

MATH 201: PAPER B

March 2020

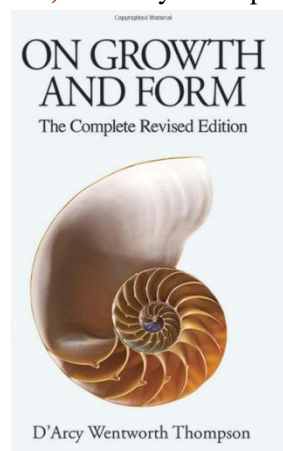
Write a 3 to 6-page essay on one of the following topics. Your paper will be evaluated based on *content, style, grammar, and originality*. Be certain to give credit to all of your sources (including those on the web) at the end of the paper. Quality is far more critical than quantity. *Avoid dullness*.

Due date: 23 April 2020

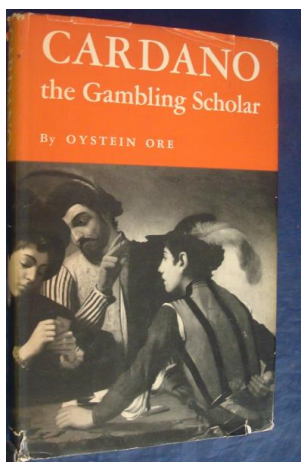
- 1) Choose one of the four chapters in Vilenkin's **In Search of Infinity**, and explore the ideas expressed in the chapter. (Chapter 1. Infinity and the universe, Chapter 2. The mysteries of infinite sets, Chapter 3. Remarkable functions and curves, or a stroll through a mathematical hall of wonders Chapter 4. In search of the absolute)

<https://yakovenko.files.wordpress.com/2011/11/vilenkin1.pdf>.

- 2) D'Arcy Thompson's **On Growth and Form**, Cambridge University Press; (1992). (first written in 1917, revised by Thompson in 1942) 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 significant 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 using 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.



read

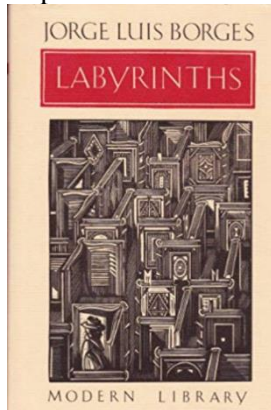


- 3) Discuss the discovery of the solution to the cubic equation, drawing from the lives of Tartaglia and Cardano. You may wish to portions of the lively text by Orstein Ore, **Cardano: The Gambling Scholar**, Dover (1965).

- 4) 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 and Borges' vision of the infinite.

In addition to Borges' fascination with the infinite, there continue to be many examples of how our culture is fascinated by tales of the

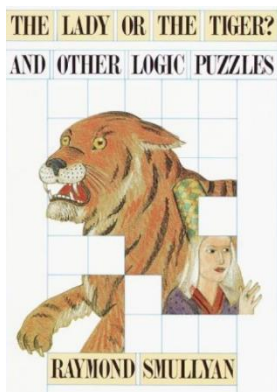
infinite. Explore and discuss other contemporary examples of our culture’s fascination with the



infinite.

Alternatively, write a short story in the style of Borges that engages the reader in a particular encounter with the differential calculus.

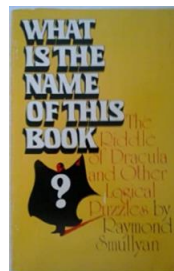
- 5) Read David Foster Wallace’s idiosyncratic book, **Everything and More: A Compact History of Infinity**, W. W. Norton (2003). You will find fascinating discussions about the paradoxes of infinity. Explore his thesis that “However good calculus is at quantifying motion and change, it can do nothing to solve the real paradoxes of continuity....” (p. 145).
- 6) What is the Continuum Hypothesis? What were the contributions of Cantor, Gödel, Cohen?
- 7) Stephen Jay Gould, in his brilliant work, **The Mismeasure of Man**, Norton (1996), argues forcefully how the misuse of science and mathematics has 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.”
- 8) Difficult: What is the Banach-Tarski paradox? What is the axiom of choice? Transfinite induction?
- 9) *What is the Name of This Book?* published in 1978 is a collection of logic puzzles and paradoxes that culminate in the development of Gödel’s incompleteness theorem. Explore one of Smullyan’s books and discuss the “Lady or the Tiger” problem as well as several other puzzles that intrigue you.

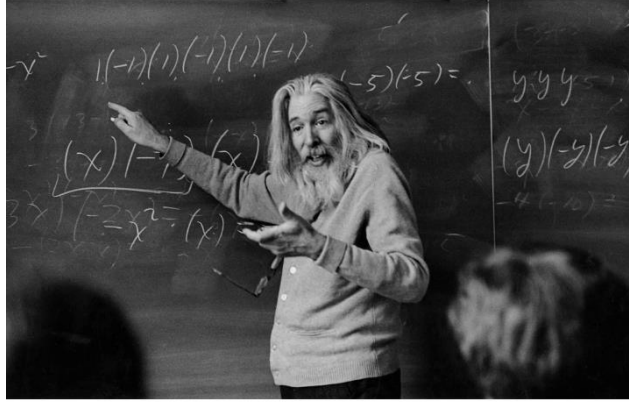


Also read the brief articles:

<https://qedinsight.wordpress.com/2011/04/01/the-logic-puzzles-of-raymond-smullyan/>

<https://www.nytimes.com/2017/02/11/us/raymond-smullyan-dead-puzzle-creator.html>





Raymond Smullyan, who died this past week, taught math and philosophy at Lehman College in the Bronx in the 1970s. Eddie Hausner/The New York Times

- 10) Explore the history of Diophantine equations.
- 11) 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