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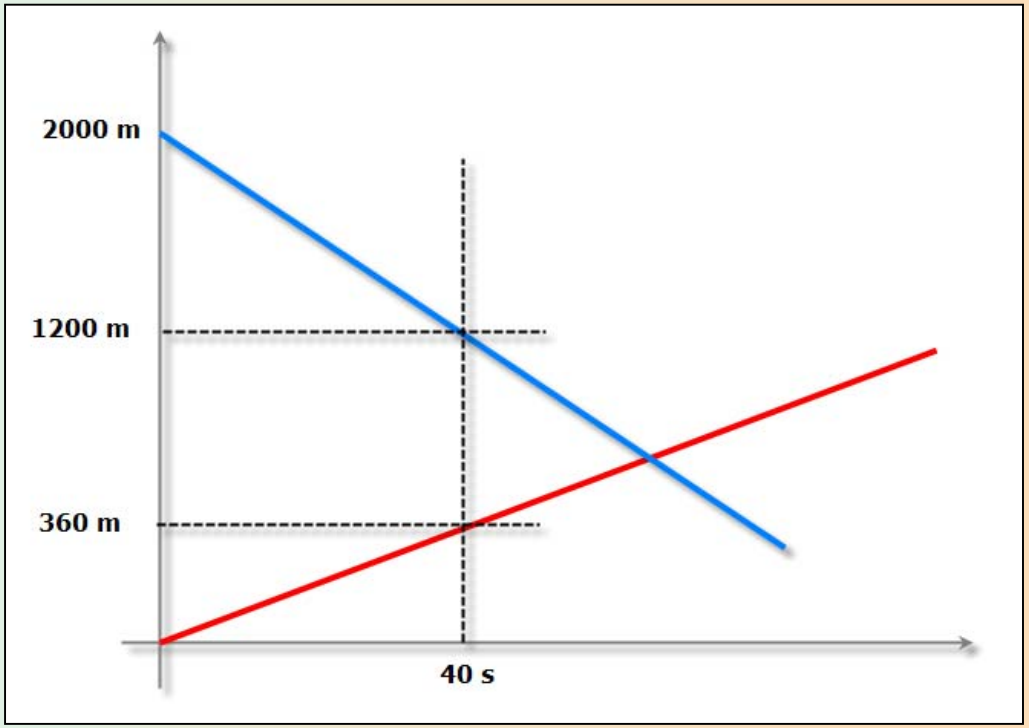
Motion with Constant Velocity: Problem

PROBLEM

According to the x-t graph below, calculate when and where the moving bodies pass each other.

NOTE:

Suppose that the value of “Y” coordinate is zero at every point



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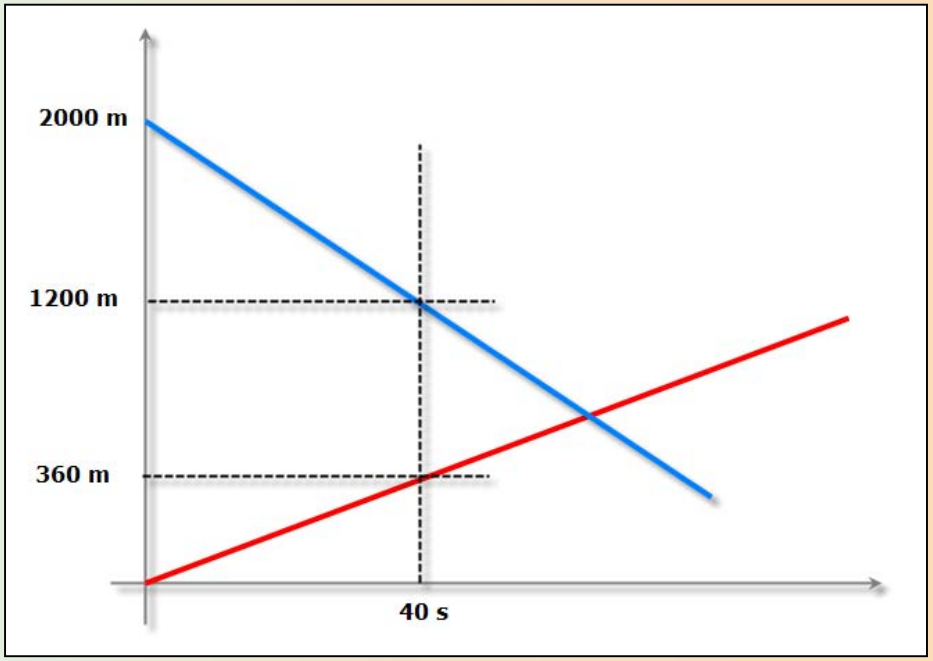
SOLUTION

First, we have to determine the equation of each body. To do so, we need the initial positions and the velocities of the bodies.



$$x_{0A} = 0;\ x_{0B} = 2000$$

$$v_A = \frac{\Delta x_A}{t} = \frac{360\ m\ -0}{40\ s} = 9\ \frac{m}{s};$$

$$v_B = \frac{\Delta x_B}{t} = \frac{1200\ m\ -\ 2000}{40\ s} = -20\ \frac{m}{s}$$

$$\vec{r}_A = 9\ \frac{m}{s} * t\ \vec{i}$$

$$\vec{r}_B = \left(2000\ m\ -\ 20\ \frac{m}{s} * t\right)\ \vec{i}$$

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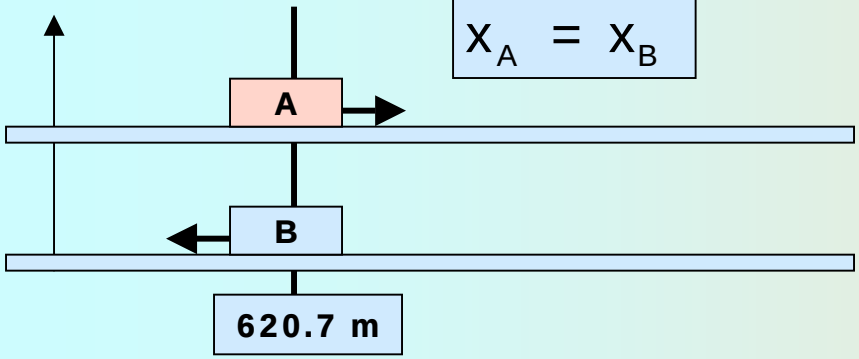
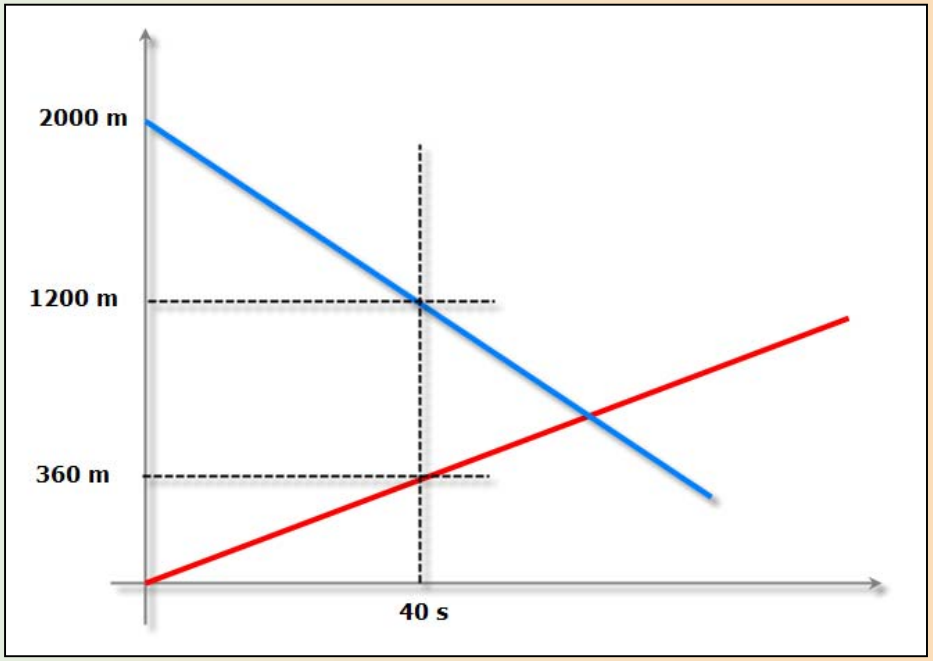
SOLUTION

The condition we have is that both bodies cross; that condition can be expressed as:

$$\vec{r}_A = \vec{r}_B$$

$$x_A = x_B$$





From that condition we can calculate the time ("when") when they pass each other:

$$9\ \frac{m}{s} * t\ \vec{i} = \left(2000\ m - 20\ \frac{m}{s} * t\right)\ \vec{i}$$

$$29\ \frac{m}{s} * t = 2000\ m \rightarrow t = \frac{2000\ m}{29\ \frac{m}{s}} = 68.97\ s$$

Then, we can calculate the value of the X coordinate ("where"):

$$x_A = x_B = 9\ \frac{m}{s} * 68.97\ s = 620.7\ m$$