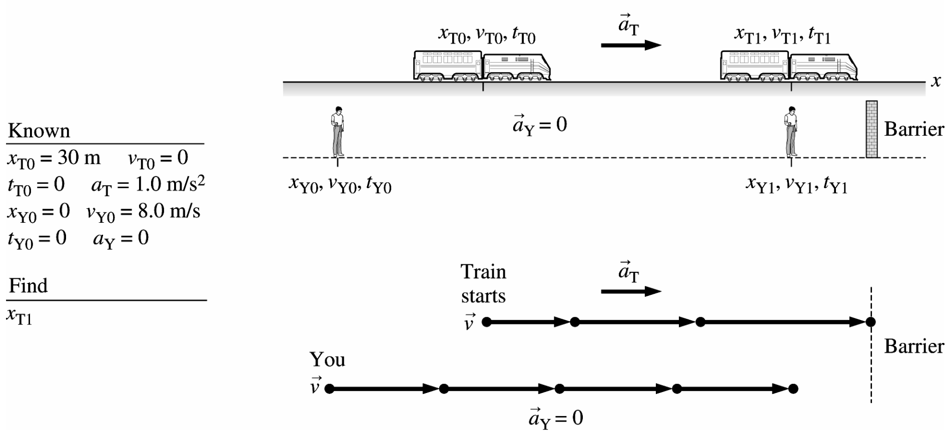
2.68. Model: We use the particle model for the large train and the constant-acceleration equations of motion.
Visualize:

Pictorial representation



Solve: Your position after time t_{Y1} is

$$x_{Y1} = x_{Y0} + v_{Y0}(t_{Y1} - t_{Y0}) + \frac{1}{2}a_Y(t_{Y1} - t_{Y0})^2$$
$$= 0\text{ m} + (8.0\text{ m/s})(t_{Y1} - 0\text{ s}) + 0\text{ m} = 8.0\, t_{Y1}$$

The position of the train, on the other hand, after time t_{T1} is

$$x_{T1} = x_{T0} + v_{T0}(t_{T1} - t_{T0})^2 + \frac{1}{2}a_T(t_{T1} - t_{T0})^2$$
$$= 30\text{ m} + 0\text{ m} + \frac{1}{2}(1.0\text{ m/s}^2)(t_{T1})^2 = 30 + 0.5t_{T1}^2$$

The two positions x_{Y1} and x_{T1} will be equal at time $t_{Y1}(=t_{T1})$ if you are able to jump on the back step of the train. That is,

$$30 + 0.5t_{Y1}^2 = 8.0t_{Y1} \Rightarrow t_{Y1}^2 - (16\text{ s})t_{Y1} + 60\text{ s}^2 = 0 \Rightarrow t_{Y1} = 6\text{ s and }10\text{ s}$$

The first time, 6 s, is when you will overtake the train. If you continue to run alongside, the accelerating train will then pass you at 10 s. Let us now see if the first time $t_{Y1} = 6.0$ s corresponds to a distance before the barrier. From the position equation for you, $x_{Y1} = (8.0\text{ m/s})(6.0\text{ s}) = 48.0$ m. The position equation for the train will yield the same number. Since the barrier is at a distance of 50 m from your initial position, you can just catch the train before crashing into the barrier.