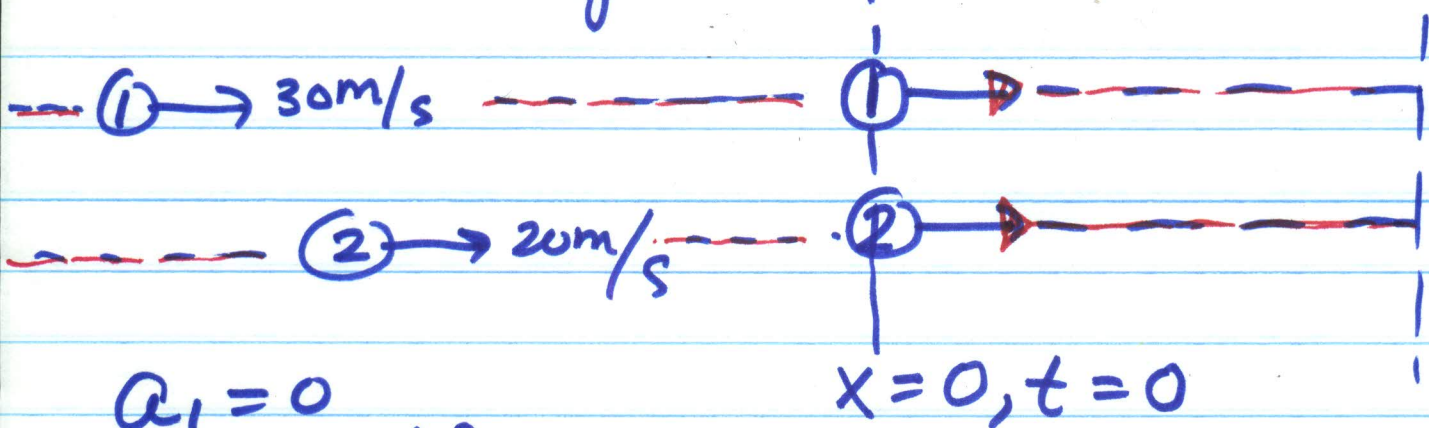


Example: motion with constant acceleration

2 cars are travelling on a straight road. Car 1 has a velocity $v_{10} = 30 \frac{\text{m}}{\text{s}}$ and is behind car 2 which has a velocity $v_{20} = 20 \frac{\text{m}}{\text{s}}$. At the instant that car 2 catches up with car 1, car 1 begins accelerating at a constant rate $a_2 = 2 \text{ m/s}^2$. When will car 2 catch up with car 1?

Draw a diagram of the situation



$$a_1 = 0$$

$$a_2 = 2 \text{ m/s}^2$$

For ① $x_1 = v_{10} t$ ($x_{10} = 0$)

For ② $x_2 = v_{20} t + \frac{1}{2} a_2 t^2$ ($x_{20} = 0$)

① & ② at SAME x : $x_1 = x_2$

$$v_{10}t = v_{20}t + \frac{1}{2}a_2t^2$$

$$30t = 20t + \frac{1}{2}(2)t^2$$

$$30t = 20t + t^2 \Rightarrow 10t = t^2$$

$\therefore$ $t = 10s$ When ② catches up to ①

Where will ② catch up to ①?

$$\begin{aligned} x_2(10s) &= 20(10) + \frac{1}{2}(1)(10)^2 \\ &= 200 + 100 = \underline{\underline{300m}} \end{aligned}$$

OR $x_1(10) = 30 \cdot (10) = \underline{\underline{300m}}$