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Business and maths – what’s the link?

Intended learning outcomes

By the end of your work on this chapter you should:

- understand why anyone aiming at a business career needs to be reasonably proficient in certain areas of mathematics
- have had a chance to reflect on your previous experiences of studying mathematics, and on the strengths and weaknesses of your personal learning style
- have begun to develop your skills at reading about and writing mathematics
- be aware of the use and limitations of spreadsheets and calculators when carrying out mathematical processes.

1.1 Why do I need this book? Business without maths

When you learned that maths – possibly disguised as something like ‘Quantitative Methods’ – would form part of your business or management course, I wonder if like many students you found yourself thinking, ‘Why on earth do I have to do that?’ Let’s see if I can convince you that successful business people really do need to be comfortable with maths.

Just try to imagine for a moment what it would be like to set out to run a business without using any mathematics – in other words, any numerical information. For a start, you would not be able to run your business legally, since all registered companies (in the UK at least) have to file accounts once a year with Companies House. You would not be able to measure how well the business was doing, except in a vague, impressionistic sort of way. You would probably not even be able to get the business started, because financial support for new businesses from lenders depends on business plans – and business plans contain forecasts, budgets, estimated dates when the company will break even, all of which need to be expressed in mathematical terms.

Now you may be thinking that you don’t have any ambitions to start your own business, or to be a chief executive. You’re more interested in working in a particular business function. It’s easy to see why maths is important for someone intending to work in a technical area – accounting, say, or engineering – but perhaps your aim is to go into a career in hotel or leisure management, food retailing or human resource management. Surely you can avoid working with numbers in those areas? And anyway, aren’t there specialists who can deal with any numerical work which does arise?

The quotes below, taken from the website <http://www.mathsatwork.com/real.html>, show how people working in those areas find that in fact they do need to use maths, and particularly arithmetic, in their everyday work.

From Debbie Adams, Senior Restaurant General Manager, Pizza Hut (UK) Ltd:

It is important to understand where our sales have come from each day and what they mean.

I need to understand average spend per customer or table, net and gross values of items, VAT calculations, and percentages (e.g. If we forecast sales of £1,000 and they actually total £1,277, the percentage increase). I also need to pay members of staff, calculating the numbers of hours worked, how much they get paid per hour, employees’ national insurance contributions, holiday pay, and any other benefits or deductions.

Analysing the business on a daily and weekly basis is key. For example, if we tell the company we think we are going to make £X and we come in under that, they aren’t going to be too happy.

I use simple maths, adding, subtracting, averages, ratios and percentages, but it is the understanding of maths that is a prerequisite of the job.

From Joe Dybell, Supply Chain Controller, Tesco:

I am the controller of the Tesco supply chain, therefore the role uses maths to calculate and forecast the company sales figures. This is then related to how we set up the

systems, by calculating how much stock to order and send, and informing the 24 distribution centres how much work they have to do on a daily basis.

As the answer is never right or wrong, I use maths to demonstrate improvements in sales, customer service level and wastage by week or by year.

My job is ideal for someone who enjoys numbers and playing with numbers. They need to be able to identify trends in complex information and then test theory to see if they hold true.

And from Tess Toole, working in human resources for the Royal Liver Insurance Company:

My job is to pay the 500 or so people that work at Royal Liver Building for Royal Liver Assurance. I basically gather together all payments and all deductions and input them into the computer system. The computer calculates the net pay for each person. This is gross pay less income tax, national insurance and pension contributions, if applicable. The money due to each person is automatically sent into their bank accounts and payslips are produced which I send out.

Maths is obviously a very large part of my job. I use it to calculate small sums to find out how much overtime a person is due and to calculate how much pension contributions a person would pay. I use it in the large and complicated calculations involved in manually calculating the whole of the employees' wages.

I won't pretend that I'm a maths genius and that I do all these sums in my head – of course I don't. For the amount of calculation that I do a calculator is a must. Knowing how to subtract, divide, get percentages and averages is essential regardless of whether or not a calculator is used. You have to know what buttons to press to get the answer you want!

As these quotes make clear – and as most people working in business would testify – there is hardly any area of business where mathematics can be totally avoided.

But don't worry: as these quotes also make clear, we are not talking about rocket science here. None of the people quoted would claim to be expert mathematicians. They are simply intelligent people who have put their mind to acquiring skills which are an enormous asset to them in their everyday work. There is no reason why you too should not acquire those skills; the aim of this book is to help you to do so. The rest of this chapter is intended to provide a foundation for your learning, by offering some ideas about effective ways to learn maths.

1.2 How to learn mathematics

Insight from the experts

There are some telling phrases in each of the quotes above, which can start us thinking about good and less good ways to learn about mathematics.

Debbie says, 'it is the understanding of maths that is a prerequisite of the job'. In other words, not just mechanically carrying out procedures, but understanding what you are doing and why you are doing it. More about this a bit later in the section.

Joe says, 'the answer is never right or wrong'. This is something which perhaps distinguishes maths used in a business context from the kind of 'maths for its own sake' you may have studied before, and which many students can find unsettling at first. Because we are dealing with practical problems, the calculated answer may not tell the whole story, or there may be a range of possible 'right answers' from which we must choose on business, rather than mathematical, grounds. Very often later in this book you will find that exercises don't end with a numerical answer, under which you can draw a neat line and wait for someone to tick it as correct; instead, you will be asked 'What does this mean in practical terms?' So you need to get used to linking the maths with other aspects of the problem, and using your knowledge of other business areas – and your ordinary common sense – alongside the mathematical techniques you've learned.

Finally, Tess says, 'I won't pretend that I'm a maths genius and that I do all these sums in my head ... You have to know what buttons to press to get the answer you want!' The advent of calculators and spreadsheet packages has taken a lot of the drudgery out of mathematics, but it certainly hasn't removed the need to understand what's going on. In fact, it is even more important now to have a 'feel' for the kind of answer you expect to get, so that you are not totally at the mercy of the machine. For this reason, you'll find sections called 'For Excel users' at the end of most of the chapters in the book, showing how the material of the chapter links to various Excel functions.



Pause for reflection

Decide whether you agree or disagree with the following statements (be honest!):

- My main objective in studying this course is to pass the assessment.
- I don't like just accepting what my lecturer tells me.
- I like to work things out for myself.
- Maths is all about knowing the right methods.

What kind of learner are you?

If you agreed more strongly with the second and third statements above than with the other two, then your approach to learning will stand you in good stead in your study of this course. Just listening to someone telling you things about mathematics (or for that matter, reading about them in a book) will never give you a really secure understanding of the subject. To achieve that you must try the ideas out for yourself with pen and paper, and think about what you are doing while you are doing it.

If you agreed more strongly with the first and last statements – well, there is nothing wrong in wanting to pass the assessment – you'd be silly if you did *not* want to pass! But

if you let ‘being able to do the questions’ rather than ‘understanding what’s going on’ drive the way you try to learn maths, you will never achieve a feeling of real confidence in your ability; and if you learn ‘methods’ in a mechanical way, you will be flummoxed by the first example you come across that isn’t exactly like one you’ve done before.

Most of you will probably feel that you don’t fall neatly into one or the other category. You’ll find some topics interesting, and want to get a deeper insight into the underlying ideas; other parts of the subject will stimulate you less, and you may feel that you just have to get on and plough through examples in the hope that ‘the penny will drop’ while you’re doing this, as it often does.

Nevertheless, throughout this book I will be seeking to reinforce the kind of learning that involves understanding, and to discourage the kind that reduces maths to formulae and recipe-like ‘methods’. You may find this irritating at times, but I promise it will pay off in the end.

Lose the label!

There is one other aspect of your study of maths which needs to be considered: your previous experiences of the subject, at school and maybe at college, in a professional training course or at work. Many people, by the time they start a higher education course, have already labelled themselves ‘bad at maths’, perhaps because they’ve been told this by a teacher, or because they have done badly in an exam. This happens with many subjects, of course – from the age of about seven I have carried an invisible label ‘bad at sports’ around my neck! – but it’s particularly prevalent with maths. It’s not unknown for public figures such as MPs to admit cheerfully that they ‘never could do sums’.

However, you need to throw away this label before we go any further. One of the main objectives of this book is to give you not just mathematical skills, but confidence in using those skills, and you will never gain that confidence while you retain the idea that you are ‘bad at maths’ in the same unchangeable way that you have blue or brown eyes, or are tall or short. In any case, the kind of maths we will be studying in this course is probably quite different from that which you have met before, in that it is ‘maths for a purpose’ and not just ‘maths for its own sake’. Many students find that concepts that made little sense when encountered in the abstract are perfectly easy to understand when they have a practical context.

So lose the label. If you had the ability (as you obviously did) to get on to your higher education course, then you have the ability to learn and understand this kind of mathematics.



Pause for reflection

Think about your earlier experiences of studying mathematics. Write down three things you enjoyed or were good at, and three that you did not enjoy or found difficult. Can you see anything that links the topics in the two groups? (For example, if you

enjoyed work with graphs, geometry, and statistical diagrams such as pie charts, this might indicate that you are someone who relates well to pictorial or visual ideas.)

Compare your lists with those of one or two other people in your learning group. How similar are they? If this suggests that there are common areas which everyone is anxious about, explore why this might be.

A short list of tips for studying maths

- Always have a pencil and paper to hand when you're reading a maths book or your notes, so that you can try out calculations, fill in gaps in mathematical arguments, and scribble down summaries of what you are reading in your own words. This is the only way you will get, to use a fashionable word, 'ownership' of the ideas you're reading about.
- Never let anything go past which you don't understand, in the hope that it will make sense later. Maths is a cumulative subject, in which one topic builds on another, so if you don't understand something today, that may well prevent you from understanding something more important tomorrow.
- Don't be afraid to ask about things you don't understand. Your lecturer will be pleased that you are making the effort, not annoyed because you didn't understand first time.
- Everyone – and I mean everyone – makes mistakes with maths – not major conceptual errors, but little slips in arithmetic. Don't lose faith in your lecturer when he/she does so! And if you find something in a textbook – including this one! – that you can't follow, don't immediately assume it's your fault, just possibly an error could have crept in. Textbook authors and lecturers are no more infallible than the rest of humanity.
- Most learning follows a spiral process, so don't feel that once you have learned something you should never need to revisit it. Often when you return to a topic you will find that your understanding is deeper, due perhaps to something else you have learned subsequently.

1.3 The language of mathematics

Many people feel that the fact that maths is generally written in a special language forms an obstacle to their enjoyment of the subject. This language tends to involve numerous symbols, rather than the English sentences that we are used to with other subjects.

It's certainly true that the language of maths, just like French or Russian, takes a bit of getting used to. But I'm sure that no one will have any difficulty in reading the statement $3 + 2 = 5$ as 'three plus two equals five'. The symbols $+$ and $=$ are familiar because you have known how to interpret them for a long time, and you understand that they are simply symbolic ways of writing 'plus' and 'is equal to'. In the same way, the other symbols that we will encounter are shorthand notations for other mathematical operations, and in time you will become as adept at interpreting them as you are today with $+$ and $=$.

I will try to make a point, every time we encounter a new piece of notation, of explaining how it should be read. This isn't just being pedantic; it is very hard to feel you really understand a concept when you don't even have a proper way of putting it into words. You'll also find a glossary at the end of the book – that's a list of all the terms and symbols used in the text, with an explanation of their meaning.

You can make your mathematical work a great deal easier to follow – both for anyone else who needs to look at it, and for yourself when you come to look back at it later – by making sure that you put in plenty of explanation of what is going on. You should be able to read well-written mathematics as you would ordinary English. So, for example, suppose that you want to write down the calculation of your wages when you have worked 35 hours at £8.80 per hour plus 5 hours overtime at £13.20 per hour. You could just write

$$35 \times 8.80 + 5 \times 13.20 = 374$$

(or indeed input the whole calculation straight into a calculator) and there would be nothing wrong with this, but to make it clearer what is going on, it would be better to write:

$$\begin{aligned} 35 \text{ hours at } \pounds 8.80 \text{ per hour} &= \pounds 308 \\ 5 \text{ hours at } \pounds 13.20 \text{ per hour} &= \pounds 66 \\ \text{So total pay} &= \pounds 308 + \pounds 66 = \pounds 374. \end{aligned}$$

It's true that in this simple case, you might not need so much detail, but the point I am making is that it never does any harm to put in more rather than less explanation.

Whatever you do, don't string together lines of mathematics with = signs between things which aren't equal – a common failing which can lead to a lot of confusion. For example, with the above calculation you might be tempted to write

$$35 \times 8.8 = 308 + 5 \times 13.2 = 66 + 308 = \dots$$

If you unpick this, it includes the statement ' $35 \times 8.8 = 308 + 13.2$ ', which is manifestly not true. Of course, it's not difficult to unravel what is meant, but nevertheless writing down untrue statements is not good practice, and in more complex situations can send you off in totally the wrong direction.

Get into the habit, then, of trying to read your maths aloud – if you can't do this, or if you have to resort to 'little three up in the air' or 'strange squiggly symbol' – you need to have another look at the way it's written.

One final point: like any other subject, maths has its own particular terminology, sometimes using words that will be new to you, sometimes using ordinary English words but in a special sense. Students sometimes get irritated by this. I have heard a student rep ask in a course committee why lecturers had to use so many long words, and why they couldn't use ordinary English. The answer, I'm afraid, is that while it's often possible to give a reasonable explanation of an idea in 'ordinary English', there are some concepts that simply have to be given a new name. And at the time when many of these concepts

were being invented, everyone who had been through higher education learned Latin and Greek, so the names tend to be derived from those languages, which is perhaps why they sound strange to us today.

For instance, the top of a fraction is known in mathematics as the *numerator* (we'll come across this term again in Chapter 2). OK, you could refer to 'the number on the top of the fraction' – but it might be a whole algebraic expression rather than just one number. So it is much more efficient to refer to the numerator – and once you know what it means, the term is no stranger than, say, 'television' – another word derived from Latin and Greek.



Pause for reflection

Write down as many symbols and technical terms as you can remember from your previous study of maths. Then try to define in words what each of them means.

Compare your list with those of other people in your learning group. Are there things on your list that aren't on theirs, or vice versa? If so, explain to each other what the unfamiliar ones mean. If you are doubtful about any of them, check your understanding with your tutor.

You should now be aware that you already have quite a wide 'mathematical vocabulary', which will give you a good start for your further study.

1.4 Spreadsheets and calculators

We heard, in the quote from insurance company employee Tess Toole at the start of this chapter, that 'for the amount of calculation that I do a calculator is a must'. Calculators, and spreadsheets such as Excel, are an essential tool for carrying out arithmetical work, particularly where large volumes of information are involved.

However, like any other tool such as an electric drill, calculators and spreadsheets need to be used in an informed way if they are not to cause potential damage. There are two aspects to this:

- (a) You need to know how to get the tool to do what you want it to do. With a calculator, this involves reading and working through the instruction book which comes with the machine – and which many users promptly lose or throw away. It is not possible in this book to give detailed instructions on how to carry out particular calculations, since different calculators vary in the details of their operation. However, you will find links to some useful sites on the companion website. With a spreadsheet, finding out how it works probably involves doing an introductory course. This may be provided within your overall programme, but if not you can find some very helpful free online courses on the Microsoft Office online training website at <http://office.microsoft.com/en-us/training/default.aspx>. The audio course 'Get to

know Excel: create your first workbook' is a good place to begin. You will find a link to this site on the companion website associated with this book.

- (b) You need to know exactly what the tool is doing as a consequence of the buttons you press or the instructions you give. So, for example, if you put the calculation $3 \times 6 + 4$ into a cell in an Excel spreadsheet, you need to be aware that the multiplication will be carried out before the addition, so that the answer will be 22 and not 30. We'll be coming back to this point in the next chapter.

The sections called 'For Excel users' at the end of most chapters of this book will assume that you already have the skills outlined under (a) above. In other words, they assume you understand the basics of how to use a spreadsheet: to enter data, move things around the sheet, copy and paste cells, and so on. We shall then focus on the further skills you need to get Excel to help with the concepts covered in the chapter.

So if you're hoping to use Excel to help you with your course – or if this is a compulsory element of the course – then it might be a good idea, before going any further, to check that you are comfortable with the basic skills.

1.5 ... and a word about the Web

The Internet is a wonderful resource, and you will find many references to specific websites throughout this book.

However, if you have become reliant on searching the Web, copying and pasting information (with due acknowledgement, of course) as part of your assessed work in other subjects, then a word of warning is perhaps needed. If you simply search on a word such as 'quotient' (don't worry if you don't know what that means, as it will be covered in the next chapter), you will find literally millions of hits, some of which are relevant to the simple mathematical use of the term, and others not. Even where a web page does give a simple definition (for example, a Wikipedia page), it may move on quickly to more advanced uses of the term. So you could frighten yourself quite unnecessarily by trying to use a site where the level of discussion is too advanced.

It is also as well to remember that nothing on the Web is guaranteed to be correct. Although your searches may come up with handouts and course materials from many universities across the globe, these may contain errors (in my experience, sometimes serious ones). Even where the material is sound, different uses of notation and terminology can lead to confusion and misunderstanding.

So it is as well not to rely too heavily on seeking out web-based information to support your study of maths. Better to stick to books and other resources recommended in your course reading list, or by your course tutor.



For further exercises and multiple choice revision questions visit the companion website: www.palgrave.com/business/morris

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