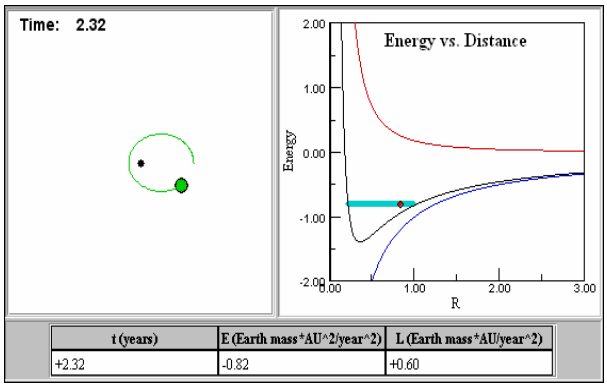
Worksheet for Exploration 12.4: Angular Momentum and Energy



A planet (with a mass equal to that of Earth) orbits a star as shown in the animation **(position is given in astronomical units (A.U.) and time is given in years)**. Along with the animation is a graphical depiction of the energy of the planet. Three curves are shown: in black the total effective potential energy, in blue the gravitational potential energy, and in red the effective rotational potential energy represented by the term: $L^2/2mR^2$. The teal line represents the total energy of the planet as a function of distance to the central star, R. Restart.

a. What happens to the red curve as the initial speed of the planet is changed?

b. What happens to the blue curve (the gravitational potential energy) as the initial speed of the planet is changed?

c. What happens to the teal curve (the total energy) as the initial speed of the planet is changed?

Now consider the total energy and angular momentum calculated in the table. Look at the circular, bound, and unbound cases.

d. How do the values for total energy and angular momentum change when the type of orbit is changed?

e. Can you find a general rule for whether an orbit is bound?

f. Feel free to explore different values of the initial velocity.