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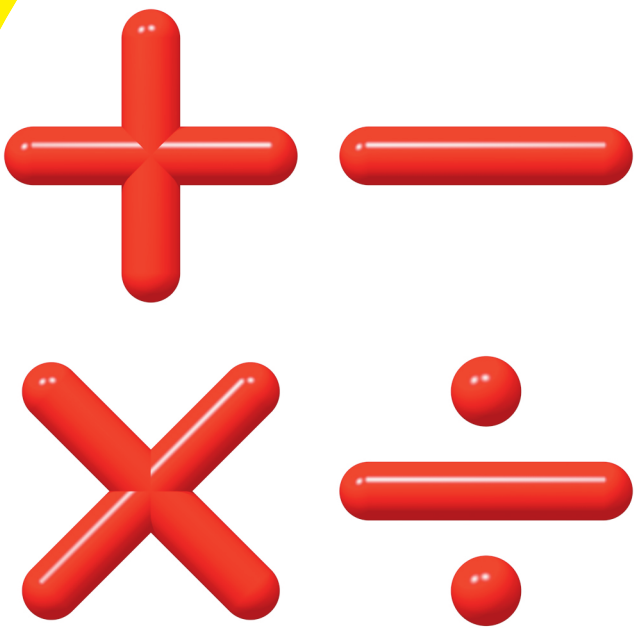

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Basic Maths FOR DUMMIES®

by Colin Beveridge

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About the Author

Colin Beveridge is a maths confidence coach for Flying Colours Maths and co-author of the *Little Algebra Book*.

He holds a PhD in Mathematics from the University of St Andrews and worked for several years on NASA's Living With A Star project at Montana State University, where he came up with an equation which is named after him. It's used to help save the world from being destroyed by solar flares. So far so good.

He became tired of the glamour of academia and returned to the UK to concentrate on helping students come to terms with maths and show that not all mathematicians are boring nerds; some are exciting, relatively well-adjusted nerds.

Colin lives in Poole, Dorset with an espresso pot, several guitars and nothing to prove. Feel free to visit his website at `www.flyingcoloursmaths.co.uk` or follow him on Twitter at `www.twitter.com/icecolbeveridge`.

Dedication

For the teachers who taught me most of what I know: Brian Rodrigues, DJ Rowley, Dana Longcope and Naomi Dunford.

And for the students who taught me most of the rest.

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Introduction

Hi! I'm Colin, and I want to change the world.

I live in a world where, when I say 'I'm a maths tutor,' people say to me 'Oh, maths . . . I was never any good at that,' or 'I haven't used maths since I left school.'

I live in a world where I have to bite my tongue rather than say 'I don't mind that you think maths is hard, but I am saddened that you're proud of this,' or 'Are you sure about that? I bet you used maths six times before breakfast this morning.'

I want to live in a world where everyone is okay at maths. Not a world full of Einsteins, not a world full of geeks – just a world where having a solid level of maths is as natural to everyone as having a solid level of reading and talking.

This book is part of my vision – and I'm delighted that you've picked it up. You've taken the first step to being a bigger part of my ideal world, and I want to do everything I can to help you become as good at maths as you want to be.

I want to show you that maths makes sense, most of the time, and that you use maths countless times a day, often when you don't even realise it. I want to show you that after you break problems down into smaller steps, those problems are so much more doable. I want to help you stop feeling stupid or afraid or troubled by maths. I know you aren't stupid: you just haven't got the hang of maths yet.

Most of all, I want to hear how you get on. The best way to catch me is on twitter (`@icecolbeveridge`) – I can't promise I'll get back to you straight away, but I promise I'll read and reply if I possibly can.

About This Book

In this book, I try to help you understand not only *how* to do the maths you need, but *why* you do the maths in a certain way. I show you maths isn't some mystical language of squiggles but instead is a concise and efficient way to communicate. One of the nice things about maths is that it changes very little from country to country. I studied maths in France for a year and was

surprised that most of the words, even in the ridiculously advanced maths they thought I could do, were either basic French vocab or very similar to the English words. The sums were exactly the same. (I still couldn't do them, but that's a different story.)

Now, I'm pretty good at maths. I've been a full-time maths tutor since 2008. Before that I worked on a NASA project in the USA. I have an equation named after me. I know my stuff.

But – and this is a big 'but' – I know that being a good mathematician isn't the same as being a good maths teacher. I'm lucky to have worked with enough people at the stage you are now – smart and interested, but needing help to understand – that I can break down maths into smaller, simpler parts that I hope you'll understand.

Among other things, I cover the following in this book:

- Keeping calm instead of stressing about maths.
- Solving regular arithmetic problems – adding and taking away, multiplying and dividing.
- Rounding off and estimating your answers.
- Dealing with decimals, fractions, percentages and ratios.
- Messing about with measures of time, money, weight and temperature.
- Understanding shapes – how you measure them and how you move them around.
- Grappling with graphs – both reading and drawing.
- Summing up statistics, including averages and probabilities.

How could that not be fun?

This book is based on the UK Adult Numeracy Core Curriculum, from Entry Level 3 through to Level 2. Whether or not a Level 2 numeracy qualification is equivalent to an A–C pass at GCSE is a murky area I don't want to muddy further, but I reckon they're roughly the same level in difficulty, although the numeracy curriculum covers slightly fewer topics.

So, that means this book may help you do pretty well at GCSE level but won't cover all of the topics involved – particularly algebra, which this book barely touches. If you read this book cover to cover and understand everything, you should ace any UK Adult Numeracy test thrown at you. Although I've based this book on the core curriculum, I sometimes dip into topics in a little more detail than needed. I also cover a few areas from a slightly earlier level in the curriculum if I reckon you may find the particular subject hard.

Whether you're studying for a numeracy qualification or a GCSE, or just want to brush up on your basic maths skills, this book has what you need. Best of all, the book follows the *For Dummies* format. Divided into easy-to-follow parts, the book serves as both your reference and your troubleshooting guide.

Conventions Used in This Book

I keep the conventions to a minimum in this book. Here are the ones I use:

- I use *italics* for emphasis or to highlight new words or phrases.
- **Boldfaced** text indicates key words in bulleted lists or the key steps of action lists.
- `Monotype` font is used for internet and email addresses.

What You're Not to Read

This book is designed to be an easy-access reference guide to basic maths. I cover each subject in its entirety in individual chapters, and the information doesn't depend on what comes before or after. This means you can jump around the book to the subjects you want to focus on and skip those you feel comfortable with already or just aren't interested in.

If you feel like you're starting from scratch, I strongly recommend you peruse the whole book to get a solid idea of all that's involved. If you already have a decent maths background, you probably want to focus on the areas you find are relatively weak for you – but you may also find some of the insights in other areas help to shore up your maths skills.

No matter what your background, you can skip paragraphs marked with the Technical Stuff icon without giving up an understanding of the primary subject. Also, sidebars supplement the primary text – you can skip them without missing the main point.

Foolish Assumptions

Making assumptions is always a risky business, but knowing where I'm coming from may put you at ease. So, in writing this book, I assume that:

- You know how to count and are familiar with the symbols for the numbers.
- You understand the idea of money and changing a banknote for an equivalent value of coins.
- You know what some basic shapes look like.
- You're prepared to think fairly hard about maths and want either to pass a numeracy qualification or to simply brush up on your maths skills.

How This Book Is Organised

Like all *For Dummies* books, *Basic Maths For Dummies* is a reference and each topic is allotted its own part in the book. Within each part are individual chapters relating specifically to the topic in question.

Part I: Whole Numbers: The Building Blocks of Maths

If you want to be good at maths – and I presume you do, otherwise you'd have picked up a different book – being able to do three things really well is helpful:

- **Stay calm:** Maths can be hard enough when your mind isn't complaining about how impossible it is and trying to sabotage your efforts. I give you tips on how to keep that under control and set yourself up for success.
- **Do sums on paper:** As a mathematician, I think this is the least important of the three for being good at maths. Unfortunately, the people who write exams disagree with me, so I walk you carefully through methods for adding, taking away, multiplying and dividing, and I try to show you *why* the sums work.
- **Work out rough answers:** Being able to give a ballpark answer quickly is far more important to me than being able to work out a huge long-division sum. I show you how to work out a rough answer without giving yourself a headache.

Part II: Parts of the Whole

Stand back, everybody – I'm going to use the F-word. A word some people would like to see banned from books in public libraries and never have to hear on the TV. That's right, I'm talking about fractions. *Gasp! I can't believe he wrote that!*

I'm here to tell you that there's nothing dirty about fractions, even improper ones. There's a lot of misinformation out there about fractions, and some teachers find talking about fractions very difficult without getting embarrassed. But don't worry – in Part II I try to answer all of your questions about fractions in a frank and easy-to-understand manner. I also cover their close friends, decimals, percentages, ratios and proportion, which are all versions of the same thing.

I also introduce you to the Table of Joy – an easy way to work with percentages, ratios and literally dozens of other topics. I use this table throughout the book. In fact, the Table of Joy is probably the most useful thing I know.

Part III: Sizing Up Weights, Shapes and Measures

The third part of this book is about applying your maths knowledge to real-life things – generally things that you measure.

Some of these concepts are perfectly familiar – you've probably worked with time and money since you were old enough to throw a Monopoly board across the room. However, there are places you need to be careful – and this book gives you a few extra tips and tricks to pick up in those areas.

Some of the measuring concepts are a bit trickier. I look at the different ways to measure weight and temperature and show you some of their many applications.

I also look at size and shapes – again, there are different ways of measuring these and many facets of shape to play with.

Part IV: Statistically Speaking

Statistics has a reputation for being boring and difficult. For a long while, I bought into that story too – but then I started using statistics and applying it to something I cared about. Suddenly, I was drawing graphs that helped me understand my project, working out statistics that told me what was going on and making predictions based on probabilities . . . and I was hooked.

I can't promise you'll find statistics as exciting as I do, but I do my best to make the topic interesting. I cover the ins and outs and ups and downs of graphs and tables, how to interpret them and how to draw them; I look at averages; and I dip a toe into the murky and controversial world of probability.

Part V: The Part of Tens

All *For Dummies* books finish with The Part of Tens, a bunch of lists full of practical tips to help you manage the material in the rest of the book.

I run you through ways of calming down and some ideas for remembering your number facts. I show you some of the booby-trap questions examiners may set, and I offer some exam-technique tips so you can get in there and ace it. Good luck!

Icons Used in This Book

Here are the icons I use to draw your attention to particularly noteworthy paragraphs:

Theories are fine, but anything marked with a Tip icon in this book tells you something practical to help you get to the right answer. These are the tricks of the mathematical trade.

Paragraphs marked with the Remember icon contain the key takeaways from the book and the essence of each subject.

The Warning icon highlights errors and mistakes that can cost you marks or your sanity, or both.

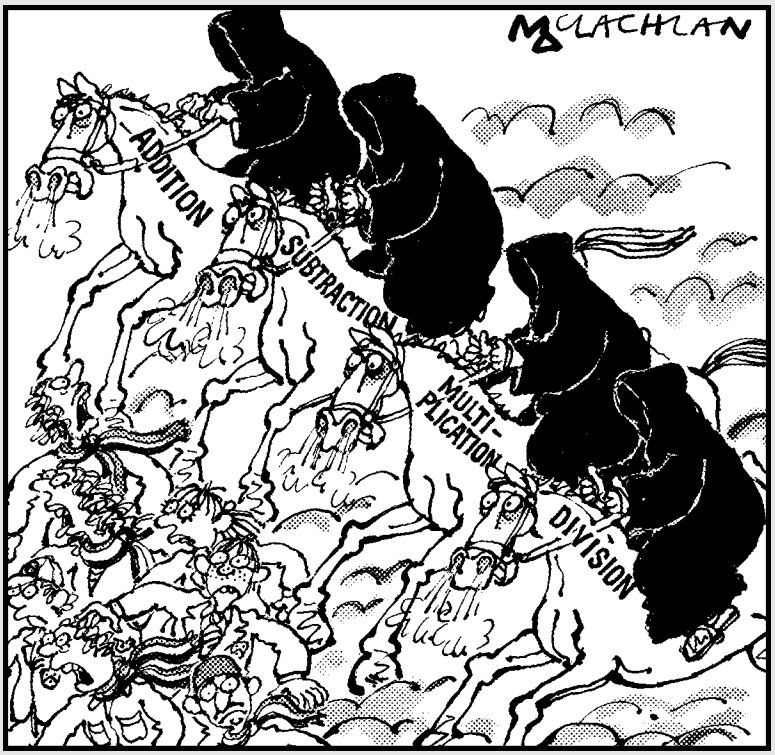
You can skip anything marked with the Technical Stuff icon without missing out on the main message, but you may find the information useful for a deeper understanding of the subject.

Where to Go from Here

This book is set up so you can jump right into the topics that interest you. If you feel like an absolute beginner in maths, I recommend you read Parts I and II to build a foundation for the other topics. If you're pretty comfortable with the mechanics of maths, use the table of contents and index to find the subject you have questions about right now. This book is a reference – keep it with your maths kit and turn to it whenever you have a question about maths.

Part I

Whole Numbers: The Building Blocks of Maths



THE FOUR HORSEMEN OF THE ARITHMETICS

In this part . . .

If you can count, you can do maths.

It's helpful to build up shortcuts to make maths easier, though – and that's what this part is all about: making maths easier. I show you how to stay calm and focused (and shut up the little voices telling you you can't do maths) and then help you figure out how to add, take away, multiply and divide whole numbers – the sums all of the others are based on.

You need to be able to see if your answer looks right: to do that, you need to be able to round off and to estimate so that you don't say something daft like 'The Eiffel Tower is four centimetres tall'.