

How to Write a Paper for a Mathematics Class

1. The purpose of a paper in a mathematics class is to show that you have read about a mathematical topic not covered in this class or any other math class you've taken, and to understand it well enough to explain it to someone else. In short, try to impress me, the instructor, with how thoroughly you researched and understood some aspect of mathematics. You will usually need at least two references, sometimes more, but rarely many more. Consider your audience to be a classmate who knows nothing about your topic, but who is smart and picks new ideas up quickly. Your explanation, therefore, can be concise, but do not leave gaps for the reader to figure out.

2. Your topic need not be advanced, but it should contain some interesting mathematics. For example, cubism is not automatically a mathematical topic just because it includes circles and squares. But if you show how circles and squares are arranged using a mathematical formula to create a special effect in a work of art, that's real mathematics. A paper on ballet and mathematics should include something more advanced than the counting used in dance. It's great to discuss a famous mathematician, but you must show that you understand something about his or her mathematics, and not just be about the person's life. Don't choose an overly broad topic such as "The History of Mathematics." Instead, focus on a narrower topic and cover that topic in detail.

3. There are many ways to find ideas for papers. You can find books in the library with suitable topics under the call letters QA 7 (general math), QA 8-9 (philosophy of math), QA 11-19 (math education), QA 21-29 (history of math), QA 36-39 (fundamentals of mathematics), QA 93-99 (mathematical recreations), QA 111-115 (arithmetic), QA 440-448, 474, 483-484 (geometry), or other areas of the QA's on the 8th floor of the library. Still another possible source is the 4-volume set *The World of Mathematics* (QA3.N48). Mathematics and music is included in ML3800, ML3805, ML3809, and MT165.

Here is a list of a few possible topics:

Chinese Remainder Theorem	abacus
a topic in number theory	math and art
math and magic	trisecting the angle
Kepler's Laws	conic sections
magic squares	codes and ciphers
Catalan numbers	
game theory	
the work of some famous mathematician	
math of some historic culture (e.g. Chinese, Egyptian, Muslim)	
almost anything by Martin Gardner (mathematical recreation)	
almost anything by Steven Brams (mathematics of political science and theology)	
any topic in the textbook that we don't cover in class	
a topic from "Excursions in Modern Mathematics," used in other sections of Math 30A	

I also have some material if you are having trouble coming up with a topic.

4. If you are interested in a topic and cannot find a book on the topic in the library, you may wish to search the Internet. Search engines such as Google and Yahoo can be helpful in finding web pages with useful information. In your references, list the URL for the pages you use. Be careful; there is a lot of unreliable information on the Internet. Before using information on a web page, you should investigate who has posted the page and whether the person seems reliable. Most papers based only on internet sources tend to get low grades.

5. The paper should be about 6 pages in length, not counting the cover page and the references. This assumes 6 pages packed well with information; if you include diagrams or material which takes up a large amount of space, feel free to go beyond 6 pages. This also assumes a normal font size. If you use a large font size, your paper should be longer. Longer than 6 pages is fine; shorter is not. You may wonder how you can say very much in only 6 pages. The solution is to make sure each sentence conveys some information. Many students have the tendency to fill up a page at the beginning with such palaver as, "Magic squares are an interesting topic. Many mathematicians have studied them for a long time. They have an extensive history. I have never studied them before, but I found that if we take the time to examine them, we will find they have many amazing features blah blah blah . . ." Try this instead: "A magic square is . . . The earliest known magic square was found in . . ." Similarly, cut out filler paragraphs at the end such as, "I learned a lot about magic squares through this paper. There is much more to cover that I don't have room for here. Nevertheless, magic squares

gives some insight blah blah blah. . ." When you've run out of things to say, stop. I have found many papers got better when the first and last pages were removed.

6. Assume your reader is familiar with any topic covered in class, but when you use a new mathematical term, be sure to define it. Be precise. Avoid vague expressions; for example, don't say "Polar coordinates are useful in engineering" unless you are going to explain how polar coordinates are useful in engineering. It is acceptable to say that some details are beyond the scope of your paper, but do so sparingly. Rather than just mentioning the names of mathematical ideas developed by some person or group of people, give examples to show what those ideas are all about.

7. You may have been told in other classes never to say "I" or "me" in a paper. For this class, it is acceptable to use "I" whenever appropriate. Here are some examples of appropriate uses:

"Here is an example I created to illustrate these ideas." (Good! I encourage you to try to create your own examples.)

"To test this hypothesis, I collected the following data." (Great! If data is relevant to your topic, collecting your own is fine.)

"Based on these examples, I suspect that the following statement is always true." (Terrific! Making a conjecture is an important mathematical activity, assuming you have some evidence for your conjecture.)

"Based on the previous examples, it seemed to me that the following statement is always true, although it is not stated in any of my references: . . . Here is the proof that I came up with." (Amazing! Looks like an A+ paper from here.) Many of the best math papers will contain the word "I" because they go beyond just quoting what other people say and involve some creativity on the part of the author.

8. You may have been told in other classes not to include your own opinions in a paper. In a math paper, your opinion is important, assuming you have evidence to support it.

BAD: "This method is very difficult." (Says who? Why?)

GOOD: "This method is more difficult than the first because it requires making an accurate initial guess, for which there is no good method."

9. Do not write down anything you don't understand!!! If there's something that you want to include in your paper but you don't understand it, feel free to ask me for help. If you quote a formula or describe a procedure, try to justify it with a derivation or an explanation.

10. The details of the style are not important. Use anything that is reasonable. Just make sure I will have an easy time reading it. For example, if you quote material from a book, I don't really care whether the footnote is at the bottom of the page or at the end of the paper, but if I cannot quickly find the source of your quote (including the page number), your style is unacceptable. Give references for all sources that you actually use, and don't list references that you don't use.

11. The paper that is basically adequate earns a C. If you want to earn an A, try to impress me. Show me that you've learned something significant about mathematics.

12. Spell-check your paper.

13. Start early. An A paper takes time. The paper tossed together a few days before it is due usually earns a C, D, or even an F.

14. Don't plagiarize. This means that if you borrow someone else's ideas, or if you quote from another source, even if the quote is not verbatim, you need to give credit to the source. Even when you give credit, try to rephrase the ideas in your own words, which means doing a lot more than changing the word "house" to "home." To avoid plagiarism, you will be required to submit an electronic copy of your paper to Turnitin.com, an anti-plagiarism site. I will give you more details in a separate handout.

15. Make sure that you do not post your paper anywhere on the internet this semester or submit it to any other class.