

**Midterm Exam History and Foundations of Space and Time**  
**15 April 2013**

1. In the 18th century Saccheri attempted to prove Euclid's fifth postulate from the first four postulates.
  - a. Formulate the fifth postulate.
  - b. Describe Saccheri's strategy for proving that the fifth postulate follows from the other postulates.
  - c. How did Saccheri convince himself that the so-called hypothesis of the acute angle was impossible?
  
2. Newton adopted a substantialist position with respect to space.
  - a. Explain what "substantialism" is, and what the opposite position is.
  - b. Explain Newton's reasons for being a substantialist.
  - c. Explain Leibniz's argument on the basis of which he attacked Newton's ideas about space.
  
3. In his 1905 paper on the Electrodynamics of Moving Bodies, Einstein introduced special relativity. Describe Einstein's strategy in this paper:
  - a. What reasons does Einstein give to be dissatisfied with the existing theory?
  - b. How does Einstein build up his own theory?
  - c. In what way (generally described) does Einstein derive the Lorentz contraction? Compare this with the way Lorentz himself had derived this contraction.
  
4. By means of a famous thought experiment (in which flatlanders measure their two-dimensional world in which there is a semi-spherical "bump") Hans Reichenbach argued that the assignment of a geometry to a surface is conventional.
  - a. Explain Reichenbach's argument.
  - b. Give your own (argued) opinion about Reichenbach's argument.

*Handwritten notes:*  
Einstein's strategy  
Lorentz contraction