A Sample of a LaTeX Document

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Contents

Chapter 1

Introduction

Hello, world! This is a short example further illustrating the power of LaTeX. LaTeX is especially useful to writers who care about mathematics but it is useful to a much broader range of writers than just those. A second chapter appears in Section 2 on page 4. Note that the use of the package **hyperref** lets us follow these cross references very easily in programs such as *yap* and Adobe *Acrobat Reader*.

To illustrate the mathematical power of LaTeX, here is a short derivation of the quadratic formula, usually taught in high school algebra. Figure 1.1 shows a particular quadratic polynomial of the type $y = ax^2 + b + c$ where $a = 3$, $b = 2$, and $c = -4$. A problem of frequent interest is to find all the points where the polynomial is zero. The graph reveals two such points. One near $x = -1.5$ and one near $x = +0.8$. The quadratic equation derived here lets us compute the values more exactly.

$$0 = ax^2 + bx + c \tag{1.1}$$

We start by factoring a out of the polynomial and completing the square.

$$\begin{aligned} 0 &= a\left(x^2 + \frac{b}{a}x\right) + c \\ &= a\left(x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2\right) + c - a\left(\frac{b}{2a}\right)^2 \\ a\left(x + \frac{b}{2a}\right)^2 &= \frac{ab^2 - 4a^2c}{4a^2}. \end{aligned}$$

A little further manipulation yields

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}.$$

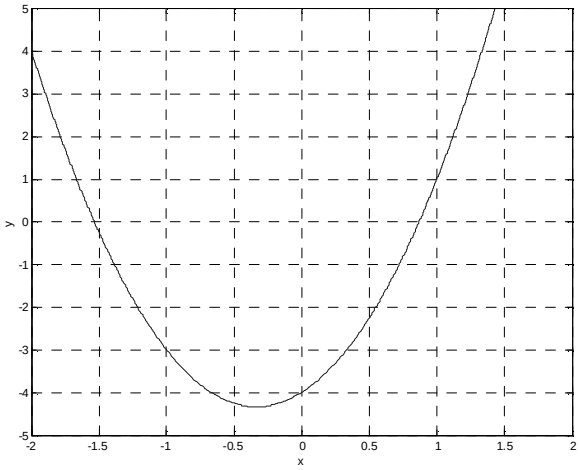

Figure 1.1: A Quadratic Polynomial: finding the roots

Taking the square root on both sides of the equation gives us

$$x + \frac{b}{2a} = \pm\sqrt{\frac{b^2 - 4ac}{4a^2}}$$
$$x = -\frac{b}{2a} \pm \frac{1}{2a}\sqrt{b^2 - 4ac}.$$

The right-hand side can then be put over a common denominator, yielding

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}. \tag{1.2}$$

Applying this to the case illustrated in Figure 1.1, we have

$$\begin{aligned} x &= \frac{-2 \pm \sqrt{2^2 - 4(3)(-4)}}{2(3)} \\ &= \frac{-2 \pm \sqrt{52}}{6} \\ &= -\frac{1}{3} \pm \frac{\sqrt{13}}{3} \\ &= -1.53518 \text{ or } 0.86852. \end{aligned} \tag{1.3}$$

In equation (1.1) we see a very general quadratic polynomial, set equal to zero. The derivation seeks all points x which satisfy this equation. Equation (1.2) shows the result in a form familiar to students of high-school algebra.

It's quite easy to include descriptions of LaTeX in a document, too. For example, the `\label` commands in the file allow cross-references to each equation, shown here using the **amsmath** macro `\eqref{}`. The **hyperref** package makes it easy to follow them in programs such as *yap* and Adobe *Acrobat Reader*.

Chapter 2

Further Developments

This chapter is present only in order to show how to add additional chapters. It is easy to make a cross-reference to another chapter. For example, we can refer to Section 1 on page 2.