Answer on Question #57562 – Math – Algebra

Question

Two cars start together in the same direction from the same place. The first car goes with uniform speed of 50 km/hour.

The second car goes at the speed of 40 km/hour in the first hour and increases the speed by 4 km in each succeeding hour. After how many hours will the second car overtake the first car if both cars go non stop?

Solution

We can write an equation to the second car:

$$S_2(t) = v_{20} \cdot 1 + v_{20}(t-1) + \frac{a(t-1)^2}{2}$$

where $v_{20} = 40, a = 4$.

Because the first car goes with uniform speed, then

$$S_1(t) = v_{10}t,$$

where $v_{10} = 50$.

When they met each other, the distance, which they passed, would be the same:

$$S_1(t) = S_2(t),$$

$$v_{10}t = v_{20} \cdot 1 + v_{20}(t-1) + \frac{a(t-1)^2}{2}$$

$$at^2 + t(2v_{20} - v_{10} - 2a) + a = 0$$

Choose solution t greater than 1, because before increasing the speed, the distance differs:

$$t = \frac{a + v_{10} - v_{20} + \sqrt{(v_{10} - v_{20})(v_{10} + 2a - v_{20})}}{a} =$$

$$= \frac{14 + \sqrt{10 \cdot 18}}{4} = \frac{7 + 3\sqrt{5}}{2} \approx 6.85 \text{ h}$$

Answer: $\frac{7 + 3\sqrt{5}}{2}$ hours.