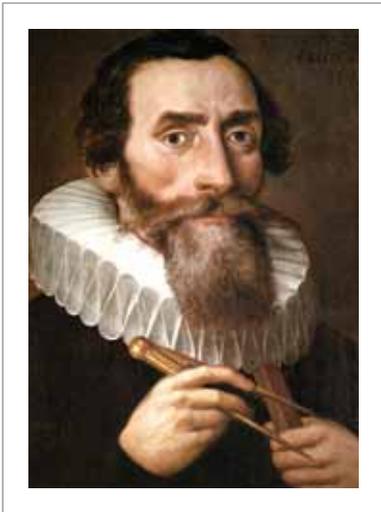


Other Patterns in Mathematics

You have learned about linear patterns (7.1), exponential patterns (7.2), quadratic patterns (7.3), and Fibonacci patterns (7.4). There are many other types of mathematical patterns. Two of them are shown in Examples 5 and 6.



Kepler's laws and his assertion that the planets orbit the Sun in elliptical orbits with varying speeds disagreed with the accepted models of Aristotle, Ptolemy, and Copernicus.

EXAMPLE 5 Analyzing Kepler's Third Law

In the heart of the Scientific Revolution in Europe, Johannes Kepler analyzed the astronomical observations of Tycho Brahe and, in 1609, published his first 2 laws of planetary motion.

1. The orbit of every planet is an ellipse, with the Sun at one of the two foci.
2. A line joining a planet and the Sun sweeps out equal areas during equal intervals of time.

His third law of planetary motion was not published until 9 years later. It concerns the pattern in the following table. The period is the time (in years) it takes a planet to make one orbit around the Sun. The mean distance is the average distance (in astronomical units) between a planet and the Sun as the planet passes through its elliptical orbit.

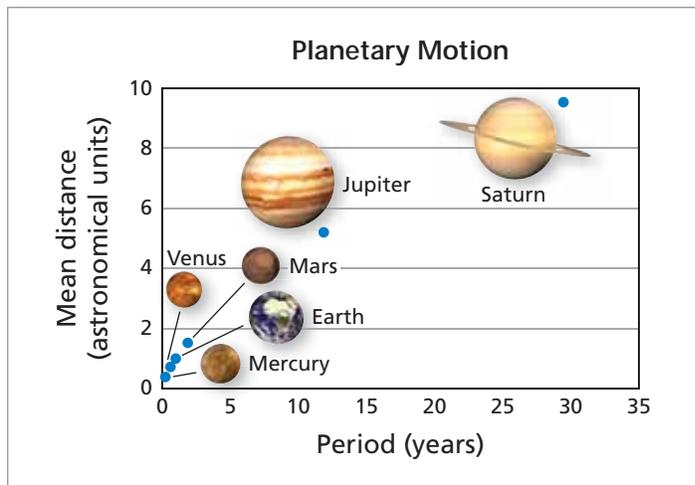
Planet	Mercury	Venus	Earth	Mars	Jupiter	Saturn
Period	0.241	0.615	1.000	1.881	11.862	29.457
Mean distance	0.387	0.723	1.000	1.524	5.203	9.537

Can you see the pattern?

SOLUTION

After many years, Kepler noticed that the square of the period is the cube of the mean distance. This relationship is summarized in Kepler's Third Law of Planetary Motion.

3. The square of the period of a planet is directly proportional to the cube of its mean distance from the Sun.



✓ Checkpoint

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Verify Kepler's Third Law by completing the following table.

Planet	Mercury	Venus	Earth	Mars	Jupiter	Saturn
$(\text{Period})^2$						
$(\text{Mean distance})^3$						