Acceleration + Displacement

Constant Velocity ~ $v = \frac{\Delta d}{\Delta t}$

Constant Acceleration ~ $a = \frac{\Delta V}{\Delta t}$ $\left(\Delta V = V_2 - V_1\right)$

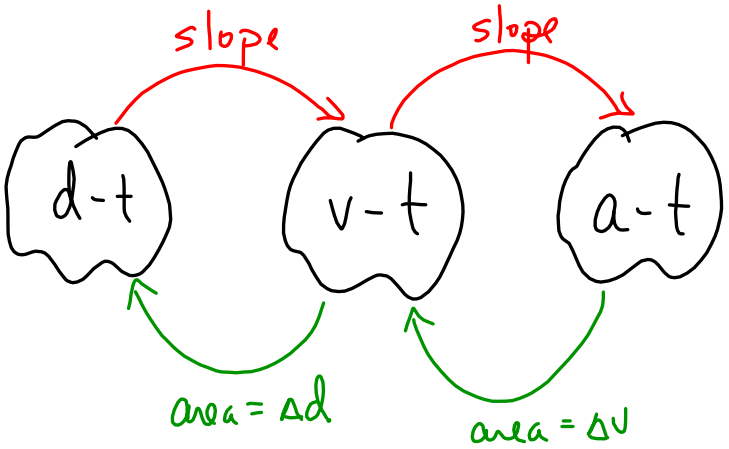
$V_{ave} = \frac{\Delta d}{\Delta t}$ $\left(V_{ave} = \frac{V_1 + V_2}{2}\right)$

Maybe Useful:

① $\Delta d = V_1 \Delta t + \frac{1}{2} a (\Delta t)^2$

② $\Delta d = V_2 \Delta t - \frac{1}{2} a (\Delta t)^2$

③ $V_2^2 = V_1^2 + 2a\Delta d$



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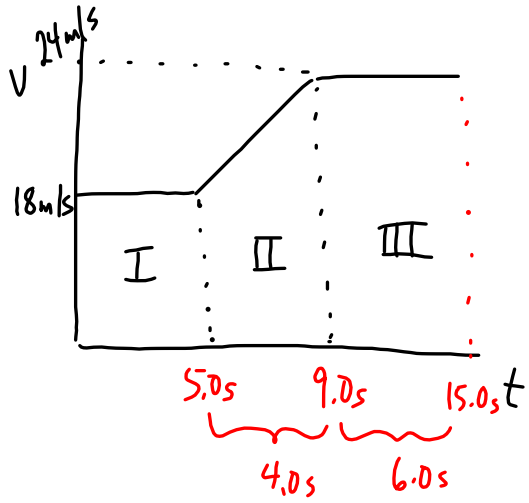

Section I - constant velocity

$v = 18\ m/s$
$\Delta t = 5.0\ s$
$\Delta d = ?$

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

$\Delta d = v\Delta t$

$\Delta d = (18\ m/s)(5.0\ s)$

$\Delta d = 90\ m$

Section II - Const acceleration

$v_1 = 18\ m/s$
$v_2 = 24\ m/s$
$\Delta t = 4.0\ s$
$\Delta d = ?$

$v_{ave} = \frac{\Delta d}{\Delta t}$

$\Delta d = v_{ave}\Delta t$

$\Delta d = \left(\frac{v_1 + v_2}{2}\right)\Delta t$

$\Delta d = \left(\frac{18\ m/s + 24\ m/s}{2}\right) 4.0\ s$

$\Delta d = 84\ m$

Section III - Constant Velocity

$v = 24\ m/s$
$\Delta t = 6.0\ s$
$\Delta d = ?$

$\Delta d = v\Delta t$

$\Delta d = (24\ m/s)(6.0\ s)$

$\Delta d = 144\ m$

TOTAL:

$$\begin{array}{r} 90\ m \\ 84\ m \\ +\ 144\ m \\ \hline 318\ m \end{array}$$

$\vec{\Delta d} = 3.2 \times 10^2\ m\ [E]$

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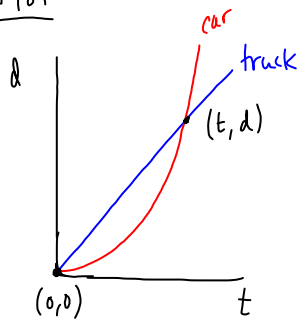

Truck - constant velocity.

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

$\Delta d = v\,\Delta t$

$d - 0 = (22\text{m/s})(t - 0)$

$d = 22t$

$(y = mx + b)$

Car - Constant Acceleration

$v_i = 0$

$\Delta d = ?$

$\Delta t = ?$

$a = 4.8\text{m/s}^2$

$\Delta d = \cancel{v_i \Delta t}^{0} + \frac{1}{2}a(\Delta t)^2$

$d - 0 = \frac{1}{2}(4.8\text{m/s}^2)(t - 0)^2$

$d = 2.4t^2$

Using substitution:

$22t = 2.4t^2$

$0 = 2.4t^2 - 22t$

$0 = t(2.4t - 22)$

Set each factor equal to zero:

$t = 0$ and $2.4t - 22 = 0$

$2.4t = 22$

$t = \frac{22\text{m/s}}{2.4\text{m/s}^2}$

$t = 9.2\text{s}$

$d = (22\text{m/s})\,t$

$d = (22\text{m/s})(9.2\text{s})$

$d = 2.0 \times 10^2\text{m}$

The car catches up with the truck at 2.0×10^2m [N] of the traffic light.

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