1. In this problem we just have to calculate the proper time interval in B rest frame. The situation is symmetrical for the round trip — if we neglect accelerations, etc. at the turning point.

We simply have

\[ \Delta t_B = \Delta t_A \sqrt{1 - \left(\frac{v}{c}\right)^2} \]

\[ = 2 \text{ years} \times \sqrt{1 - (0.99)^2} \]

\[ = 0.282 \text{ yrs} \]

2. We'll use

\[ E = E_0 \cosh y \]

\[ p = E_0 \sinh y \]

where \( v = \tanh y \)

\( y \) is the rapidity, we set \( c = 1 \).

The force is defined as

\[ F = \frac{dp}{dt} \]

So in frame A, \( F_A = \frac{dp}{dt_A} \)
Using the previous relations,

\[ F_a = \frac{d}{dt_a} (E_0 \sinh y) = E_0 \cosh y \frac{dy}{dt_a} = E \frac{dy}{dt_a} \]

We now use the fact that rapidity is the same in both frames. We also relate it to the relative velocity

\[ dv = (1 - \tanh^2 y) dy = (1 - v^2) dy \]

By definition, \( v = 0 \) in \( B \) frame, so the acceleration in \( B \) frame is

\[ a_B = \frac{dv}{dt_B} = \frac{dy}{dt_B} \]

Now we write \( F_a \) in terms of \( B \)-quantities

\[ F_a = E \frac{dy}{dt_a} = E \frac{dy}{dt_a} \frac{dt_a}{dt_B} \frac{dt_a}{dt_B} \frac{dy}{dt_B} = E \frac{dy}{dt_B} \frac{1}{\gamma} \]

But also \( E = M_0 \gamma \) \( \gamma \) so using \( \frac{dy}{dt_B} = a_B \)

\[ F_a = \gamma M_0 a_B \frac{1}{\gamma} = M_0 a_B \]