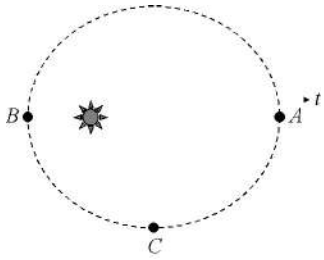
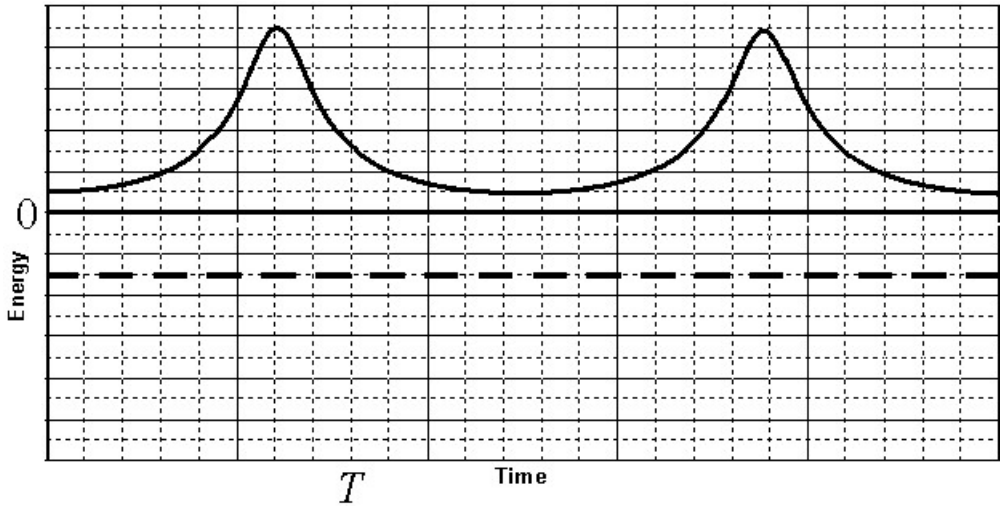
NAME _____ DATE _____

Scenario

A planet orbits a star in the counterclockwise orbit shown in the diagram at right. At time $T = 0$, the planet is at point A in its orbit. At a later time, the planet is at point B. At a still later time $t = T$, the planet is at point C in the diagram. The kinetic energy of the planet is shown in the graph below (solid line) as a function of time. The total energy of the star-planet system is shown on the same grid by the dashed line as a function of time.





Analyze Data

PART A: Suppose that it takes 1.25 years for the planet to travel from point A to point B. How many years are shown on the graph above? Explain your reasoning.

PART B: Half of 1.25 years is 0.625 years. Does it take 0.625 years for the planet to go from point B to point C? Explain your reasoning.

Using Representations

PART C: On the graph above Part A, sketch the graph of the potential energy of the star-planet system over the same interval. Draw your graph to scale using the grid lines.

PART D: On point C on the orbital diagram above, draw a vector labeled v representing the velocity of the planet at point C, and draw a vector labeled F representing the net force exerted on the planet at point C.

PART E: At time $t = T$, when the planet is at point C, the kinetic energy of the planet is decreasing. Use your vectors drawn in Part D to explain why this is the case.

PART F: Sketch a graph of the angular momentum of the planet taken about the star as a function of time in the space at the right, where counterclockwise angular momentum is positive. Using your vectors drawn in Part D, explain why the graph has the shape that you drew.