36.47. Model: Let the earth be reference frame S and let the spaceship be the reference frame S′. S′ moves relative to S with speed v.

Solve: For an observer in the earth's frame S, the length of the solar system is 10 lh. The time interval for the spaceship to cross is Δt = 15 hours. The time interval measured in S′ is the proper time because this can be measured with one clock at both positions (i.e., both edges of the solar system). The velocity v is

$$v = \frac{10 \text{ lh}}{15 \text{ hours}} = \frac{2}{3} \text{ lh / h} = \frac{2}{3}c$$

Because $\Delta t' = \Delta\tau$, from Equation 36.9 we have

$$\Delta\tau = \Delta t\sqrt{1-\beta^2} = (15 \text{ h})\sqrt{1-\left(\tfrac{2}{3}\right)^2} = 11.2 \text{ hours}$$