Neglect gravity. For the Galilean transformation

\[ V_f = V_c + V_b = c/2 + c/3 = 5c/6 = 0.83c \]

For a Relativistic transformation;

\[ V_f = \frac{V_c + V_b}{1 + V_cV_b/c^2} = 5c/7 = 0.71c \]

\[ t = d/c = 90 \times 10^9/3 \times 10^8 = 300s \]

\[ \gamma = \sqrt{\frac{1}{1 - (3d)^2}} = 5/4 \]

\[ \Delta t = \gamma \Delta t' \]

\[ d = c\beta\gamma t \]

\[ t' = d/c = \beta\gamma t \]
\[ \gamma_B = \sqrt{\frac{1}{1 - \left(\frac{1}{2}\right)^2}} = \sqrt{\frac{4}{3}} \]

\[ \gamma_L = \sqrt{\frac{1}{1 - \beta_L^2}} \]

\[ \frac{L/2}{\gamma_B} = \frac{L}{\gamma_L} \]

\[ \beta_L = \sqrt{\frac{13}{16} c} \]