NYU Physics I—spacetime diagrams

1 Draw a spacetime diagram for your own rest-frame. On the spacetime diagram, show your own world-line.

2 Imagine there is a galaxy flying away from you with a velocity $v = 0.5\,c$. When the galaxy is moving away, it sends back to you a light signal every $T' = 3.3\,\text{ns}$ (as recorded in the galaxy's rest frame). Draw the world-line of this galaxy on your spacetime diagram and mark the events corresponding to the departures of the signals from the galaxy. Draw at least five such events.

3 Draw all the world-lines for all the the signals. Mark the events of the signals reaching you.

4 Calculate the time intervals between the arrival events (arrivals of the signals from the galaxy) according to you (that is, in your frame). Give your answer in terms of T', β, and γ. *Hint:* It should be longer than what is suggested by the simple time-dilation formula.

5 Why do the time intervals in the previous problem *not* agree with the time-dilation formula? What, on the spacetime diagram, *does* agree with the time-dilation formula?