Problem 2.10

Car A travels at 55 mi/hr. Car B travels at 70 mi/hr.

a.) Assuming they start at the same time, what's the difference in arrival times for a destination 10 miles away?

b.) How far must B travel to be 15 minutes ahead of A?

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a.) Assuming they start at the same time, what's the difference in arrival times for a destination 10 miles away?

$$x_2 = x_1 + v_1 t + \frac{1}{2}at^2$$

$$\Rightarrow \quad \Delta x_A = v_{1,A} t \quad \text{(as a=0)}$$

$$\Rightarrow \quad (10\text{ mi}) = (55\text{ mi/hr})t_A$$

$$\Rightarrow \quad t_A = .182\text{ hrs}$$

and

$$x_2 = x_1 + v_1 t + \frac{1}{2}at^2$$

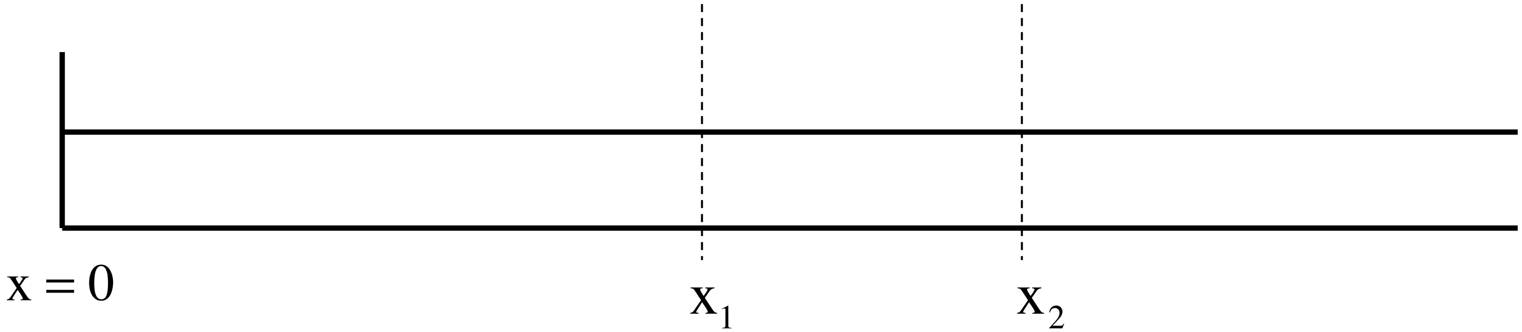
$$\Rightarrow \quad \Delta x_B = v_{1,B} t_B \quad \text{(as a=0)}$$

$$\Rightarrow \quad (10\text{ mi}) = (70\text{ mi/hr})t_B$$

$$\Rightarrow \quad t_B = .143\text{ hrs}$$

so $\Delta t = .182 - .143 = .039$

b.) How far must B travel to be 15 minutes ahead of A?



Assume car B is at x_2 at time *t* and car A is at x_1 at that same point in time. The difference between those two points must equal to the distance car A travels in a quarter of an hour. With that, we can write:

$$x_1 = v_A t \qquad \text{and} \qquad x_2 = v_B t$$

$$= (55 \text{ mi/hr})t \qquad\qquad = (70 \text{ mi/hr})t$$

$$= 55t \qquad\qquad = 70t$$

From car A $\quad \Delta x = x_2 - x_1 = 70t - 55t = 15t$

$$= v_A(.25)$$

$$= (55)(.25)$$

$$\Rightarrow \quad t = .92 \text{ sec} \quad \Rightarrow \quad x_2 = v_B t = (70\text{mph})(.92 \text{ sec})$$

$$= 64.4 \text{ mi}$$