A Short Example illustrating use $\mathcal{AMS}$-LaTeX commands

Steven L. Kleiman*

Abstract. This short paper shows how to use $\mathcal{AMS}$-LaTeX commands to do common formating tasks involved in writing a paper for the UJM/18.096.

1. Introduction. The formating tasks discussed in this paper are all basic matters. Many of them involve subtlties, which are often overlooked by beginners.

Section 2 shows how to include figures. Section 3 states Euler's celebrated formula, and derives the formulas for the cosine and the sine of a sum. Section 4 discusses referencing.

2. Inclusion of Figures. This section of the paper contains Figure 2-1, which is taken from the primer [**5**, p. 204].

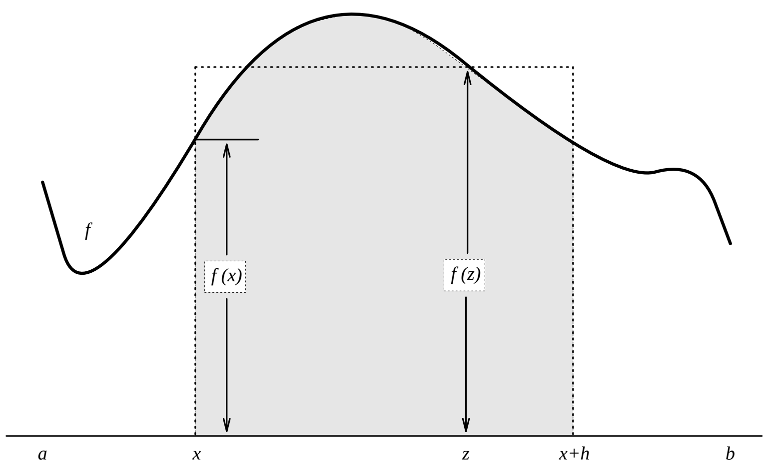

Figure 2-1. Geometric setup of the proof of the First Fundamental Theorem.

Be sure to refer to your figure in the text before, never after, you include the figure itself. You may find you need to reword your text or resize the figure, so that it fits. You may also need to encourage LaTeX to put the figure in the appropriate place; the article documentclass often tries to place it at the top of the current page, which is too early.

*The author wishes to thank the MIT Math Department for its continued support of the UJM.

3. Euler's Formula. According to Thomas and Finney [**6**, p. 851], "one of the most famous results involving the elementary complex functions is the formula

$$e^{iz} = \cos z + i \sin z, \tag{3-1}$$

which is known as *Euler's formula*." Notice that, if we take $z := \pi$ in Equation 3-1, then we obtain the formula $e^{i\pi} = -1$, which relates four of the most important numbers in mathematics.

Euler's formula, Equation (3-1), has other interesting consequences. For example, it yields the formulas for the cosine and the sine of a sum.

Proposition 3-1 (Sum formulas). *Let w and z be any two complex numbers. Then*

$$\cos(w + z) = \cos w \cos z - \sin w \sin z,$$
$$\sin(w + z) = \cos w \sin z + \sin w \cos z.$$

Proof: By the law of exponents, $e^{i(w+z)} = e^{iw}e^{iz}$. Hence Euler's formula yields

$$\cos(w + z) + i \sin(w + z) = (\cos w + i \sin w)(\cos z + i \sin z).$$

Expanding the right-hand side, we obtain

$$(\cos w \cos z - \sin w \sin z) + i(\cos w \sin z + \sin w \cos z).$$

Finally, equating the real and imaginary parts, we obtain the asserted formulas. □

4. Tables. Many papers include tables. Table 4-1 appears on p. 61 in Pramook Khungurn's paper [**4**], where the context is explained.

Table 4-1
Factorizations of the Coxeter element $\mathbf{C}_n$ of W_n.

names of cases	reflections allowed	number of factorizations
both-fixed	$\oplus_{ij}, \ominus_{ij}, \odot_k$	n^{n-1}
positive-free	$\oplus_{ij}, \odot_i$	n^{n-1}
negative-free	$\ominus_{ij}, \odot_i$	$n!$
negative-fixed	$\ominus_{ij}, \odot_k$	$A(n, k)$
positive-one	$\oplus_{ij}, \odot_1$	$(n-1)^{n-1}$
positive-two	$\oplus_{ij}, \odot_2$	$(3n-4)(n-2)^{n-2} - (n-1)^{n-1}$

Another example is provided by the table of integrals in the primer on mathematical writing [**5**, p. 205]. The source code is found in the file `piiUJM2.tex`, which is contained in the 18.096 locker `http://web.mit.edu/18.096/www`.

5. Algorithms. In mathematics and computer science, many papers include listings of formal algorithms. For example, Algorithm 5-1 lists the pseudocode of an algorithm to compute the integral closure of an integral domain that is presented explicitly as a finitely generated algebra over a field k; this listing appears on p. 61 in Anand Deopurkar's paper [**3**].

Like figures and tables, algorithms are *floats*. That is, they are blocks of material that must not be split across pages; therefore, when they do not fit where they are

Algorithm 5-1. Normalization algorithm.

Input: An integral domain $R = k[x_1, \ldots, x_n] / \langle f_1, \ldots, f_r \rangle$.
Output: The integral closure $\overline{R}$.

Let $V = \mathbf{V}(f_1, \ldots, f_r)$.
Determine I such that $\mathbf{V}_V(I) = V^s$.
Let $I := \sqrt{I}$.
while $R \neq \mathrm{Hom}_R(I, I)$ **do**
    $R := \mathrm{Hom}_R(I, I)$.
end while
return R.

referenced for the first time, they are "floated" to another place, such as the top of the next page. Consequently, they can not be treated as part of the text in the manner of a display. Thus you can say that Euler's formula is

$$e^{iz} = \cos z + i \sin z,$$

because you can be sure that the formula will appear on the next line; however, you must say that the code is listed in Algorithm 5-1, not that the code is the following.

6. Referencing. The list of references must contain only works that are explicitly cited. As an aid, the file mathp2e.sty writes a warning message into the LaTeX log file for each bibliography entry that is not cited somewhere using the command `\cite`. For example, when you run LaTeX on the present file, you get three such warnings.

The style of the entries varies greatly from discipline to discipline. Within each discipline, the style varies a little from publication to publication. The entries in the list below illustrate the style used for books, journal articles, and URLs in the MIT Undergraduate Journal of Mathematics.

Normally, the name of each journal is abbreviated. A list of standard abbreviations is given in the annual index issue of the Math Reviews and on line at the URL `http://www.ams.org/msnhtml/serials.pdf`. However, to get the proper bibliographic information for the works you list, the easiest way to proceed is to look up the work on line in the MathSciNet through MIT Library's service Vera.

Acknowledgements

When others have supported your work in one way or another, you can express your appreciation in a separate section, entitled "Acknowledgements." It makes sense to do so when you have more to say than can reasonably fit in a footnote. Such a section is common in math journals, and is usually placed before the section of references.

References

[**1**] Alley, M., "The Craft of Scientific Writing," Prentice-Hall, 1987.

[**2**] Belville, S., and Harrison, H. A., "Essential LaTeX on Athena (AC-50)," `http://web.mit.edu/olh/Latex/ess-latex.html`.

[**3**] Deopurkar, A. *Normalization of Algebraic Varieties,* MIT Undergraduate J. Math., **9** (2008), 43–65.

[**4**] Khungurn, P, *Factoring the Coxeter Element of the Hyperoctahedral Group,* MIT Undergraduate J. Math., **7** (2005), 59–80.

[**5**] Kleiman, S., and Tesler, G., *Writing a Math Phase Two Paper*, MIT Undergraduate J. Math., **1** (1999), 195–206.

[**6**] Thomas, G., and Finney, R., "Calculus and Analytic Geometry," Fifth Edition, Addison-Wesley, 1982.