

Chapter 1

Math that Works as Hard as You Do

In This Chapter

- ▶ Reviewing the very basics of math
 - ▶ Identifying the tools of the trade
 - ▶ Looking at math's basic disciplines and branches
 - ▶ Applying math to the business of work
 - ▶ Previewing ten of this and ten of that
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Technical mathematics (*technical math*) is an essential part of the work and the education of everyone in a technical career. If you're studying a trade in a two-year college or an occupational program, you can't dodge it, whether you're taking formal math courses or dealing with math calculations in specialized courses.

For example, Heald College is a famous college in San Francisco and much of California in general, as well as Portland and Honolulu. To get a degree as a medical assistant (Associate in Applied Science), you have to take Math 10, Essential Math; Math 103, Elementary Algebra; and Math 205, Modern Business Mathematics. And that's for an education in healthcare.

Even if you're already working in the field you want, you encounter plenty of technical math to do. All the construction trades deal with math to build buildings, pour sidewalks, install flooring, lay carpet, calculate fencing runs, and figure out how much paint goes on the walls. And because these trades are businesses, you have to figure amounts of materials, costs of materials and labor, and client billing. You may try to avoid math, but if you do, you may be avoiding a chance to advance your career.

Bottom line: Math isn't just something theoretical that professors in universities work with. It's a practical skill used in most careers. Technical occupations built the world and also made it fit to live in. That takes technical math.

If math gives you the willies, heebie-jeebies, butterflies in the stomach, or palpitations of the heart, suffer no more. Every principle in this book is easy, if you look at it the right way. Technical math is easier (not harder) than you think.

Discovering the Benefits of a Technical Math Book

Regular math books are fine, but we believe that you can get more benefit more quickly from a technical math book. A technical math book is all about practical math, focusing on math for technical careers — the math principles you're likely to need in everyday work. Abstract math need not apply.

Unlike regular math books, which tend to be about a single discipline (for example, algebra, geometry, or trigonometry), a technical math book is comprehensive so that you don't have to go to several texts to get what you need. This book covers a little bit about a lot of subjects, and no subject goes deeper than you need it to go.

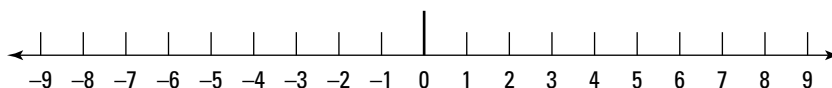
A good technical math book also includes practical examples based on real-life experiences. As a result, you may even discover something about careers other than your own. And you may be able to apply a lot of workplace math to your personal life as well as your work life.

The Basics Are Basically Basic

The most basic component of math is *numbers*. The first thing you do with numbers is count, and you started counting when you were very young — as soon as you could talk, your mother probably cajoled you to tell Aunt Lucy how old you were or to count from one to five.

If you put numbers on a line, you get (are you ready?) a *number line*, shown in Figure 1-1. The number line is an arrangement of whole numbers called *integers*. (See Chapter 3.) With a number line, you can count as high as you want by going to the right and as low as you want by going to the left.

Figure 1-1:
A number
line.



Counting is not only the first math thing you probably ever did, but it's also the first thing that ancient people did. The earliest math discovery is the Ishango bone, a tally stick, and it's more than 20,000 years old!

Another basic component of math is *arithmetic*. That's addition, subtraction, multiplication and division. You learned them in elementary school, but if you didn't understand them well, you may still have trouble with the processes today. Even if you knew them and then forgot them, you can get a refresher in Chapters 4 and 5.



The word *arithmetic* comes from the Latin word *arithmetica*, which comes from the Greek words for "counting," "number," and "art." Yes, it's the art of counting numbers.

When you know about numbers and know arithmetic, you're on your way to becoming a technical math terror. They're basic skills, but those basic skills handle a lot of the math in day-to-day life and prepare you for some more interesting topics.

Meeting Measurement and Conversions and Studying Story Problem Strategies

Measuring quantities and amounts is fundamental to every career; knowing your units is important. It sounds simple, but the world throws you a couple of curve balls with two different common systems of measurement (American and metric), which we cover in Chapter 6.

Chapter 6 also shows you all the basic units of length, area, weight, volume, and liquid volume and how to convert from one unit to another, an essential in technical work. You also see how to convert from one unit system to the other.

When you know your math basics and your conversions, you can slay math monsters faster than Conan the Barbarian slays movie monsters. But Conan had a vital tool you don't have, the Atlantean Sword. That's where Chapter 7

comes in. It contains the tricks, traps, and techniques you need for solving story problems; with its help, you'll laugh, scoff at, deride, and mock the so-called word problems that come up in everyday work life.

Using Workhorse Math

Four math disciplines — fractions, decimals, percentages, and exponents — are the workhorses of your trade. All careers use one or more of them, and some careers use all of them.

You use these four workhorses for many utilitarian purposes, a little like the way draft horses have been used for logging, plowing, pulling beer wagons (yes, the Budweiser Clydesdales are draft horses), hauling freight, and transporting passengers in horsecars. Like the horses, the math disciplines are strong and docile.

The chapters in Part II of this book tell you plenty about fractions, decimals, percentages, and exponents (and the exponent's trusty sidekick, the square root), but here's a little taste to whet your appetite:

- ✓ **Fractions:** Fractions come in various forms, including stacked, unstacked or inline, decimal, and percentage; check out the following for examples.

$$\frac{1}{2} \quad \frac{1}{2} \quad 0.500 \quad 50\%$$

You use fractions in just about every trade, and not only in doing your basic job — this math also comes up in working with time, money, and computer capacity. Find out more in Chapter 8.

- ✓ **Decimals:** Decimals are a form of fraction, and they're essential for work in major trades. The laboratory and the machine shop are two places where you find a lot of decimal numbers. Chapter 9 gives you the details.
- ✓ **Percentages:** Percentages are fractions based on 100. You need percentages to express portions of a whole quantity, and they're at the very core of working with money. Head to Chapter 10 for more.
- ✓ **Exponents and square roots:** Exponents let you express very big and very small numbers (and do math with them) in a very compact way. Square roots help you solve a couple of pesky problems in your daily work. Chapter 11 has the lowdown on these concepts.

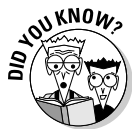
Building Your Knowledge of the Branches of Math

Some people say, “A little knowledge is a dangerous thing,” but that’s not necessarily so. *No knowledge* is a dangerous thing.

Don’t worry if you have “a little knowledge” about math. The good news is that you only need to know a little and you’ll do fine. But perhaps the best news is that Part III helps you out by expanding what you do know.

Algebra makes any problem solvable after you figure out the formula you need. As Chapter 13 shows, formulas are easy to develop, and they make even complicated story problems (shown in Chapter 7) collapse into solutions.

Geometry, as shown in Chapter 14, lets you draw the various shapes you need to measure landscape jobs, dress patterns, or whatever your job requires. Plus, you develop a great vocabulary about lines, angles, and shapes that can aid you in your daily work.

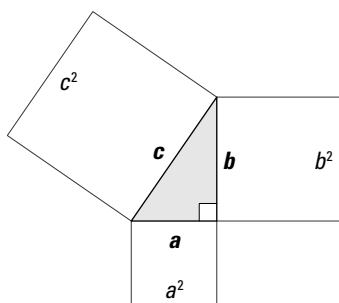


Alexander Pope, the poet, first wrote this saying in *An Essay on Criticism* in 1709.

A little learning is a dangerous thing;
drink deep, or taste not the Pierian spring:
there shallow draughts intoxicate the brain,
and drinking largely sobers us again.

You may even use the Pythagorean theorem to find the lengths of sides of a triangle. That’s part of a method for finding the areas of patios, yards, and odd-shaped rooms, and in special cases, you can even use it to find the area of a piece of pie. Figure 1-2 shows a classic geometrical view of the theorem.

Figure 1-2:
Graphic
of the
Pythagorean
theorem.



In Figure 1-2, a^2 represents the square of length a , and b^2 is the square of length b . Also, c^2 is the square of side c . Don't worry about the letters or even the theorem now — we reveal all in Chapter 14. And check out Chapter 15 for help with areas, perimeters, and volumes.

In trigonometry, good math appears to be magic, but it's really just good math. Trigonometry is essential for surveyors, land engineers, and fire look-outs, to name just a few. When you do a little trig, you can easily figure out how wide a river is without getting your feet wet. The solution to this problem has eluded one of the authors (Barry) since he was Boy Scout, but with the help of Chapter 16, he (and you) can finally cross that bridge.

Life Math Isn't Classroom Math

The math of the classroom is good. The principles are solid, and the math is conceptual as well as real. Classroom math improves your thinking, and improved thinking can greatly reduce the Homer Simpson “D’oh!” factor in your life.

However, the math of life is what you face every day. It's good, real, and entirely practical. When you do life math, it directly affects your work and the people who depend on you. Your calculations can affect

- ✓ The appearance and building quality of a client's new home
- ✓ Effective wildfire fighting
- ✓ Precise property line measurements
- ✓ Accurate reporting of patients' vital signs
- ✓ Correct dispensing of drugs to patients
- ✓ The quantity, taste, and nutrition of what people eat

Luckily, the chapters in Part IV help you deal with this side of math. They help you use graphics (particularly charts and graphs), do excellent time accounting (for payroll and client billing), and make smart purchases of computers and high-tech instruments (computer math).

“But wait,” you say. “I don't do payroll or buy the computers, and no one has seen a graph at my office since 1972. Why do I need all this stuff?” The answer: Sometimes these math tools can be very valuable in your personal life. Pretend (and it's not really pretending) that your wages seem flat, yet your family's health insurance and out-of-pocket healthcare costs seem to

be rising. Is that true? Find out by using a line graph (which we cover in Chapter 17). Figure 1-3 shows a comparison of annual wages and annual healthcare costs over several years.

The graph clearly shows something you'd hoped not to see. Healthcare costs are in fact overtaking your salary at a rapid rate.

