

## 1 Abstract

This project used Kepler's laws to generate the orbits of Earth and Mars, and to map the distance between the two planets over time. The distance between the two at a given time was approximated by assigning constant velocities to small fractions of the planets' orbits. The final result of the distance function was inaccurate, likely due to the method of approximation, but the exact reason is unclear.

## 2 Introduction

This project uses an integration approximation method to generate the positions of Earth and Mars at a given time. The final result is not expected to be fully accurate as the tilt of Mars' orbit relative to the Earth's was not considered. Nevertheless, the purpose of this project was to experiment with an approximation method of modeling and comparing the orbits of two planets. Since all the planetary data is loaded in from a text file, modeling planets other than Earth and Mars is as simple as changing the start positions, semimajor axes, and eccentricities contained in the text file. The relevant equations were taken from Classical Mechanics by Taylor and the Georgia State Website. The Georgia State website was also the source of the eccentricities and semi-major axes. The starting positions for Earth and Mars were approximated using the application Solar System Scope, based on March 31, 2021. This was a rough estimate, but the application was the best that could be found. The other relevant constants (mass of the sun and the gravitational constant "G" were considered common knowledge). Figure (2) was created based on Kepler's laws found in Classical Mechanics by Taylor, and relevant constants.

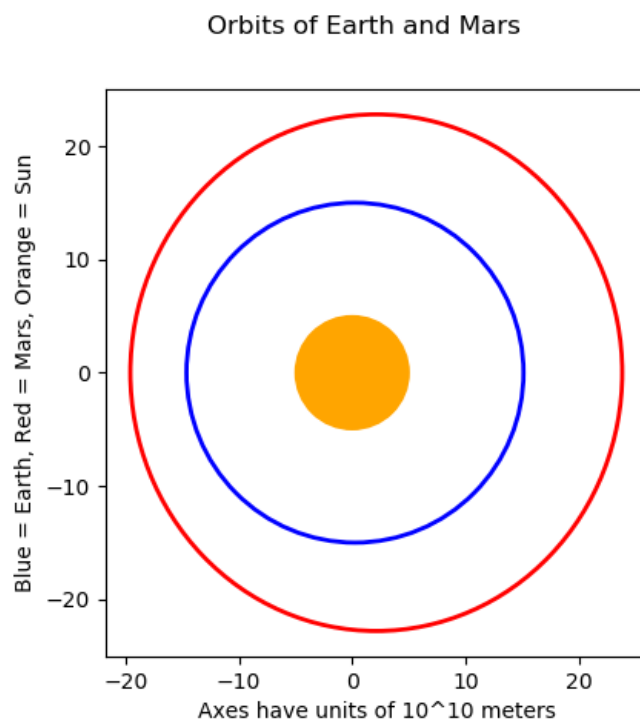


Figure 1: Orbits of Earth and Mars based on Kepler's laws. Orbital tilt is not considered