How To Use Kepler’s Third Law

The following is an explanation to help you figure out how to use your calculator to solve problems involving Kepler’s Third Law, and three practice problems to check yourself with.

• If I give you the planet’s orbital period:
  – Type in the orbital period
  – Hit the $x^2$ key on your calculator OR
  – Type in “^” followed by “2” and hit the Enter key.
  – Next, type in “^” followed by “0.333” and hit the Enter key, OR
  – Next, hit the “2nd Function Key” (often says “SHIFT” or “2nd Func” or “INV”)
  – Hit the $x^y$ key and type in 3. Then hit enter.
  – The number you see is the planet’s average distance from the sun, in AU.

• If I give you the planet’s average orbital distance from the sun:
  – Type in the orbital distance.
  – Hit the $x^y$ key on your calculator, type in 3, and hit “Equals” or “Enter” OR
  – Type in “^” followed by “3” and hit the Enter key.
  – If you see a “square root” key on your calculator hit it OR
  – Type in “^” followed by “0.5” and hit the Enter key.
  – The number you see is the planet’s orbital period, in years.

Examples

• Use these examples to determine if you are using Kepler’s Third Law correctly:
  – An asteroid orbits the sun at a distance of 2.7 AU. What is its orbital period?
    • Using $a = 2.7$ AU, you should get $P = 4.44$ years.
  – A dwarf planet discovered out beyond the orbit of Pluto is known to have an orbital period of 619.36 years. What is its average distance from the sun?
    • Using $P = 619.36$ years, you should get $a = 72.66$ AU.
  – Chiron is a dwarf planet that orbits the sun between Saturn and Uranus, and has an average distance from the sun of 14 AU. What is its orbital period?
    • Using $a = 14.0$ AU, you should get $P = 52.38$ years.