How to write a Parabola article

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1 Introduction

Like most articles, even highly technical research articles, the main purpose of *Parabola* articles is to tell a good story, and the Introduction is where the story begins. It is here that you (the author) have the chance to lure your readers in by engaging their attention and curiosity. Briefly tell your readers what your article is about and what it will show them, and give any relevant and interesting context that might show why your article is of interest. Feel free to play with the format and style of presentation - and feel free to choose a different format than that suggested by this article. Being clear, precise and engaging allows your readers to understand and enjoy your writing.

2 Telling a good story

Writing mathematics well can take some practice and experience but there are some useful rules of thumb, given below, that can help you even if you have never written an article before.

Write to a general audience

I once heard that news media articles are usually written so that most 12 year-old people would be able to understand them. A similar rule of thumb is useful for writing mathematical papers: try to write your article so that as many readers as possible would understand it, and so that they might understand it as easily as possible. Explain all notation, concepts and technical terms that readers might not already be familiar with.

Avoid filling

If a paragraph or sentence does not improve the article, then delete it. If text is written in parentheses (such as here), then consider how important that text is: If it is important, then does it need parentheses? If it is not important, then should it be deleted?

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Write clearly and logically

Suppose that I wrote:

$$(x-1)^2 + 2x = x^2 + 1$$
$$(x-1)(x-1) + 2x = x^2 + 1$$
$$(x-1)x - (x-1) + 2x = x^2 + 1$$
$$x^2 - x - x + 1 + 2x = x^2 + 1$$
$$x^2 + 1 = x^2 + 1$$
$$0 = 0$$

After looking at this for a little while, you might correctly guess that I was trying to prove that $(x-1)^2 + 2x = x^2 + 1$. However, the intent of the proof should be clear; instead, I made you guess. Also, this is not a proof: it is just a list of unrelated statements. These statements need to be linked together to create a logical flow, for instance as follows:

$$(x-1)^2 + 2x = x^2 + 1$$
$$\Rightarrow (x-1)(x-1) + 2x = x^2 + 1$$
$$\Rightarrow (x-1)x - (x-1) + 2x = x^2 + 1$$
$$\Rightarrow x^2 - x - x + 1 + 2x = x^2 + 1$$
$$\Rightarrow x^2 + 1 = x^2 + 1$$
$$\Rightarrow 0 = 0$$

Unfortunately, my proof is now incorrect: I have proven that $0 = 0$ which is certainly true but is not what I wanted to prove. To fix this, I could use bi-implication symbols $\Leftrightarrow$ instead of implication symbols $\Rightarrow$. However, the order of logic is still back to front: I begin where I want to end. Reversing the order gives a more natural flow of logic:

$$0 = 0$$
$$\Rightarrow x^2 + 1 = x^2 + 1$$
$$\Rightarrow x^2 - x - x + 1 + 2x = x^2 + 1$$
$$\Rightarrow (x-1)x - (x-1) + 2x = x^2 + 1$$
$$\Rightarrow (x-1)(x-1) + 2x = x^2 + 1$$
$$\Rightarrow (x-1)^2 + 2x = x^2 + 1$$

This is now a coherent and logically linked collection of statements that logically conclude that $(x-1)^2 + 2x = x^2 + 1$, which was what I wanted to prove. However, the statements are a mess to look at and could be presented more nicely as follows:

$$0 = 0$$
$$\Rightarrow \qquad x^2 + 1 = x^2 + 1$$
$$\Rightarrow \quad x^2 - x - x + 1 + 2x = x^2 + 1$$
$$\Rightarrow \quad (x-1)x - (x-1) + 2x = x^2 + 1$$
$$\Rightarrow \qquad (x-1)(x-1) + 2x = x^2 + 1$$
$$\Rightarrow \qquad (x-1)^2 + 2x = x^2 + 1$$

This is much better than what I initially wrote but we can do better and simply write

$$(x-1)^2 + 2x = x^2 - 2x + 1 + 2x = x^2 + 1\,.$$

Writing maths

The best mathematical writings usually feature words instead of technical symbols, and mathematical notation instead of vague or verbose text. For instance, write "for all", "implies" and "therefore" instead of using symbols "$\forall$", "$\Rightarrow$", and "$\therefore$", and spare the reader the pain of parsing sentences such as

> "The square of the length of the hypotenuse of a right triangle is equal to the sum of the squares of the lengths of the other sides."

Instead, use notation and simple language:

> "For each right-angled triangle with side lengths a, b, c, where c is longest,
>
> $$a^2 + b^2 = c^2 \, . \quad "$$

When writing an article for Parabola, use LaTeX [1]. This is not difficult and does not take long to learn; for instance, you could begin by looking at the LaTeX code written to produce this article; see [2]. It shows some standard LaTeX uses and features a few more advanced tricks as well.

There are many features in LaTeX to make it easy to write beautiful mathematics. For instance, use the `\begin{theorem}[...]\end{theorem}` environment to present theorems nicely, as we could have done above:
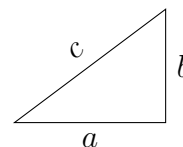
Theorem 1 (Pythagoras' Theorem)**.**
For each right-angled triangle with side lengths a, b, c, where c is longest,

$$a^2 + b^2 = c^2 \, .$$

Pictures

Mathematics is often described best in pictures and, if you can improve your *Parabola* article by including a picture, then please do so. To draw pretty mathematical pictures, you can use the LaTeX packages `pstricks` and `TikZ`. This might seem daunting but is actually quite easy to draw most pictures.

To illustrate Pythagoras' Theorem in the previous subsection, for instance, I could have drawn the right-angled triangle here on the above-right by writing the `TikZ` code:

```
\begin{center}
  \begin{tikzpicture}[scale=0.4]
    \draw (0,0) -- (4,0) -- (4,3) -- cycle;
    \draw (2,0  ) node[below] {$a$};
    \draw (4,1.5) node[right] {$b$};
    \draw (2,2.2) node[above,left,rotate=37] {$c$};
  \end{tikzpicture}
\end{center}
```

3 Be patient

To write a good article for *Parabola*, you first need a good story to tell. It might take time to find something that might interest readers but be patient: good ideas come if you wait for them. You could also browse through past issues of *Parabola* to find inspiration and to see how others have written good articles.

Once you have found a good story for your article, you can begin writing your first drafts. It can take much revision and many drafts to create a beautiful article, and this might test your patience or seem like too much work. During this process, it can be useful to show your drafts to friends, family or colleagues. Their feedback can help you make your article more engaging and easier to understand. Remember also to proofread your article carefully. This is difficult! Can you find a grammatical error remaining in this article?[3]

Once you can't find more to improve, then your draft is ready for submission to *Parabola*. Referees will look at it to see whether it is potentially interesting to readers, mathematically correct and nicely presented. Approximately two out of three submitted articles are rejected because they would not be of interest to readers or because the maths is incorrect. The articles not rejected sometimes require further editing, or even re-writing, so please make your article as nice as you can before submitting it. All this revision might sound scary and tedious but is sometimes what is needed to make a good and pretty article: it is worth it. To make these revisions easier, I will happily help you with any needed advice and support.

4 Enjoy!

The most enjoyable articles to read are usually the articles that were most enjoyable to write. Therefore, please, if possible, enjoy your work when playing with the maths and when writing up your article, perhaps in enjoyable collaboration with others. The desire to publish an article can be strong but don't let this desire make you rush any parts of the process: discovering beautiful maths and writing an engaging article often takes time. By taking that time, and by enjoying the process, you can produce an article that both you and your readers will enjoy.

We editors at *Parabola* look forward to enjoying your articles too, so we look forward to your submissions!

Acknowledgements

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[3]*Hint.* A small word is missing near the end of page 3.

References

[1] *LATEX - A document preparation system*, https://www.latex-project.org, last accessed on 2020-08-27.

[2] T. Britz and I. Co-author, How to write a Parabola article, *Parabola* **56 (2)** (2020), https://www.overleaf.com/read/dtfhsxgcdqpk.