

2. (14 points) Clearly state each of Kepler's Laws of planetary motion. Also, state the implication of each law in simple terms.

- 1) Planets orbit Sun in elliptical orbits with Sun at one focus.
This implies that a planet's distance from the Sun varies.
- 2) Equal areas^{of an orbit} are swept out in equal amounts of time.
This implies that a planet's speed varies as it orbits the Sun.
The planet moves fastest at perihelion.
- 3) $p^2 = a^3$
This implies that the farther a planet is from the Sun, the more slowly it goes around.

3. (14 points) An object orbiting the Sun has an aphelion of 24 AU and an eccentricity of 0.20. How long does it take for the object to orbit the Sun? You can express your answer in years or seconds.

$$d_a = 24 \text{ AU}$$

$$e = 0.20$$

$$d_a = a(1+e)$$

$$24 = a(1+0.2)$$

$$a = 20 \text{ AU}$$

$$p^2 = a^3$$

$$p^2 = (20)^3$$

$$p = 89 \text{ years}$$