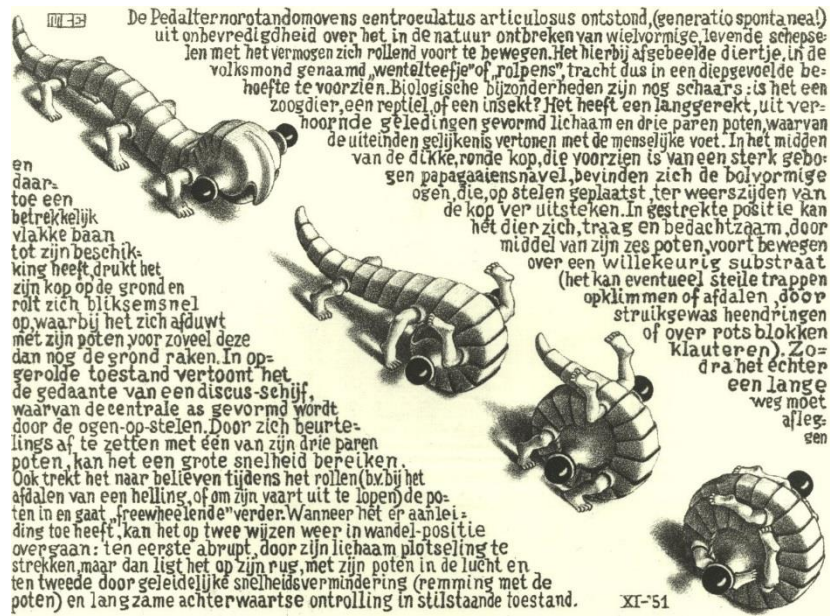# ESSAY TOPICS FOR MATH 117

Curl Up, M. C. Escher

Write a 3 - 5-page essay on one of the following topics. Your paper will be evaluated based on content, style, grammar, and originality. Be certain to give credit to all of your sources (including those on the web) at the end of the paper. Quality is far more important than quantity. Avoid dullness.
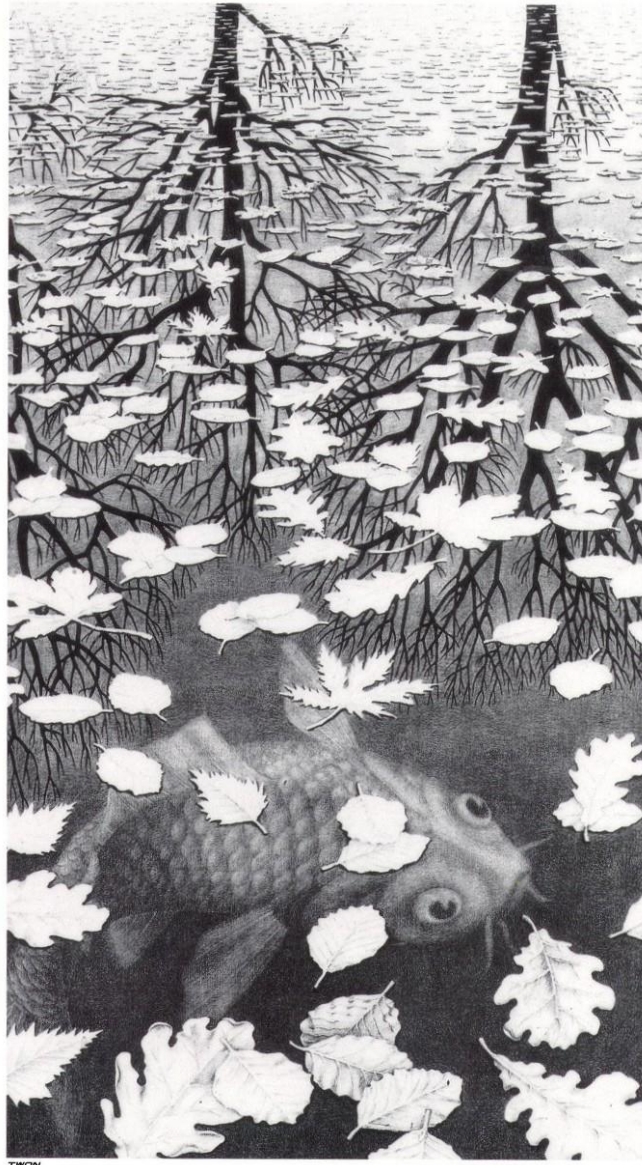
Due date: 1 May 2019

1. Read John Allen Paulos, **Innumeracy: Mathematical Illiteracy and Its Consequences**, Hill and Wang paperback (2001). In reviewing Paulos' best-selling book, Douglas Hofstadter, author of **Gödel, Escher, and Bach**, wrote: "*To combat [innumeracy] John Allen Paulos has concocted the perfect vaccine: this book, which is in many ways better than an entire high school math education! Our society would be unimaginably different if the average person truly understood the ideas in this marvelous and important*

book. It is probably hopelessly optimistic to dream this way, but I hope that **Innumeracy** *might help launch a revolution in math education that would do for innumeracy what Sabin and Salk did for polio.*" Do you agree with Hofstadter's statement? Justify your position, preferably drawing from personal experience.

2. Explore the life of a student growing up in 19th century England learning algebra from the text **Hall & Knight's Elementary Algebra** (available in Google Books). This may be historical fiction, or you may wish to view this as an actual historical portrait.

3. Read George Pólya, **How To Solve It**, Ishi Press (2009). In this highly readable book, renowned mathematician Polya describes a four-step problem-solving procedure. Describe this process in your own words. Using *exercises from your homework assignments* as examples, show how Polya's method can be applied to design solutions to calculus problems.

4. We have already seen the value of identifying symmetry in the graphing of functions. Develop the theme of symmetry in mathematics, art, architecture, chemistry, human anatomy, or any other discipline. You may wish to read and incorporate ideas from Herman Weyl's beautiful (and short) book, **Symmetry**, Princeton University Press (1983).

5. D'Arcy Thompson's **On Growth and Form**, CreateSpace (2011), has been called by Nobel laureate P. Medawar "*the finest work of literature in all the annals of science that have been recorded in the English tongue*." Others have called him "the first bio-mathematician." The central thesis of **On Growth and Form** is that zoologists of his time overemphasized the role of evolution, and underemphasized the roles of physics and mathematics as determinants of the form and structure of living organisms. Perhaps the most famous part of the work is Chapter IX (of the abridged version), "*On the Theory of Transformations, or the Comparison of Related Forms.*" Here Thompson explores the degree to which differences in the forms of related animals could be described utilizing relatively simple mathematical transformations. Choose a topic or an example from Thompson that particularly intrigues you; describe and discuss this example in your paper. Explain why you find this topic remarkable.

6. Discuss the discovery of the solution to the cubic equation, drawing from the lives of Tartaglia and Cardano. You may wish to read portions of the lively text by Orstein Ore, **Cardano: The Gambling Scholar**, Dover (1965).

7. Read Nate Silver's critically acclaimed book, **The Signal and the Noise: Why So Many Predictions Fail -- But Some Don't**, Penguin Press (2012) in which *"Silver examines the world of prediction, investigating how we can distinguish a true signal from a universe of noisy data. Most predictions fail, often at great cost to society, because most of us have a poor understanding of probability and uncertainty. Both experts and laypeople mistake more confident predictions for more accurate ones. But overconfidence is often the reason for failure. If our appreciation of uncertainty improves, our predictions can get better too. This is the 'prediction paradox': The more humility we have about our ability to make predictions, the more successful we can be in planning for the future."* Discuss how this book has influenced your views toward predicting the future.

8. Read Jonathan Swift's **Gulliver's Travels** (or at least several chapters). Write an essay in the style of Swift describing your adventures in visiting a new land that developed a reasonably advanced civilization that does not teach algebra in schools.

9. The renowned Argentine writer **Jorge Luis Borges** was fascinated by the infinite. Read several of the short stories in Borges' **Labyrinths: Selected Stories and Other Writings.**   Discuss the relationship between the study of the infinite in mathematics and Borges' vision of the infinite. Alternatively, write a short story in the style of Borges that engages the reader in a particular encounter with the differential calculus.

10. Stephen Jay Gould, in his brilliant work, **The Mismeasure of Man**, Norton (1996), argues forcefully how misuse of science and mathematics have been used as an instrument of discrimination, using the I.Q. test as a significant example. Read and discuss your personal reaction to this work that is regarded by many as "a major contribution toward deflating pseudo-biological 'explanations' of our present social woes."

11. **Read Sheila Tobias, Overcoming Math Anxiety**, W. W. Norton & Co. (1995). The first edition of this book, written in 1978, made "math anxiety" a household term. In the revised version, Tobias explains her view that math anxiety is a political issue and that math competence doesn't have to be determined by gender or class. Do you agree with Tobias' thesis? Justify your position. Give examples from your own experience. Be sure to consider more recent research, such as that of Dr. Sian L. Beilock, math anxiety expert at The University of Chicago's Psychology Department: When Math Hurts: Math Anxiety Predicts Pain Network Activation in Anticipation of Doing Math

12. Write a creative and imaginative short story in which precalculus plays a central role.

13. You may wish to choose a topic not listed here. If so, *you must obtain prior approval* from your instructor.

Three Worlds, M. C. Escher