# Retrograde Motion Worksheet

A) Historical Concepts Narrative (Fill in the blank.)

The _____ theory of the ancient Greek Ptolemy explained retrograde motion by placing planets on _____ that moved on bigger circles called deferents. This "wheels within wheels" theory could crudely explain retrograde motion, but it was _____ and totally wrong.

In the 1500s, Copernicus advocated a _____ theory of the solar system that was largely correct. Retrograde motion was now a _____effect that occurred naturally when Earth passed a slower moving outer planet. The Copernican theory was much _____.
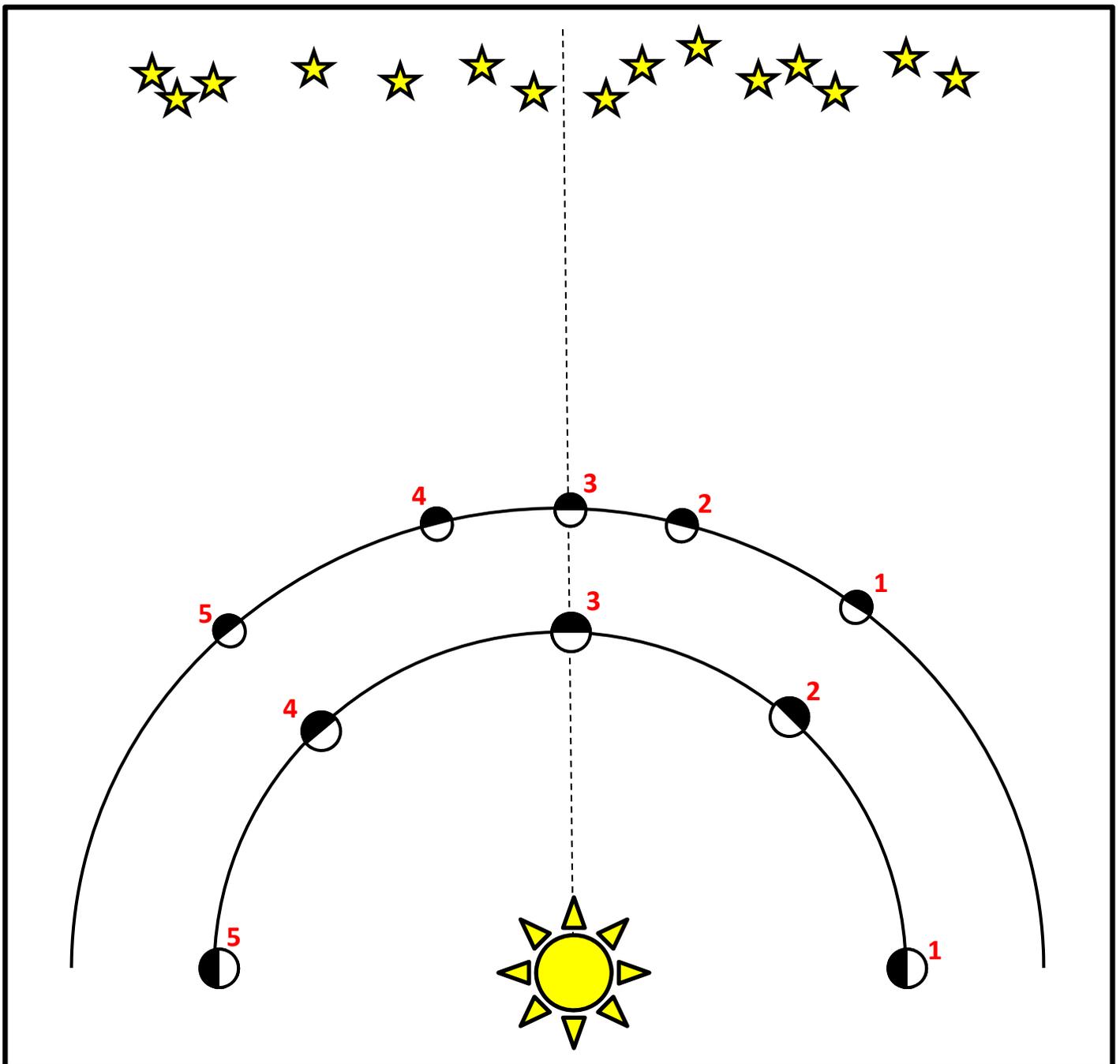
B. Retrograde Perspective

Directions: The diagram on the preceding page illustrates the positions of Earth and Mars at 5 different times.

- Draw perspective arrows illustrating the apparent position of Mars among the stars in the sky. (A ruler will be helpful.)
- Add the positions of Earth and Mars at four other times and draw the arrows indicating the position of Mars for these perspectives.
- Crudely draw the apparent path of Mars among the stars connecting your 9 (apparent position) data points. Use the motion of the planets on their orbits to properly sequence the apparent positions in your planetary path.

C. The Parameters Describing Retrograde Motion

Directions: The table below provides data on the retrograde motion of the superior planets in our solar system. Use the table data to help you estimate answers to the questions that follow.

Planet	Distance (AU)	Synodic Period (days)	Retrograde Interval (days)	Retrograde Loop Angular Size (°)
Mars	1.5	780	72	15.9
Jupiter	5.2	399	121	9.9
Saturn	9.5	378	138	6.8
Uranus	19.2	370	151	4.0
Neptune	30.1	367	158	2.8

i) Estimate a Retrograde Interval for the asteroid Ceres. _____

ii) Estimate a Retrograde Loop Angular Size for the asteroid Ceres. _____

iii) Estimate how often one could observe Ceres in retrograde motion. _____

iv) Estimate a Retrograde Interval for the Kuiper Belt Object Pluto. _____

v) Estimate a Retrograde Loop Angular Size for the Kuiper Belt Object Pluto. _____

vi) Estimate how often one could observe Kuiper Belt Object Pluto in retrograde motion. _____

D. "Far Out"

Directions: Add a row to the table above and complete the values for the hypothetical planet in a very large orbit "Far Out".