

Project 6: Parallels and Connections

The purpose of this problem set is to make connections and apply the material. You may work alone or in a group of up to 2 people. Groups turn in one project writeup. Be sure to show work and explain your reasoning in your own words. In addition, be sure to acknowledge any sources outside me or your group, like “The insight for this solution came from a conversation with Joel.”

1. Exercises 2.3 #1—discuss at least two possibilities and explain your reasoning.
2. Exercises 2.7 #2 with additional instructions:
 - a) Instead of outlining a proof for part (i), write a rigorous proof, using reasoning from *Euclid's Elements Book I*—you may assume only Euclid's first 31 propositions—and identify any underlying assumptions.
 - b) Complete part (ii) as instructed. If it isn't true then provide a counterexample in addition to an explanation.
 - c) For elliptic geometry in part (iii), use spherical geometry. If it isn't true then provide a counterexample in addition to an explanation.
3. Exercises 4.2 #1
4. Examine the following statement: If a straight line cuts one of two parallel lines, it cuts the other. Prove that this statement proves Playfair's and that Playfair's proves this statement. You may assume *Euclid's Elements Book I* before I-28.
5. Explore parallels in a creative way—produce an imaginative work of your own making involving parallels on the sphere (no parallels), the plane (1 parallel), and hyperbolic geometry (infinitely many parallels). For example, this might be a series of photographs or physical models, a poem, a video, a song, written as a newspaper interview, a newsletter bulletin, a presentation, a study guide, a classroom worksheet... It must be a product you create and that you can turn in. Be sure to acknowledge any references and give proper reference where it is due, including any pictures.
6. (Individual component) Research one item related to focuses in your major(s) or intended careers and parallelism, parallel lines, parallelization, or similar. Report back on it and include the source.