Sample Problem Section 1.1, #14

Two students memorize according to the model

\[
\frac{dL}{dt} = 2(1 - L)
\]

where \( t = \text{time} \), \( L(t) = \text{fraction of material learned} \)

a) If student 1 has learned \( L_1(t) \) at time \( t \)
   and \( L_1(0) = \frac{1}{2} \)
   then \( \frac{dL_1}{dt} \bigg|_{t=0} = 2(1 - L_1(0)) = 2(1 - \frac{1}{2}) = 1 \)

while if student 2 has learned \( L_2(t) \) at time \( t \)
   and \( L_2(0) = 0 \)
   then \( \frac{dL_2}{dt} \bigg|_{t=0} = 2(1 - L_2(0)) = 2(1 - 0) = 2 \)

So \( L_2 \), student 2, is learning faster at time 0.

b) Student 2 cannot catch up to student 1.
   The learning rate of both students slows down as \( t \) goes to \( 1 \) and \( t \) goes to infinity.
   But student 1 is always ahead of student 2.