Getting Published in Mathematics

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REU/REG0 Programs, Summer 2009

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Version 7/28/2009

Getting a mathematical research paper published is a complex, lengthy, and often mysterious, process. The following tries to shed some light into this process and explain what goes on behind the scenes. For students, and anyone (including fresh PhD's) with little experience in getting papers published, the most important piece of advice on getting something published is: **Don't try anything without advice and guidance from your advisor or an experienced mathematician familiar with your work.**

1 Writing a paper

Before thinking about how to get published, you need to have a finished paper. It is very import that the paper be in as perfect a form as possible, before submitting it to a journal. I won't go into the mechanics of writing papers and what constitutes good mathematical writing. However, make sure to consult with your advisor throughout the process. Most likely, there will be multiple (maybe a dozen or more) rounds of revisions before the advisor will give his/her stamp of approval.

2 Choosing a journal

All journals are not equal, and choosing the right journal to submit a paper to is of critical importance. On the one hand, you don't want to submit a paper to a low quality journal or one with a questionable reputation. (There exist several journals which are run by crackpots and which mostly attract crackpot papers.) On the other hand, if you send a paper to a journal with very high standards, it is likely that the paper will be rejected on the grounds that it doesn't meet these high standards.

For papers resulting from undergraduate research, the most obvious choice would be one of the journals specializing in publishing such research (see the Mathematical Journals handout for a list of such journals). Another option might be the Fibonacci Quarterly, or similar journals. However, if the research is of sufficiently high level, it may be suitable for a specialized journal such as the Journal of Number Theory. You should consult with your advisor (and other faculty) on whether this is the case, but I would guess that the vast majority of publications resulting from REU programs don't make it to that level.

3 Submitting a paper

Once you have decided (in consultation with your advisor) on a journal, the next step is to find out what the procedures for submitting papers to this particular journal are. For some journals, papers must be submitted to a central office, while for others, they can be sent to any one of the editors. Also, some (but by no means not all) journals allow electronic submission of TeX files. This information can usually be found in the back of a journal issue, and on the journal's website. Every submission should include a cover letter, saying that the enclosed paper is being submitted for journal xyz. This is important since many editors handle papers for more than one journal. Also, it is fairly common among mathematicians to send preprints of papers to people they believe might be interested in these papers, and a busy editor receiving a paper with no cover letter might consider the paper as just such a courtesy preprint.

Once you have submitted a paper, you should expect an acknowledgement within a few weeks. If you have not received an acknowledgment within, say, a month of the date of submission, a quick email inquiry to the editor you

submitted the paper to is appropriate. Occasionally, papers get lost, either in the mail, or on some editor's desk, or perhaps in a journal's editorial office.

4 The refereeing process

Nearly all journals have some sort of screening process for articles submitted for publication. This is what is usually referred to as the "refereeing process," and it is one the most critical, but also one of the most mis-understood, stages in the process of getting a paper published. It is here that "life and death" decisions (acceptance or rejection of a submitted paper) are made.

The severity of the screening depends very much on the particular journal. At one extreme, there are a few journals that do only a superficial review and publish nearly everything that gets submitted to them. These journals are the mathematical equivalents of vanity presses. They tend to have a poor reputation, because they end up publishing many sub-standard papers, and they are not journals that you want to have your paper published in.

At the other extreme, some of the elite journals will accept only a small fraction of all papers submitted to them, and may have rejection rates of maybe 80% or more.

Most journals probably fall somewhere in the middle, with acceptance rates of between 1/3 and 2/3. At the Illinois Journal of Mathematics, the acceptance rate is about one out of every three papers; the Journal of Number Theory probably has an acceptance rate of more than 50%. Reliable statistics are hard to come by as journals do not (generally) publish their acceptance rates. Also, the numbers may vary over time, and may depend on the subject area. If a journal has a disproportionally large number of papers in one area, it may set the bar higher for papers in that area. There is also a supply/demand factor. Journals usually publish a fixed number of pages per year; if the number of papers submitted per year amounts to twice as many pages, the journal will try to keep the acceptance rate at about one out of every two papers submitted.

It is important to understand how the screening process works. With many journals, the first step is a pre-screening at the editorial level. The editor to whom the paper has been submitted may take a quick look at the paper to see if the paper is *potentially* suitable for publication in the particular journal. This serves to eliminate crackpot papers and papers that are outside the scope of a particular journal – such as papers in number

theory submitted to a journal on differential equations, or expository papers submitted to a journal devoted to publishing original research. Also, papers that may be worthy of publication in *an appropriate* journal (e.g., a journal specializing in the area of the paper), but are clearly not up to the standards of the particular journal to which they have been submitted, may be rejected at this stage. At the Illinois Journal of Mathematics, about one out of every three papers are rejected at this stage for various reasons, though the most common is the last one – a paper that is *clearly* below the standards of the IJM, though it may be publishable in a journal with lower standards.

If a paper is not screened out at the editorial level, it will be sent to a specialist in the area of the paper for a detailed evaluation. This process is called "refereeing," and the person performing the evaluation is called the "referee." Some journals have a policy to use at least two referees for each paper, but the most common scenario is that a paper is initially sent to only one referee. If that referee declines to do the job, or simply does not respond, the paper will be sent to an alternate referee. It is not unusual that an editor has to send a paper to several potential referees before finding someone who is agreeable to do the job.

If a paper makes it to the refereeing stage, its fate rests largely with the referee, though the editor handling the paper and, in some cases, the entire editorial board, make the final decision on acceptance or rejection. An enthusiastic report by the referee virtually guarantees publication, while a lukewarm, ambiguous endorsement may set the paper up for rejection. (In the latter case, the editor might use his/her own judgment or consult a second referee before making a decision.)

Refereeing is the most critical stage that a paper has to go through, but it is also one of the most mis-understood parts. Authors need to realize that refereeing is a hard and time-consuming task, and that referees do not (in general) get paid for this service. Most professional mathematicians are willing to take on refereeing duties as a service to the mathematical community; after all, they probably have published a number of papers themselves, and thus have been many times at the receiving of this service. Referees are usually busy people, and the greater a referee's reputation, the busier that person is. It is unreasonable to expect referees to review a paper immediately upon receipt, since they may have other papers stacked up and waiting to be refereed and are usually busy with teaching, research, and administrative duties. While some referees do return a report within a few weeks, the average refereeing time is probably in the order of a few months, and it is

not uncommon (and in the case of a very long and very technical paper not unreasonable) for a referee to take up to a year. Many referees are too busy during the semester and do all their refereeing during the summer and winter breaks.

It is important to make the job for the referee as easy as possible, by sending in a paper that has been carefully checked and proofread and which is in as close to perfect form as possible. Not only does this make the referee's life a bit easier, but it also increases the chances that the paper gets accepted. Nothing is more frustrating for a referee than having to deal with a paper that has been sloppily written and is full of typos; when I get a paper like this, I would usually ask the editor to return it to the author and request that the author brings the paper up to acceptable shape before evaluating the paper on its merits. Many authors are under the mistaken impression that minor glitches and typos are not a big deal since they'll be discovered and fixed during the refereeing process. While some referees indeed go to great lengths to check a paper line-by-line and note every mistake, most referees simply do not have the time to do that, and most editors do not expect referees to perform this kind of service. **It is not the referee's job to fix up a badly written paper; the responsibility for the accuracy and correctness of a paper rests entirely with the author, not with the referee or the editor.**

5 Refereeing criteria

A common misconception is that the referee's job is to check the correctness of a paper. Of course, a referee should be *reasonably confident* that the results of a paper are correct, but a correct theorem alone does not necessarily merit publication. Besides correctness, the "novelty" of the results is a necessary condition for publication in a research oriented journal. If the results are known and have been published elsewhere, they are usually not worth publishing again. (An exception could be made if the result is an important one and the proof is significantly different from the previously published proofs. In that case, the novelty lies in the method of proof.)

Correctness and novelty are the two obvious necessary conditions for getting published in a research oriented journal. However, not every new and correct theorem is worthy of getting published, or merits publication in a particular journal. Other criteria include:

- **Interest.** A result should be "appealing" in some natural sense, and should be of interest to a sufficient number of people.

- **Originality.** A result that, while being new, is just a minor variation or extension of a known result is is less deserving of publication than a result (or method of proof) that breaks new ground.

- **Definiteness.** A result should be in a reasonably "definitive" form, and should be such that it is hard to improve upon. This means, among other things, that it is (essentially) the best one can achieve with the methods used.

- **Depth.** A result should be of sufficient depth for the journal that it is submitted to. For example, a result that is at the level of an exercise in a graduate level course, or a problem in the *Monthly*, is inappropriate for a research journal such as the Journal of Number Theory. For college level journals, or journals devoted to undergraduate research, the requirements here are more lax, but results should be sufficiently nontrivial.

- **Comparison to other work.** Mathematical results rarely occur in isolation. There is usually a body of literature on the subject, and related results have been published in other papers. In evaluating the merits of a particular paper, it is often useful to make comparisons to related published work. For example, the case for publication in the *Journal of Number Theory* becomes stronger if there exist related results of similar depth and interest published in the JNT or in a *comparable* journal, such as *Acta Arithmetica*. On the other hand, if most related work has appeared in lower level journals, such as the *Fibonacci Quarterly* or *Math. Magazine*, the referee would probably recommend against publication in the JNT and suggest instead that the paper be submitted to a lower level journal.

6 Rejections

The acceptance rate at most high quality mathematical journals is probably significantly less than 50%; having a paper rejected by a good journal is not unusual, even for seasoned mathematicians with good reputation, and it is

nothing to be ashamed of. While some papers are rejected on the grounds that there is an irreparable error in the proof, or that the results are not new, the majority of papers that are rejected are likely to be worthy of publication in an *appropriate* journal, but were not deemed of sufficiently high interest and quality for the journal they were submitted to. Most papers that are rejected for the latter reason are resubmitted elsewhere and end up getting published.

In order to reduce the chance of having a paper rejected, it is important to carefully choose the journal to which the paper is being submitted. The journal should be appropriate for the level and nature of the results of the paper. If one aims too high, the risk of rejection is high. Students should consult with their advisor on this matter.

7 Revisions

It is very rare, even with seasoned authors, that a paper is accepted as is. Usually, the referee will suggest improvements in the paper, and the author should make a serious effort to follow the suggestions of the referee. It is not uncommon that a paper has to go through several rounds of revisions before it is deemed acceptable. The referee's suggestions should be viewed as constructive criticisms that will likely, if implemented, improve the paper to a point where it is acceptable. In fact, you should regard a report with detailed suggestions for a revision as good news. If the referee didn't think of the paper as worthy of publication (modulo some revisions), he/she would probably say so directly and not bother to prepare a long list of revisions. Also, if an editor, after receiving a referee's report, felt that the paper was not up to the standards of the journal (again modulo revisions), he/she would not ask the author to send a revised version, but reject the paper outright.

8 The production process

This is the end game. Once a paper has been accepted, it goes into the production pipeline. At this point, the publisher may ask the author to send TeX files of the paper, prepared according to specific instructions. To make things easier for the publisher, and to reduce the chance of errors being introduced, you should try to follow these instructions as best you can.

Depending on the "backlog" of the journal, it may take several months to a year or more before the publisher begins to typeset the paper. Even with papers that are already in some TeX format, there is a significant amount of copy-editing and marking up to be done. The end result of this stage are the "Galley proofs" or "Galleys." The Galleys are a preliminary version of the journal article, which are sent to the author, with a request to mark any corrections and to return the marked-up article within a specific period of time – usually a few days. In order to avoid delays in the publication of the paper it is important to return the proofs promptly within the requested period of time. Also, if you have moved since you originally submitted the paper, be sure to provide the publisher with an up-to-date address.

After all authors have returned their Galley proofs, the publisher makes appropriate corrections, and then sends the manuscript on to the printer. Many journals now have electronic editions which appear before the printed issues. You might want to check the journal's website to see if your paper has been posted.

Most journals provide authors with a set of 50 or 100 complimentary "reprints" of their article upon publication. These will usually be mailed some time after the journal issue has appeared. Again it is important to keep the publisher up-to-date on your address.