ArtSci 1D06 2017–18 Essay

The essay should be in the range 1500–2000 words (that is, 3–5 pages single spaced or 5–8 pages double spaced, in 10–12 point font). You should choose from one of the topics below, but not more than 4 people may work on the same topic. (If you really really want to do another topic, discuss with me or your TA.) You are encouraged to meet with the other students working on the same topic in order to understand what it is about. Of course, the essays will be written individually. You should have at least three references, at least one of which is not a web source.

Topics
1) Fractals, eg Mandelbrot set, Sierpinski triangles
2) Interesting problems involving π:
   - Buffon's needle
   - $\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$
   - transcendence of π
3) Paradoxes
   - Borel problem
   - Banach-Tarski paradox
   - Russell's paradox
4) Infinity
5) Surreal numbers
6) Historical developments
   - complex numbers
   - rigor in the foundations of calculus
   - controversy about Euclid's 5th postulate
7) Non-euclidean geometry
8) Euclidean geometry
9) Irrational numbers
10) Wavelets
11) Fourier series
12) Travelling salesman problem and P versus NP conjecture
13) Poincare's conjecture
14) Twin primes conjecture
15) Fermat's last theorem
16) Random Walks
17) mathematics in finance
18) mathematical epidemiology

Procedure and timeline

October 20: Talk about writing on technical topics
November 17: Brief description of the topics
Before end of semester: Choose topic, inform me and/or TA
January: Research the chosen topic; meet with other students working on same topic to discuss
February 2: Submit draft of essay for informal feedback
March 2: Final version of essay due