons and open jars, mathematics is learned by fitting together overlearned routines. … **Mathematics is ruthlessly cumulative, all the way back to counting to ten.**[58]

So this means it's not easy to get good at maths. But it also suggests that, if you've been frustrated about 'not being a maths person', you were probably just not quite confident with something more basic than the thing you're trying to learn. For example, if you didn't understand addition, it would be very hard to get your head around multiplication!

Another example: Maybe you're struggling to apply the properties of logarithms correctly. You might think you're being stupid, and tally this difficulty as more evidence that you're 'just not a maths person'. But it's quite possible that you just never quite understood how powers (exponents) work. If, for example, you don't understand why $2^x \times 2^y = 2^{x+y}$, it would be difficult to understand why $\log_2(ab) = \log_2(a) + \log_2(b)$. (If you haven't seen logs yet, don't worry about this notation.) If you don't understand *why* logarithms have the properties they do, then it's not at all

surprising that you're making mistakes in applying those properties.

You could give up. Or you could try to understand the underlying building blocks. For example, if you're struggling with calculus, go back to algebra. Figure out what concepts you don't properly understand and what techniques you haven't really practised enough. Then work to fix them: Understand those concepts and practise those techniques. Self-honesty is hard, but it pays off.

Don't blame yourself for taking time to understand and practise new things. And certainly don't blame yourself for having thought you weren't a 'maths person'. It's so easy to do that when the people around us think they aren't 'maths people' either. But now you know better, and you're ready to act.

Now you face a choice: Do you give up, or do you push yourself to *become better*?

Mathematical ability isn't fixed. Instead, it's something you can improve. (Think about it: if mathematical ability couldn't be improved, why would we spend so much money on teaching kids maths?) *See also* ***Chapter 3: Mindset***.

You might still doubt yourself, and still find yourself wondering from time to time if you are 'a maths person'. You're not in total control of how you feel, but it can really help to think of your feelings as something you *have*, not something you are *(more in* ***Chapter 2: Dealing with Motivation*** *)*. Accept these emotions, but recognise that they can be unhelpful.

One last thing here: If you don't understand very difficult writing like Chaucer, then that doesn't mean you *can't read!* Similarly, you don't have to be the very best at maths or immediately able to prove breakthrough results in order to be capable in the subject. So try not to worry if you think others are doing better than you. Just keep exploring, learning, and improving.

Quick Task #12

Find a subject you don't really enjoy. Search for a YouTube video about something interesting in that subject, then watch it. ***Yes, we're really telling you to go watch YouTube!***

Summary

You're more likely to study effectively in a subject if you find that subject interesting. To do this, it helps to 'dig deeper' into the subject, which you can achieve by talking to friends and teachers, looking online, or reading popular science books.

For example, many people hate(d) maths and think that they are not 'maths people'. However, maths is in fact beautiful, useful, and learnable:

- ***Beautiful**: Maths is a form of imaginative art. You get to create patterns, but they 'talk back' (Lockhart)!*
- ***Useful**: The patterns that mathematicians create often turn out to be incredibly good at describing the way the world actually is.*
- ***Learnable**: There is no good reason to think you're not a 'maths*

person' or that you can't improve in the subject.

Where Next?

- ***Chapter 2: Dealing with Motivation***
- ***Chapter 6: Routine and Planning***
- ***Chapter 10: Maths***

---

[49] This 'reading around your subject' also happens to be very useful in getting accepted at the UK's top universities.

[50] I owe the analogy between maths and music teaching to Lockhart, Paul. 2009. *A Mathematician's Lament*. Accessed May 22 2020. https://www.maa.org/external_archive/devlin/LockhartsLament.pdf. pp.1-2.

[51] Ibid. (see previous footnote), p.4

[52] "How Much Does Mount Everest Weigh?". *Weight Of Stuff*. Accessed May 22 2020. https://weightofstuff.com/how-much-does-mount-everest-weigh/.

[53] Li, Ruiyun, Sen Pei, Bin Chen, Yimeng Song, Tao Zhang, Wan Yang, and Jeffrey Shaman. 2020. "Substantial Undocumented Infection Facilitates The Rapid Dissemination Of Novel Coronavirus (SARS-Cov-2)". *Science* 368 (6490): 489-493. doi:10.1126/science.abb3221.

[54] "COVID-19 Map". 2020. *Johns Hopkins Coronavirus Resource Center*. Accessed May 08 2020. https://coronavirus.jhu.edu/map.html.

[55] In fact, since 2.38 is greater than 2, Coronavirus was growing in China at a faster rate than the grains of rice on our chess board.

[56] Li et al., *Substantial Undocumented Infection*

[57] Einstein, Albert, and Alice Calaprice. 2002. *Dear Professor Einstein*. Amherst, N.Y.: Prometheus Books.

[58] Pinker, Steven. 1997. *How the Mind Works*. Harmondsworth: Penguin. p.341

Acknowledgements

We are grateful to the following people for their thoughts, ideas, and feedback:

Anagh Agarwal, Ceri Ellis, Louise Flatters, Paul Goldsmith, Lucy Hampton, Katherine Holdsworth, Aideen Landers, Sophie Oestergaard, Toby Noskwith, and Walter Wallich.

We also hugely appreciate the hard work of Marketing Director Sophie Oestergaard and Graphic Designer Li Ho Kan, who designed the cover of this book.

Thank you to our teachers and parents for all their support over the years.

About Us

Peter

I'm a 2nd-year undergraduate student at the University of Oxford. I study Philosophy, Politics and Economics (PPE). For these subjects at Oxford, you do a lot of the learning on your own. For example, I might be given a philosophy essay title and a list of reading suggestions. I'd then read and learn about the topic on my own, write up my essay, and *after that* discuss the essay and the topic with my tutor (an academic). I hope that this has made me better at effective self-study.

Before university, I studied A-levels in Maths, Further Maths, and Economics, as well as a Pre-U (A-level equivalent) in Philosophy and Theology. I realised I wanted to study more maths, so I decided to pick up Further Maths several months into the course (talk about indecisive!). That meant that I ended up teaching myself about 40% of the Further Maths course. In the end, I got an A*, including a perfect score in one of the modules I taught myself. Is it because I'm a mathematical super-genius? Spoiler: I'm not. It's because I found ways to self-study effectively.

I also like to learn new things in my spare time, and recently have learned some more maths using MIT's OpenCourseWare.

Scarlett

Scarlett

I'm also a 2nd-year undergraduate studying PPE at Oxford (though I'm now focussing on Politics and Philosophy, yay!). Especially with Politics, I find that we're often pointed towards huge amounts of information which we have to read, understand, consolidate, and produce an essay on, in a very short amount of time. This has meant I've had lots of practice when it comes to many of the skills involved in self-teaching.

Before coming to Oxford, I completed A-level courses in Maths, English Literature, and Chemistry. I also studied Psychology to AS level. Due to a variety of issues, both in my private life and connected with the teaching at my school, I spent a lot of time working towards my GCSEs and A-Levels without much support. Trust me, I know the struggle!

I hope to be able to impart a couple of bits of (amateur) wisdom related both to self teaching towards an exam, and more generally cultivating interests that rely heavily on personal motivation. Every little helps!

Tom

I'm in my second year studying Materials Science (which is a mashup of Physics, Chemistry, Mathematics, and Engineering) at the University of Oxford. I'm fortunate enough to have a lot of timetabled lectures, tutorials, and practical sessions. And it's important that I understand, fundamentally, why materials behave the way they do. So I spend a lot of time reading textbooks,

research papers, Wikipedia, and watching (mostly educational) Youtube videos!

My self-study experience spans more than my university career. I've invested a lot of time into online computer science courses and otherwise teaching myself to write code effectively. I also taught myself Further and Additional Mathematics at GCSE, as well as some A-Level topics/modules and my Extended Project Qualification. (I'd recommend getting involved with one if you can - I found it to be a great way to develop self-study skills.)

Tejas

I am a second year Physics student at the University of Oxford. I've enjoyed self-studying since high school, so much so that I quit school in Year 11 (aged 16) and decided to completely teach myself the stuff that I wanted to learn! I spent a lot of time on MIT's OpenCourseWare and solving problems from exams around the world. (The internet is a free place!) Doing this for two years really helped me improve my self-learning skills, and I hope I can share some tips here.

I initially did Physics, Maths, and Computer Science at A-level, alongside similar AP exams (US qualifications). After my interviews I ended up getting a place to study at Oxford, subject to the condition that I get an A* grade in either Maths, Further Maths or Physics. I happened to get an A grade (lower than A*) in both Maths and Physics, mostly because I was a bit new to the system and didn't know how to present answers well in the exam.

The University was strict on the requirement - so they asked me to do **further** maths and get an A*! This was a bit scary at first, since that meant I had to somehow learn an entire A-level subject in about 2 months! It turned out I could actually do it, and I ended up with a pretty convincing A*. This experience was hard, but rewarding, and I hope to share some of the things that I learned then!

Quick Tasks

Quick Task #1

What is your main motivation for reading this book? Think about it for a minute, and then write down your answer. Try to sum it up using as few words as possible.

Quick Task #2

Pick something that motivates you. Go through the three-step process to strengthen that motivation:

- *Understand it*
- *Feel it*
- *Remember it.*

Quick Task #3

Do something you find hard for 10 minutes - whether it's maths, reading a book, practising the trombone or doing handstands. It doesn't matter what it is. It only matters that you struggle and you learn - because in your growth mindset you like a challenge, after all.

Quick Task #4

If you're feeling more motivated than usual (your motivation is spiking), come up with three goals. Draw out the Spectrum of Goals, like in our

geography example, and place them in the position where you think they sit on the spectrum.

For each goal, go through the 3-step process to strengthen your core motivation:

- ***Understand** it.*
- ***Feel** it.*
- ***Remember** it.*[60]

If you're feeling less motivated than usual right now, that's OK. Come back to this task another time.

Quick Task #5

Look to the past and identify a time when things have gone wrong for you - a time when studying has been difficult. Try to answer these questions:

- *What was the cause of the setback?*
- *How did you deal with the situation well?*
- *How could you improve your response to this setback if it happened again?*

Quick Task #6

Let's make a simple schedule:

1. *List all the things you want to get done today*
2. *Rank them by priority*
3. *Bonus: Guess how long each task will take. How close were your guesses?*

Quick Task #7

Choose one of the 3 methods of getting started (Pomodoro, Take 20, or Chunks):

- *Give it a go!* :)

Bonus: Repeat this quick task for the other two methods! Which was your favourite?

Quick Task #8

Make a list of 5 things that distract you. See how many you can avoid (get rid of) next time you're studying.

Quick Task #9

Explain the 5 stages of effective study to someone who hasn't read this book.

Quick Task #10

Pick a mathematical technique and teach it to one of your parents / guardians. What do you notice about this experience? Was it easy or difficult?

Quick Task #11

Find a past exam question on a text you have studied. Take 5 minutes to write down some ideas that pop into your head. This can be a first step towards planning great exam answers. (Feel free to skip this if you've just started studying English literature.)

Quick Task #12

For any science subject you're studying, grab a pen and paper. Make a list of:

- *your top 5 online resources*
- *the 3 most important concepts you need to remember*

Quick Task #13

Find a subject you don't really enjoy. Search for a YouTube video about something interesting in that subject, then watch it. ***Yes, we're really telling you to go watch YouTube!***

---

[60] This task might look familiar if you've read Chapter 2, but it's subtly different: Here, we're doubling down on goals and talking about how to motivate yourself specifically to pursue those goals.

Appendix 1 (Problem-Solving in Maths)

Problem-solving is an important skill - not just in maths, but in life in general. As we've seen, mathematics can be beautiful, but it's certainly true that its problems can seem intimidating.

Sometimes, simple-looking problems are much harder to solve than they seem. But often the opposite is true. A problem that looks almost impossibly difficult is in fact solvable with a little bit of thought and effort.

Whether you're studying for a maths exam or learning maths for any other reason, you'll want to be able to solve problems that look hard. This is true in other subjects too, but we'll use a mathematical example[59]:

> Let x be the smallest whole number whose digits sum to 2020. Is the first digit of x divisible by 2?

This looks quite intimidating, but let's break apart this question. That way, we can see that it's not too hard to solve after all.

We're looking for a whole number whose sum of digits is *2020*. What does that mean? The sum of digits is what you get when you

add together each digit in the number. For example, the sum of digits for the number *465* is *4 + 6 + 5 =* ***15***. But we're not looking for just *any* whole number whose sum of digits is *2020*. It has to be the smallest possible one.

How could we find this number?

Well, the first thing we could try to do is to minimise the number of digits we use. More (non-zero) digits will give us a larger number - for example, *422* is bigger than *99*.

The largest digit we can use is *9*. The more *9*'s we can use, the fewer digits we will need. For example, *99* and *333333* both have digits that sum to *18*, but *99* is much smaller than *333333*.

How many *9*'s would we need to reach 2020? We can find this out! By dividing *2020* by *9*, we can see that *2020 ÷ 9* is *224 remainder 4*. That is:

$$4 + \underbrace{9 + \ldots + 9}_{224} = 2020$$

So x will have digits *4, 9, 9, 9, ...*

But where should the *4* go? For x to be the smallest whole number whose digits sum to *2020*, we need the *4* to be the first digit, since (for example) *4999999999999...* is smaller than *999999949999...*

Our question was whether the first digit of x is divisible by *2*. We now know that the first digit is *4*, and, since *4* is divisible by *2*, we can answer **yes**: The first digit of x is indeed divisible by *2*. Problem solved!

How about something harder? Let's try this challenge:

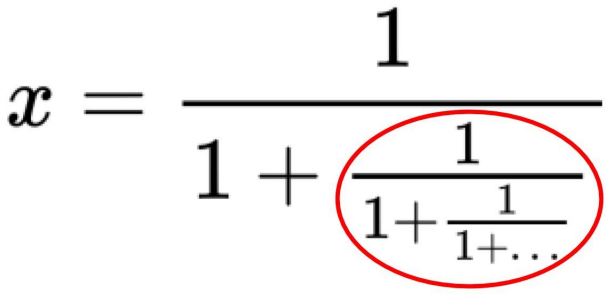
$$x = \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1 + \ldots}}}$$

> Find the value of $x^2 + x$, giving your answer as a whole number.

This looks quite intimidating. We're given just one equation and asked to find the value of an expression. The equation involves a fraction - but probably one unlike any you've seen before, since it's infinitely repeated. And yet we're asked to give this expression as a single whole number.

You could just stare at this infinite fraction and give up before you'd even started.

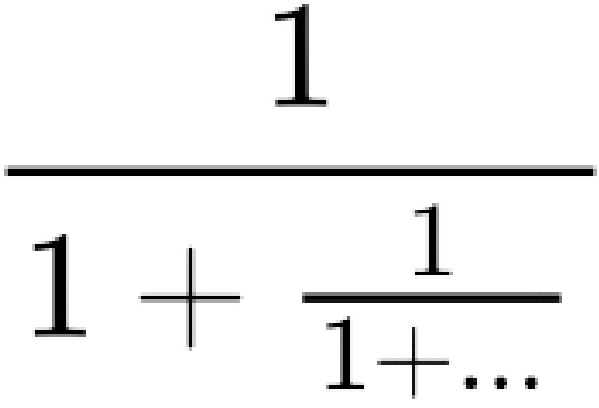
Or you could play around a little. I've drawn a ring around something that looks interesting.



Take a look first at the whole fraction to the right of the '=' sign, and then at the bit I've drawn a ring around. Notice anything?

It turns out the two are exactly the same fraction!

You might wonder how this could be, given that the fraction in the ring is *part of* the fraction *x*. But remember that this fraction is infinitely repeated. That means that these two fractions are identical.



Here's one version.

$$x = \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1 + \ldots}}}$$

Here's another version.

I've just written out slightly more of the fraction on the right than the one on the left.

With this key fact in hand, we can see:

$$x = \frac{1}{1 + x}$$

Multiplying both sides of this equation by $(1 + x)$ gives:

$$x(1 + x) = 1$$

But $x(1 + x)$ just means that we take x and multiply it by $(1 + x)$. We know that multiplying x by 1 gives us x, and that multiplying x by x gives x^2, so multiplying it by $(1 + x)$ will give us $x^2 + x$.

And $x^2 + x$ is exactly what we were asked to find! So our answer is just ***1***.

This is just one example of a mathematical problem that looks scarily intimidating, but is actually far from impossible to solve.

In these cases, your immediate reaction to a problem can scare you out of making any progress. Try not to panic when you see a question, even if it looks hard. Think, 'Can I remember anything about that technique / topic?'

Instead of doubting yourself, try to pause and ask yourself some simple questions:

- *What information have I been given?*
- *What do I want to find / show?*
- *What can I find out?*

Answering these questions can take you surprisingly far.

If you would like to try some more challenging problems, it's worth checking out 'UK Maths Challenge' or olympiad papers. I (Tejas) also recommend Paul Zeitz's 'The Art and Craft of Problem Solving' as a first book. This is usually what interested high school students read as a first introduction to problem solving, and it has lots and lots of fun problems!

---

[59] Adapted from UK Mathematics Trust's Junior Mathematics Challenge, 2019, Question 10

Appendix 2 (Analysis in English)

The 'Macro' and 'Micro' of English Literature

The macro

English literature exams usually ask you about a general topic and applied to a specific text. Usually, you'll be expected to justify your answers with broad comments as well as detailed analysis. I'm going to think about understanding a text in relation to how you might go about answering such an exam question, in order to demonstrate the kind of knowledge you're going to build and the skills you'll develop.

> **Example**: '**Othello**' **– William Shakespeare**
>
> "'Ultimately it is hard to see Emilia as anything other than a tragic victim of male power and malice.'
>
> To what extent do you agree with this view?
>
> Remember to include in your answer relevant comments on Shakespeare's dramatic methods. [25 marks]"[60]

This gives an indication of the kind of approach you'll take when considering the macro elements of a question. In this case, you might consider the general portrayal of men and women across

the play, the context within which it was written, whether you think Shakespeare intended to make any such statement, and how Emilia relates to the other characters.

Any claims you make (e.g. *'the manipulative interactions between Emilia and her husband Iago, portrays her role as that of a tragic victim'*), will be quite broad. You will then go on to justify these claims with reference to textual evidence. As well as the position of that evidence within the larger narrative. Remember that in this example, the question is closed-book, meaning you'll have to memorise any quotations you use. Don't panic! This is where revision will make all the difference.

With this particular question, you would also have to be comfortable with the historical notion of Shakespearean tragedy. When exploring a set text, it's essential to have a clear understanding of any literary movement or genre it might be a part of.

Other macro considerations include: how a character or section might function as a plot device, repeated imagery connecting different parts of the text, and what points the author might be trying to make (with reference to the intended audience or historical context).

The micro

When you've thought about these things and developed an argument, you're going to have to do some close textual analysis in order to back it up. My bet is, if you're looking to study English

at a higher level, you're not building this skill from scratch. Let's remind ourselves of what kind of thing you're doing in micro analysis.

Example*:*

Compare and contrast the presentation of love in the following poems.

Whoso list to hunt

Whoso list to hunt, I know where is an hind,
But as for me, hélas, I may no more.
The vain travail hath wearied me so sore,
I am of them that farthest cometh behind.
Yet may I by no means my wearied mind
Draw from the deer, but as she fleeth afore
Fainting I follow. I leave off therefore,
Sithens in a net I seek to hold the wind…
Sir Thomas Wyatt (1530)

She Walks in Beauty

She walks in beauty, like the night
Of cloudless climes and starry skies;
And all that's best of dark and bright
Meet in her aspect and her eyes;
Thus mellowed to that tender light
Which heaven to gaudy day denies…
Lorde Byron (1814)

I've chosen an unseen poetry question to really hone in on language analysis, as context is less relevant in this case. However, you'll need to use micro skills for all types of English Literature exam questions. This is especially true, as mentioned above, when justifying general claims about a set text. When doing this in an essay, you're going to want to blend macro and micro analysis together: moving between the two to demonstrate different levels of understanding.

As you can see with this example, any seamless movement is going to be between the two different poems, rather than between macro and micro features. Try to engage in the language analysis of one of them, then compare and contrast how similar/different techniques might be used in the other. Relate any points you make to the question as much as possible.

For example:

Wyatt's poem describes the speaker's love as a violent and desperate pursuit, describing a failing 'hunt' for a wild hind (deer). As the verse progresses, the pursuit seems increasingly hopeless, and the woman less obtainable: described as like trying to catch the wind in a net. Byran also depicts what seems to be a withdrawn and untouchable object of love, but this is presented as emanating from the woman's inherent perfection, rather than the speed at which she 'fleeth'. Bryon describes an innate sense of unity inside his love herself, her beauty tapering the 'gaudy' light of day to something manifestly perfect. Far from the chaotic picture of a lusty deer hunt, 'all that's best' meets elegantly in her 'aspect'…

This 'picking apart' is the kind of thing you might do with any English Literature question. Make a point, related to your general line of argument; back it up with analysis of language, rhythm, rhyme etc; compare to a similar point about another poem. In a question that isn't asking you to analyse across two different texts, you might connect a point about one part of a text, with conflicting or corroborating evidence in another part. Try and structure your essay in this way: around clear and thought through general points about authorial intent, character portrayal, plot devices, and so on (depending on the nature of the question).

---

[60] *Mark Scheme – A-Level English Literature B – 7717/1A – June 2018*. 2018. Accessed 22 May 2020. https://filestore.aqa.org.uk/sample-papers-and-mark-schemes/2018/june/AQA-77171A-W-MS-JUN18.PDF.