

36.19. Model: The earth is frame S and the starship is frame S'. S' moves relative to S with a speed v.
Solve: (a) The speed of the starship is

$$v = \frac{20 \text{ ly}}{25 \text{ years}} = \frac{(20 \text{ years})c}{25 \text{ years}} = 0.8c$$

(b) The astronauts measure the proper time while they are traveling. This is

$$\Delta\tau = \sqrt{1 - \frac{v^2}{c^2}} \Delta t = \sqrt{1 - (0.8)^2} (25 \text{ years}) = 15 \text{ years}$$

Because the explorers stay on the planet for one year, the time elapsed on their chronometer is 16 years.