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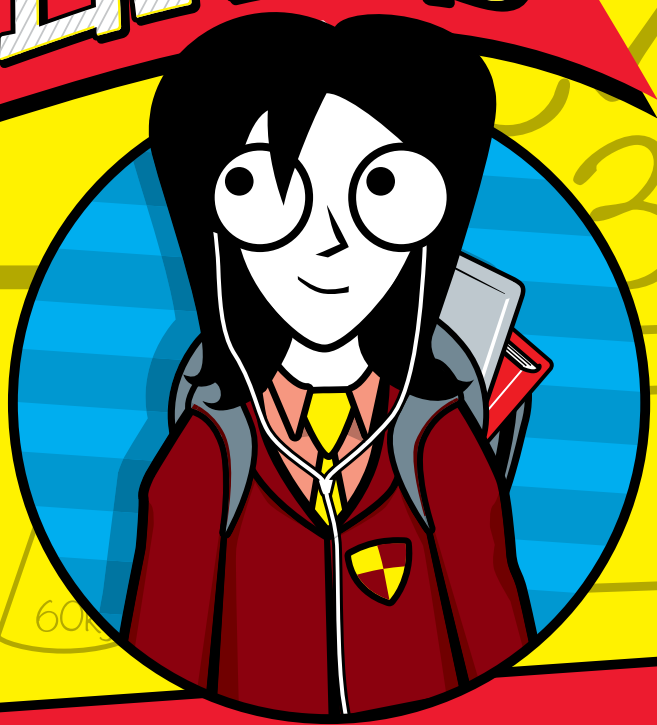
Years 6-8 Maths

FOR STUDENTS



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Years 6–8 Maths FOR *STUDENTS*

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by Ingrid Kemp
Mark Zegarelli
Colin Beveridge

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Years 6–8 Maths for Students®

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Contents at a Glance

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Introduction

Once upon a time, you loved numbers. This isn't the first line of a fairy tale. Once upon a time, you really did love numbers. Remember?

Maybe you were three years old and your grandparents were visiting. You sat next to them on the couch and recited the numbers from 1 to 10. Grandma and Grandpa were proud of you and — be honest — you were proud of yourself, too. Or maybe you were five and discovering how to write numbers, trying hard not to print your 2 and 7 backward.

Learning was fun. *Numbers* were fun. So what happened? Maybe the trouble started with long division. Or sorting out how to change fractions to decimals. Could it have been figuring out how to take away a 25 per cent discount from the cost of a purchase? Reading a graph? Converting miles to kilometres? Trying to find that most dreaded value of x? Wherever it started, you began to suspect that maths didn't like you — and you didn't like maths very much, either.

Why do people often enter kindergarten excited about learning how to count and, somewhere along the line, become convinced that they can't do maths? The answer to this question would probably take 20 books this size, but solving the problem can begin right here.

I ask you to put aside any doubts. Remember, just for a moment, an innocent time — a time before maths inspired panic attacks or, at best, induced irresistible drowsiness. In this book, I take you from an understanding of the basics to the place where you're ready to enter any mathematics class and succeed.

About This Book

Along the road from counting to algebra, most people experience the Great Maths Breakdown. This feels something like when your car begins smoking and sputtering on a 43°C highway somewhere between Noplace and Not Much Else.

Please consider this book your personal roadside helper, and think of me as your friendly maths mechanic (only much cheaper!). Stranded on the

freeway, you may feel frustrated by circumstances and betrayed by your vehicle, but for the person holding the toolbox, it's all in a day's work. The tools for fixing the problem are in this book.

Not only does this book help you with the basics of math, but it also helps you get past any aversion you may feel toward maths in general. I've broken down the concepts into easy-to-understand sections. And because *Years 6–8 Maths for Students* is a reference book, you don't have to read the chapters or sections in order — you can look over only what you need. So feel free to jump around. Whenever I cover a topic that requires information from earlier in the book, I refer you to that section or chapter, in case you want to refresh yourself on the basics.

Here are two pieces of advice I give all the time — remember them as you work your way through the concepts in this book:

- **Take frequent breaks.** Every 20 to 30 minutes, stand up and push in your chair. Then feed the cat, tidy your room (yeah, right!), take a walk, juggle tennis balls, try on last year's Santa's hat — do something to distract yourself for a few minutes. You'll come back to your books more productive than if you just sat there hour after hour with your eyes glazing over.
- **After you've read through an example and think you understand it, copy the problem, close the book, and try to work it through.** If you get stuck, steal a quick look — but later, try that same example again to see whether you can get through it without opening the book. (Remember that, on any tests you're preparing for, peeking is probably not allowed!)

Although every author secretly (or not-so-secretly) believes that each word she pens is pure gold, you don't have to read every word in this book unless you really want to. Feel free to skip over sidebars (those shaded grey boxes) where I go off on a tangent — unless you find tangents interesting, of course.

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 an upcoming test or exam or to simply improve your maths skills.

Icons Used in This Book

Throughout the book, I use three icons to highlight what's hot and what's not:

This icon points out key ideas that you need to know. Make sure you understand before reading on! Remember this info even after you close the book.

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.

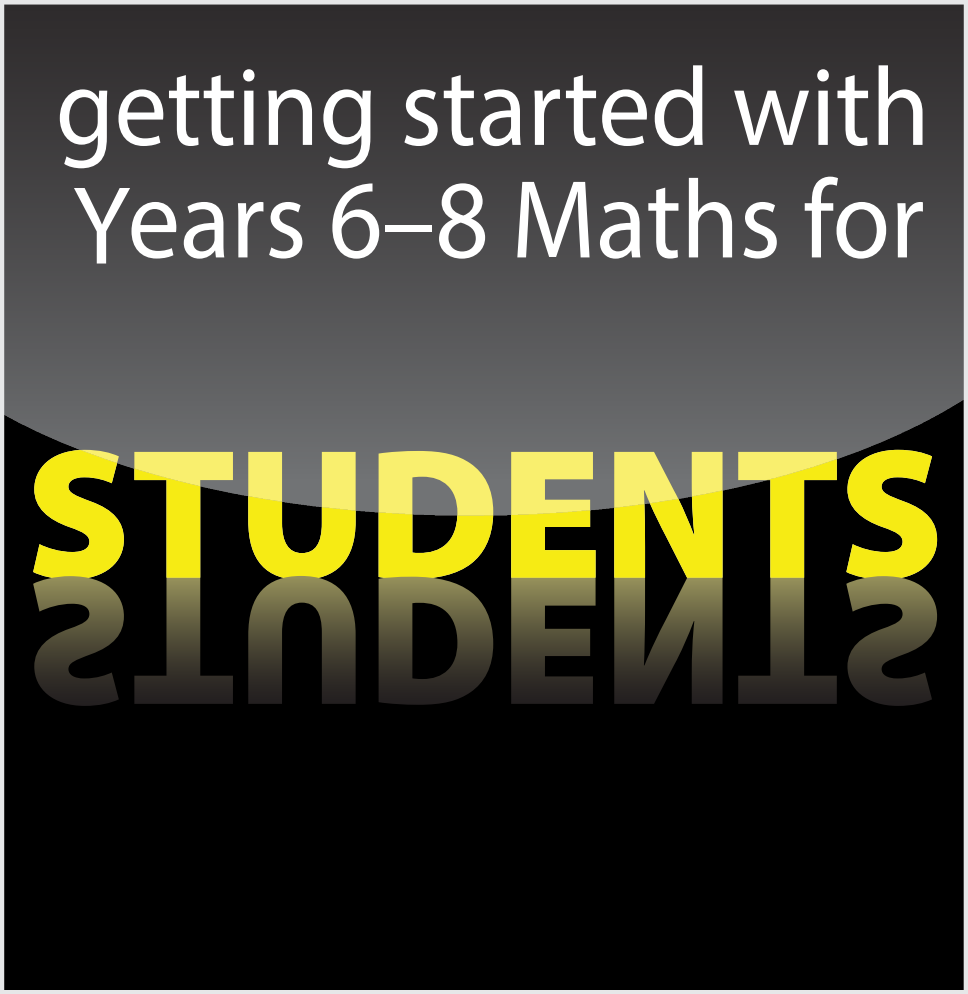
The Warning icon highlights errors and mistakes that can cost you marks or your sanity, or both.

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



In this part . . .

- Set yourself up for maths success — and understand what maths you're already good at.
- Work with number sequences, addition and subtraction.
- Multiply with style and divide with ease.
- Get your head around negative numbers.
- Understand how to solve word problems — and why doing so can be useful.

Chapter 1

Ready, Set … Success!

In This Chapter

- Realising you already use maths every day
- Understanding how you use whole and part numbers, measurements, shapes, and even algebra
- Getting ready for maths success and maintaining motivation
- Keeping a positive attitude and organising your notes

Before you read any more of this book, take a big, deep breath. I know what taking on something difficult or frightening feels like — I feel just the same about taking a class at the gym, and I still have to steel myself a bit when I go into a shopping centre.

I start this chapter by saying thanks — thanks for giving maths a try and thanks for listening to me. I'm not the kind of maths teacher who wears tweed jackets with leather patches and yells at you when you don't pick up on her mumbles straightaway. I want to help you get past the fear and the mind blanks and show you not just that you can do maths well, but that you already do maths well and can use that base to build upon. I show you how, with a bit of work, you can master the bits and pieces of maths you don't have down to a tee. You're smart. I believe in you.

Perhaps you find the maths you do in day-to-day life so easy you don't even notice you're doing sums. I spend some time in this chapter showing you what you already know and then introduce the topics I cover in the rest of the book.

You're Already Good at Maths

Put your hand up if you've ever said something like, 'I'm no good at maths.' I promise I won't yell at you. Now imagine saying, 'I'm no good at talking' or, 'I'm no good at walking.' Those things may be true at times — I get

tongue-tied once in a while, and I've been known to trip over invisible objects — but most of the time my mumbling and stumbling are perfectly adequate to get by. I bet the same thing applies with your maths. Maybe you freeze up when you see a fraction or just nod and smile politely when someone shows you a pie chart. This doesn't mean you're bad at maths, just that you trip up once in a while.

If you can shift your self-talk on maths from 'I'm no good at this' to 'I'm still getting to grips with this', you'll create a self-fulfilling prophecy and begin to understand maths.

Part of the problem may be that you don't realise how much of what you do every day involves doing maths in your head. You may not think you're doing maths when you judge whether to cross the road on a red light, but your brain is really doing a series of complex calculations and asking questions such as:

- How fast is that bus going, and how far away is it? How long will the bus take to get here?
- How wide is the road, and how long will it take for me to get across?
- What's the probability of that driver slowing down to avoid me if I'm in the road?
- How badly do I want to avoid being honked at or run over?
- What are the survival and recovery rates for my local hospital?
- How soon do I need to be where I'm going?
- How much time will crossing now save over waiting for the light to change?

You do all of these calculations — very roughly — in your head, without a calculator, and without freezing up and saying, 'I'm no good at maths.' If you regularly got any of those sums wrong — the speed–distance–time analysis, the probability or the game theory — you'd be reading this in hospital and trying to figure out what the jagged line graph at the end of the bed means. (Turn to Chapter 13 if this really is the case — and get well soon!)

So before you cross the road on your way to school or walking the dog, you solve as many as six 'impossible' sums in your head, maybe before you've even had breakfast.

Your first homework assignment

I'm not a big one for setting homework, but I'm going to ask you to do one thing for me (and, more importantly, for yourself): If you ever find yourself

in a situation where you feel like saying, 'I'm no good at maths', catch yourself and say something else. Try 'I used to struggle with maths, but I'm discovering that maths is easier than I thought', or 'I'm fine with day-to-day maths', or 'I really recommend *Years 6–8 Maths For Students*: This book turned me into a mathematical genius.'

Although mathematicians traditionally wear rubbish clothes, thick glasses and a bad comb-over, this fashion isn't compulsory. The tweed generation is dying out, and most of the maths geeks I know are now just a bit scruffy. So, don't worry: Being good at maths won't turn you into a fashion disaster with no friends.

I appreciate my homework assignment is tremendously difficult — asking you to change your entire way of thinking is a big ask. To assist you I enlist the help of a rubber band and ask you to treat yourself with something I call Dunford Therapy, after the genius who told me about it:

1. **Find a rubber band big enough to go around your wrist comfortably.**

   Put the rubber band around one of your wrists — either one, it doesn't matter.

2. **Every time you catch yourself saying anything along the lines of 'I'm no good at maths', snap the rubber band really hard against the bony bit of your wrist.**

   This will hurt. That's the idea.

3. **After you catch yourself a few times, your brain will start to rewire itself to avoid thinking such filthy and disgusting thoughts, and you'll find yourself capable of extraordinary feats of mathematics.**

If you have particularly fragile wrists or any inkling that you might do yourself more damage with a rubber band than swearing and shaking your hand in pain, don't use Dunford Therapy. The rubber band is supposed to hurt just enough to help you change your way of thinking, not to injure you.

Getting the odd maths sum wrong doesn't mean you are stupid — far from it, in fact, because you're immediately and obviously smarter than someone who doesn't even try the sum.

Talking yourself up

Encouraging yourself is a recurring theme in this book — the more you give yourself credit for the things you can do, the easier the things you're still working on become. Be sensible about things: Don't rush to the library and check out the *Journal of Differential Equations*. But when you see something that's a bit tricky-looking, try to avoid saying, 'I can't do that' or, 'I haven't

been taught that' as a response. Maybe say, 'I can't do that yet' or, 'I need to do some work on this.' Better still, say, 'What would I need to find out to be able to solve this?'

The section 'Setting Yourself Up for Success', later in this chapter, is all about ways to build your confidence and set yourself up to get on top of your maths studies quickly, effectively, and with a great big goofy grin. (Best of all, Dunford Therapy isn't part of this section.)

Whole Numbers: Party Time!

Everyone likes parties. Balloons! Silly hats! Cheese-and-kabana sticks arranged in a potato to look like an echidna! (Or is that just your parents?) But these things don't spring into existence on their own. If you want to plan a party, you may need to put your maths skills to work to make sure you buy enough snacks for everyone.

Maybe you want to bake a cake for 12 people coming to celebrate your birthday. But disaster! The recipe book only has a recipe for a cake that serves four people. What can you possibly do?

I'm sure you can come up with a few solutions. I've also got a few ideas, which I explain here in excruciating detail:

- Let people go hungry: You have 12 guests and only enough cake for four. How many will have to forgo your delicious chocolate sponge? Twelve people take away four lucky cake-eaters leaves eight guests, who perhaps would prefer the chips anyway.
- Make extra cakes: One cake feeds four people and you want to feed 12. How many cakes do you need? Twelve people divided by four per cake gives you three cakes.
- Cut your slices into smaller pieces: If you cut four slices each into three smaller bits, you have 4 times 3 equals 12.
- Make a bigger cake: This is the kind of approach that you typically get asked about in an exam. You need to figure out how much bigger to make the cake — just like before, $12 \div 4 = 3$ times as big. To make the cake three times bigger, you multiply all of the ingredients in the recipe by three.

My suggestion in the preceding list is a bit of a 'don't try this at home' moment: Although the last option is the most 'mathsy', it may not work out quite as well in real life. Unless the recipe in your cookery book gives instructions on how to adjust the cooking time of your humungous new cake,

the physics of cake-baking may conspire against you and leave you with something inedible. Try my idea if you like, but don't blame me if your cake doesn't rise.

Forgive me if you already knew how to do all of that. That's actually a good sign. The point wasn't to bamboozle you with tricky maths but to say that sometimes you do maths without even thinking about what you're doing.

One of the points from my cake example is to think about which sum is appropriate for each idea, so you can adapt the concept to different situations. What if your cake recipe serves six people? What if you're expecting 48 guests? What if the recipe is for quiche instead of cake?

In Part I of this book I look at exactly this kind of question. What kind of sum is the right one to do? How can you figure out roughly what the answer should be? How do you work out the arithmetic to get a precise answer? I look at the 'basic' operations — adding, subtracting, multiplying and dividing — along with turning words into numbers (and solving word problems) and working with negative numbers.

Parts of the Whole: Fractions, Decimals, Percentages and More

Public speaking . . . death . . . spiders . . . fractions. Are you scared? Adding 10 per cent GST! Are you scared now?

I understand. Seeing how whole numbers fit together is relatively easy, but then suddenly the evil maths guys start throwing fractions and percentages at you — and things aren't so intuitive. Fractions (at least, proper fractions) are just numbers that are smaller than whole numbers — they follow the same rules as regular numbers but sometimes need a bit of adjusting before you can apply them to everyday situations.

I have two main aims in this section: To show you that fractions, decimals, percentages and ratios are nothing like as fearsome as you may believe; and to show you that fractions, decimals, percentages and ratios are all different ways of writing the same thing — therefore, if you understand one of them, you can understand all of them.

I won't promise that you'll emerge from this section deeply in love with fractions, but I hope I can help you make peace with fractions so you can work through the questions likely to come up in exams and in real life. The chapters in Part II go into these areas in a lot more detail.

Mmmm, pizza! Everyday fractions

You use fractions and decimals in real life all the time — any time you slice a pizza into smaller bits . . . any time you say you'll be somewhere at quarter past six . . . any time you say or read the price of a product in the supermarket and, in fact, any time at all when you use money.

A fraction is really just two numbers, one on top of the other, that describe an amount (usually, anyway) between zero and one. A fraction is a part of a whole one. The bottom number tells you how finely you've divided the whole thing (the bigger the number, the finer or smaller the 'slice') and the top number tells you how many slices you have.

For example, think about a quarter of an hour. A quarter is written as $\frac{1}{4}$: The 4 says, 'Split your hour into four equal bits', and the 1 says, 'Then think about one of the bits.' A quarter of an hour is a whole hour (or 60 minutes) divided into four parts, making 15 minutes. Three-quarters of an hour ($\frac{3}{4}$) is three times as long: 45 minutes.

You already use decimals all the time as well. When you write down an amount of money using dollars and cents, you use a decimal point to show where the whole number (of dollars) ends and where the parts of a dollar (cents) begin. If you look at your mobile phone bill or your shopping receipt, you see decimal points all over the place. Don't be afraid of decimals: As far as you're concerned, decimal points are just dots in a number that you can leave in place and otherwise ignore. For example, you work out a sum like 5.34 ÷ 2 (with a dot) in exactly the same way as you work out 534 ÷ 2 (without a dot) — the only difference is that you have to remember to put the dot back in, in the same place, when you finish the sum.

Percentages are easier than you think: Introducing the Table of Joy

What if I told you I had a simple, reliable method for working out the sums you need to do in somewhere between a quarter and a half of questions in a typical maths test? Such a method exists — the Table of Joy. I go into serious detail about this table in Chapter 8, but I also dot it about here and there in other chapters.

You can use the Table of Joy in all of the following topics:

- **Converting metric units:** Working in either direction, and finding the conversion rate.
- **Currency conversion:** Converting to and from any currency, and working out the exchange rate.