Create a Planet class takes a radius and a year. For example… >> mercury = Planet(3.5,88)

For simplicity, we will assume the orbits are perfect circles, are all on the same plane and are whole days. The orbital radius and year length for each planet are given below:

A picture containing text, screenshot, number, font

Description automatically generated

The planet class should have a function position() returns the position of the planet on a specific day. For example… >> mercury.position(0) >> 3.5, 0

On day 0, Mercury’s position is at its starting position: x = 3.5 CM, y = 0 CM relative to the Sun at 0, 0.

>> mercury.position(22) >> 0, 3.5

>> mercury.position(33) >> -2.47, 2.47

>> mercury.position(440) >> 3.5, 0

A picture containing circle, diagram, line, screenshot

Description automatically generated

Notice that, for a planet, the radius is always the same. Moreover, given a specific day and the length of a year for the planet, you can compute angle a in this diagram. Thus, with the hypotenuse and angle a, you should be able to calculate x and y using “sohcahtoa”.

A picture containing diagram, line

Description automatically generated

Create a function that takes two planet objects and a day, returns the distance between the planets on that day. >> d = distance(earth, mars, 732)

Create a simulation that runs for 1000 Earth years to observe which planet is closest to Earth,. On each day, compute the distance between every pair of planets, keeping the average.

**Report Part A:**

1) A well-documented top-down structure chart showing how both the planets and the simulation work and interact. Include any assumptions.

2) Create a 8x8 chart showing the average distance between all the planets. Show the chart in the documentation.

3) Which planet is on average closest to Earth? Did that result match your expectations? Explain.

4) Run another simulation, this time for only 1000 days, each day writing to a file the distance from Earth to Mercury, Venus, and Mars(i.e., one file for Earth to Mercury, another for Earth to Venus, and another for Earth to Mars). In the end, you should have a dataset with 1000 rows and 3 columns. Using Pandas and Matplotlib, create three timeseries. Show the timeseries in a plot in the documentation. Also describe the time-series and discuss them considering your findings in #3.

5) Describe three ways you could extend the simulation.

6) Include all your code of the simulation and analysis in an appendix to your report.

**Report Part B:**

1) How efficient is your simulation? Can you do better?

2) When computing the average distance between planets, would it be better to sample random days rather than iterating over every day for 1000 years?

3) What was your original assumption regarding the closest planet to Earth? Did the results match your expectation? Does the definition of “closest” matter?