# Kepler's three laws

In the early 1600s, Johannes Kepler proposed three laws of planetary motion. Kepler was able to summarize the carefully collected data of his mentor – Tycho Brahe – with three statements that described the motion of planets in a Sun-centered solar system.

Kepler's first law explains that planets are orbiting the Sun in a path described as an ellipse. An ellipse is a special curve in which the sum of the distances from every point on the curve to two other points is a constant. The two other points are known as the foci of the ellipse. The closer together that these points are, the more closely that the ellipse resembles the shape of a circle. In fact, a circle is the special case of an ellipse in which the two foci are at the same location.

Kepler's second law – sometimes referred to as the law of equal areas – describes the speed at which any given planet will move while orbiting the Sun. The speed at which any planet moves through space is constantly changing. A planet moves fastest when it is closest to the Sun and slowest when it is furthest from the Sun. Yet, if an imaginary line were drawn from the centre of the planet to the centre of the Sun, that line would sweep out the same area in equal periods of time. As can be observed in the diagram, the areas formed when the Earth is closest to the Sun can be approximated as a wide but short triangle; whereas the areas formed when the Earth is farthest from the Sun can be approximated as a narrow but long triangle. These areas are the same size.

Kepler's third law compares the orbital period and radius of orbit of a planet to those of other planets. Unlike Kepler's first and second laws that describe the motion characteristics of a single planet, the third law makes a comparison between the motion characteristics of different planets. The comparison being made is that the ratio of the squares of the periods to the cubes of their average distances from the Sun is the same for every one of the planets.

(Taken from http://www.physicsclassroom.com/class/circles/u6l4a.cfm)
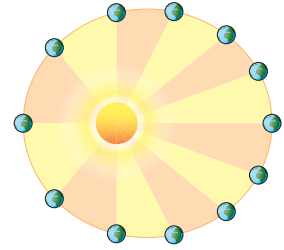
EXCERCISES

1 True or false?

a. Kepler was Ticho Brahe's mentor.   T F

b. Kepler's third law makes a comparison between different planets.   T F

c. According to Kepler's laws the Sun orbits the planets.   T F

d. A circle is the special case of an ellipse.   T F

2 Complete.

First Law: The .... of the planets about the Sun is .... in shape, with the centre of the Sun being located at one .... (The Law of Ellipses)

Second Law: An .... line drawn from the centre of the .... to the .... of the planet will sweep out .... areas in equal intervals of .... (The Law of Equal Areas)

Third Law: The ratio of the .... of the periods of .... two planets is .... to the ratio of the cubes of their average .... from the Sun. (The Law of ....)

Imaginary • path • Sun • equal • distances • equal • Harmonies • squares • time • elliptical • focus • centre • any

3 Match questions and answers.

	QUESTIONS		ANSWERS
A	What are the foci of an ellipse?	1	It is Kepler's second law.
B	What does Kepler's third law compare?	2	It compares the orbital period and radius of orbit of a planet to those of other planets.
C	What is the law of equal areas?	3	The sum of the distances from every point on the curve of the ellipse to two certain points is a constant, those points are called foci.

A	B	C ....