Another Minkowski Diagram – this time for the accelerated Ulysses

a. Confirm that the numerical value of \( g (=9.8 \text{ m/s}^2) \) when distances are measured in light years and time in years is very close to 1.

We found that if Ulysses is at \( x=0 \) at \( t=0 \), his worldline passes through the points (\( x \) and \( t \) measured by Homer):

\[
x = (\cosh g\tau - 1)/g \quad \text{and} \quad t = (\sinh g\tau)/g
\]

b. Show that the interval between the points on Ulysses’ worldline, given above, and the reference point (\( x_o=-1/g, t_o=0 \)) is a constant (\( \Delta s^2=\Delta x^2-\Delta t^2= \text{constant} \)).

c. Plot Ulysses’ worldline on a Minkowsky diagram (\( x,t \)), noting:

i) Ulysses’ worldline for \(-\infty<t<\infty\)

ii) the asymptotes for this curve (the point (\( x_o=-1/g, t_o=0 \)) should be useful for this)

iii) the worldlines for a few of the photons that Ulysses emits (for both \( t<0 \) and \( t>0 \)), and for photons moving in both the +x and –x directions.

There are parts of spacetime that cannot receive signals from Ulysses – note these areas on your diagram.