

Assignment 3: Rationality and Irrationality

Math 300 – Spring 2019 (Hachtman)

Due Monday, March 4

Assignment 3 is a reading and writing assignment related to our in-class discussion of Niven’s proof of the irrationality of π [3]. For the writing portion, you have two options to choose from.

Reading assignment: Irrationality of $\sqrt{2}$

Begin by reading pages 28–42 of David Flannery’s *The Square Root of 2: A Dialogue Concerning a Number and a Sequence* [1]. The reading is a portion of a hypothetical dialogue between a teacher and student regarding whether there is a number whose square is precisely 2. The excerpt picks up following a number of attempts by the student to find such a number of the form $\frac{a}{b}$, with a, b integers (and getting results correct within 40 decimal places!).

Writing Option 1:

Filling in the details (Proof-writing option)

We have been discussing a short proof of Niven’s [3] that π is an irrational number, with in-class time devoted to explaining the steps of the proof. For this option, write a version of that proof that is more “accessible” by filling in each step with a detailed explanation of why it is true.

Writing Option 2:

What is a proof anyway? (Research paper option)

This is a two-page paper on the topic: “What is a proof?”

What is the purpose of a mathematical proof? Who is it for? How is it made? What are its parts? What makes a proof successful? What makes a failed proof wrong? Can a proof be a failure without being wrong?

In this paper, you will give a definition of *proof*, and are invited to consider whichever of these or closely related questions interest you.

Finally, **you must include a paragraph evaluating Niven’s proof** as successful or not under your given definition.

The bibliography

For either option, you must include a correctly formatted bibliography in L^AT_EX; I suggest using BibTeX and a separate .bib file.

For option 1, you must cite Niven's paper and whatever other resources you consulted for help (such as the paper [2] which I handed out in class, if you used it).

For option 2, you must do some independent reading. Find at least 2 published sources to support your essay, and include proper citations and references to these (as well as Niven's paper). If you are having trouble finding good sources, let me know! You have access to an enormous quantity of mathematical writing at all levels through the UIC library, and I can suggest some places to start.

References

- [1] David Flannery. *The square root of 2*. Copernicus Books, New York; in association with Praxis Publishing, Chichester, 2006. A dialogue concerning a number and a sequence.
- [2] Timothy W. Jones. Discovering and proving that π is irrational. *Amer. Math. Monthly*, 117(6):553–557, 2010.
- [3] Ivan Niven. A simple proof that π is irrational. *Bull. Amer. Math. Soc.*, 53:509, 1947.