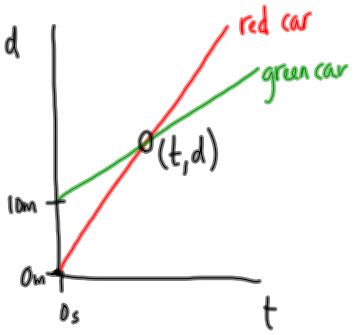
Car Chase Problems

Red car: $\vec{v} = 25 m/s\ [E]$ and $\vec{d_i} = 0m$

Green car: $\vec{v} = 15 m/s\ [E]$ and $\vec{d_i} = 10m\ [E]$

Where and when will the red car pass the green car?



Red Car

$\vec{v} = \frac{\Delta \vec{d}}{\Delta t}$

$\Delta \vec{d} = \vec{v} \Delta t$

$\vec{d_f} - \vec{d_i} = \vec{v}(t_f - t_i)$ ($\vec{d_i} = 0$, $t_i = 0$)

$\vec{d_f} = \vec{v} t_f$

$\vec{d_f} = \left(25 \frac{m}{s}[E]\right) t_f$

$y = mx + b$

Green Car

$\vec{v} = \frac{\Delta \vec{d}}{\Delta t}$

$\Delta \vec{d} = \vec{v} \Delta t$

$\vec{d_f} - \vec{d_i} = \vec{v}(t_f - t_i)$ ($t_i = 0$)

$\vec{d_f} - 10m = (15 m/s\ [E])\, t_f$

$\vec{d_f} = \left(15 \frac{m}{s}[E]\right) t_f + 10m$

$(y = mx + b)$

Using Substitution:

$\left(15 \frac{m}{s}\right)t + 10m = \left(25 \frac{m}{s}\right)t$

$10m = \left(25 \frac{m}{s}\right)t - \left(15 \frac{m}{s}\right)t$

$10m = \left(\frac{10m}{s}\right)t$

$t = \frac{10m}{10 m/s}$

$t = 1s$

$\vec{d_f} = (25 m/s\ [E])(1s)$

$\vec{d_f} = 25m\ [E]$

It will take 1s for the red car to catch up with the green car and they will be 25 [E] of the origin.

$y = mx + b$ (d = y, t = x; b: initial position; m: velocity)

Watch out for units + directions!