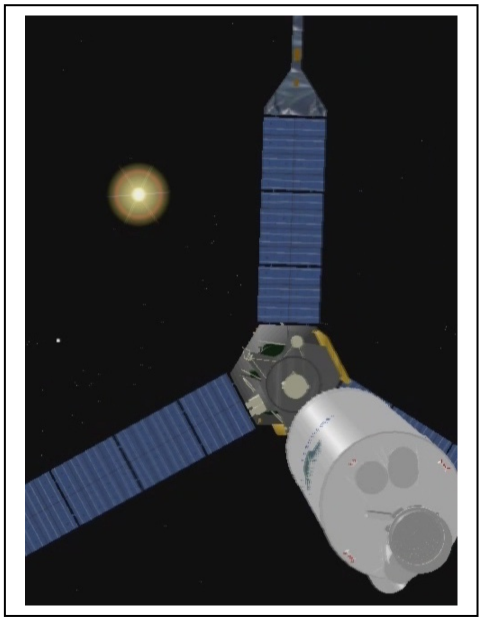

As the Juno spacecraft travels to Jupiter, it gets farther from the sun every day. Because the spacecraft generates its electrical power using solar cells, as the sun gets farther away, the amount of power constantly diminishes. At Earth, the solar panels generate about 12,700 watts. Because the spacecraft's trajectory is a portion of an ellipse, the formula for its distance, r, from the sun, located at one of the ellipse's foci, is given by the formula:

$$r(\theta) = \frac{a(1-e^2)}{1-e\cos\theta}$$

where r is in Astronomical Units, a is the semi-major axis length and e is the orbit eccentricity.

The specific equation for the Juno spacecraft can be approximately represented by a = 3.0 AU and e = 2/3, where all distances are given in units of the Astronomical Unit. The Astronomical Unit is a measure of the distance between Earth and the sun; a physical distance of 150 million km.

Problem 1 – What is the simplified form for R given the initial parameters, a and e, for the Juno spacecraft?

Problem 2 – If the amount of solar energy falling on the Juno solar panels is determined by the inverse-square law, and the amount of solar energy generated by the solar panels at r = 1.0 AU is exactly 12,690 watts, what is the formula for the solar panel power at any distance defined by the function P(r)?

Problem 3 – For what angle, θ, will the spacecraft be able to generate only ¼ of the electrical power it did when it left Earth orbit?

Problem 4 – What will the spacecraft power be when it reaches Jupiter at its maximum distance from the sun?

Problem 1 – What is the simplified form for R given the initial parameters, a and e, for the Juno spacecraft?

$$r(\theta) = \frac{5}{3 - 2\cos\theta}$$

Problem 2 – If the amount of solar energy falling on the Juno solar panels is determined by the inverse-square Law, and the amount of solar energy generated by the solar panels at r = 1.0 AU is 12,000 watts, what is the formula for the solar panel power at any distance defined by the function P(r)?

$$P(r) = 480(3 - 2\cos\theta)^2$$

Problem 3 – For what angle, θ in degrees, will the spacecraft be able to generate only ¼ of the electrical power it did when it left Earth orbit?

P = 12000/4 = 3000 watts

$3000 = 480\ (3-2\cos\theta)^2$ so $2.5 = 3 - 2\cos\theta$ and $\cos\theta = 0.25$ so **θ= 76 degrees**

Problem 4 – What will the spacecraft power be when it reaches Jupiter at its maximum distance from the sun?

Answer: The maximum value for r occurs at θ = 0, so **P = 480 watts**.