~~Assignment 8~~

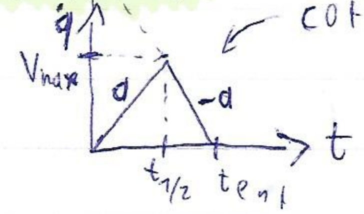
~~Name:~~

~~Mtr. number:~~

$$\cancel{S_{crit} = \int_{t_0}^{t_{end}} \dot{q}(t) = \frac{1}{2} t_{end} \cdot V_{max}}$$

~~$\hookrightarrow$ wobei $V_{max}$ erreicht wird~~

## 7.1.1.a




corner case $S = S_{crit}$

$$S_{crit} = \int_0^{t_{end}} \dot{q}\, dt = t_{1/2} \cdot V_{max}$$

$$a = \frac{V_{max}}{t_{1/2}}$$

$$\Rightarrow t_{1/2} = \frac{V_{max}}{a}$$

$$S_{crit} \overset{!}{=} f(a, V_{max})$$

$$S_{crit} = t_{1/2} \cdot V_{max} = \underline{\underline{\frac{(V_{max})^2}{a}}}$$

$$2 t_{1/2} = t_{end}$$

<u>ODER!</u>

$$S_{crit} = \int_0^{t_{1/2}} a t \, dt + \int_{t_{1/2}}^{t_{end}} -at + 2V_{max} \, dt$$

$$= \left[\frac{1}{2} a t^2\right]_0^{t_{1/2}} + \left[-\frac{1}{2} a t^2 + 2V_{max} \cdot t\right]_{t_{1/2}}^{t_{end}} \cancel{= \frac{1}{2} a t_{1/2} +}$$

$$= \frac{1}{2} a t_{1/2}^2 + -\frac{1}{2} a t_e^2 + 2V_{max} t_{en} + \frac{1}{2} a t_{1/2}^2 - 2V_{max} t_{1/2}$$

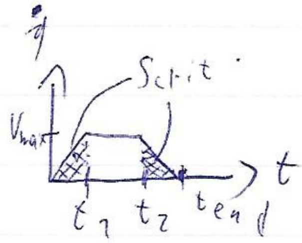
$$\overset{!}{=} \underbrace{a(t_{1/2})^2 - \frac{1}{2} a (4) t_{1/2}^2}_{-a t_{1/2}^2} + 4V_{max} t_{1/2} - 2V_{max} t_{1/2}$$

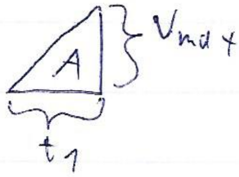
$$\overset{!}{=} -a t_{1/2}^2 + 2V_{max} t_{1/2} = -a \frac{V_{max}^2}{a^2} + \frac{2V_{max}^2}{a}$$

$$\overset{!}{=} \underline{\underline{\frac{(V_{max})^2}{a}}} \checkmark$$

7.1.1.b

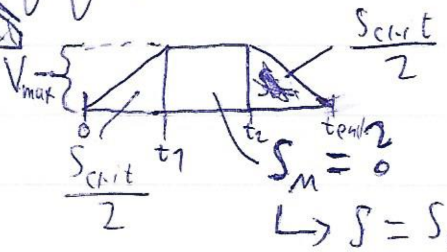
case $\overset{a}{1}$: $s \geq s_{crit} \to v \leq v_{max} \to$




$A = \frac{s_{crit}}{\cancel{2}} = \frac{1}{\cancel{2}} v_{max} \cdot t_1$

$t_1 = \frac{s_{crit}}{v_{max}} = \frac{(v_{max})^{\cancel{2}}}{a\,\cancel{v_{max}}} = \frac{v_{max}}{a} = t_1$




$\hookrightarrow s = s_{crit} + s_m \to s_m = s - s_{crit}$

$s_m = (t_2 - t_1) \cdot v_{max} = s - s_{crit}$

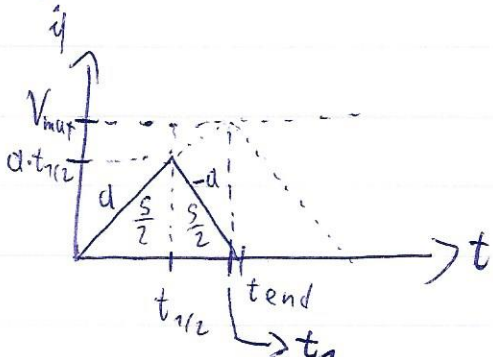
$t_2 - t_1 = \frac{s - s_{crit}}{v_{max}} \to t_2 = \frac{s - s_{crit}}{v_{max}} + t_1$

$t_2 = \frac{s - s_{crit}}{v_{max}} + \frac{v_{max}}{a}$

$t_{end} = t_2 + t_1 = \frac{s - s_{crit}}{v_{max}} + 2\frac{v_{max}}{a} = t_{end}$

## 7.1.1: b

case b: $s < s_{crit} \rightarrow v < v_{max}$




$$a = \frac{V_{max}}{t_1}$$

$$\frac{s}{2} = \int_0^{t_{1/2}} a t \, dt = \left[\frac{1}{2} a t^2\right]_0^{t_{1/2}} = \frac{1}{2} a t_{1/2}^2 - 0$$

$$\frac{s}{2} = \frac{1}{2} a t_{1/2}^2$$

$$t_{1/2}^2 = \frac{s}{a}$$

$$t_{1/2} = \sqrt{s/a} = f(s, a, \cancel{V_{max}}) = t_1 = t_2$$

$$t_{end} = 2 t_{1/2} = 2\sqrt{s/a}$$

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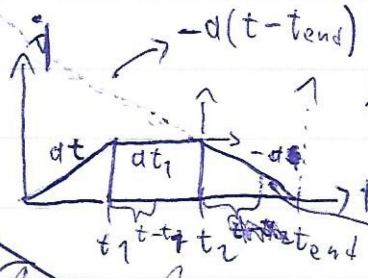
~~7.1.1.c~~

~~→ was~~




~~$\dot{q} = \begin{cases} t < 0 \rightarrow 0 \\ 0 \le t < t_1 \rightarrow at \\ t_1 \le t < t_2 \rightarrow a t_1 \\ t_2 \le t < t_{end} \rightarrow -a(t - t_{end}) = -at + a t_{end} \\ t \ge t_{end} \rightarrow 0 \end{cases}$~~

~~case b means $t_1 = t_2 = t_{1/2}$~~

~~$\rightarrow (t_{end} - t) \cdot a(t_{end} - t)\frac{1}{2}$~~

~~$\dot{q} = \begin{cases} 0 \le t < t_1 \rightarrow at \\ t_1 \le t < t_2 \rightarrow a t_1 \\ t_2 \le t \le t_{end} \rightarrow a t_1 - (t - t_2) a = a(t_1 + t_2 - t) = -a(t - (t_1 + t_2)) \\ t_{end} < t \rightarrow 0 \end{cases}$~~

~~$\rightarrow = -a(t - t_{end})$~~

~~7.1.1.c~~

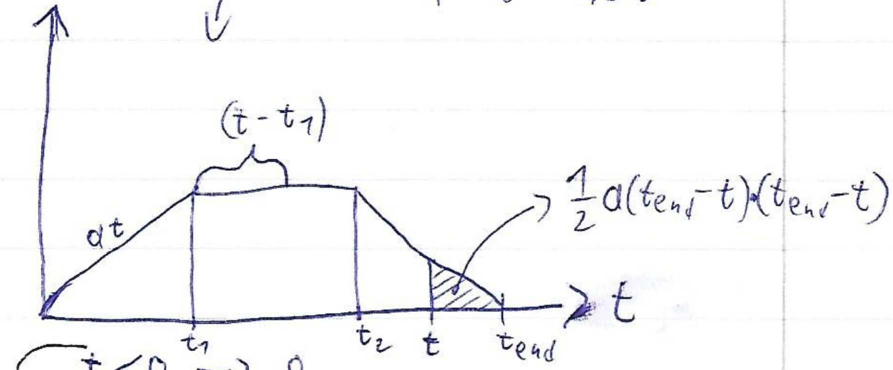
~~$q + \Delta q = s(t) = \int_0^t \dot{q} \, dt = \begin{cases} t < 0 \rightarrow 0 \\ 0 \le t < t_1 \rightarrow \frac{1}{2} a t^2 \\ t_1 \le t < t_2 \rightarrow \frac{1}{2} a t_1^2 + a t_1 (t - t_1) \\ t_2 \le t < t_{end} \rightarrow \frac{1}{2} a t_1^2 + a t_1 (t_2 - t_1) + \left[(t_{end} - t_2)\frac{a}{2} t_1 - \frac{1}{2}(t_e - t)^2 a\right] \\ t \ge t_{end} \rightarrow \frac{1}{2} a t_1^2 + a t_1 (t_2 - t_1) + \frac{1}{2}(t_{end} - t_2) a \cdot t_1 \end{cases}$~~

~~$s(t) =$~~

~~$\hookrightarrow = \underbrace{a t_1 \cdot t_1}_{2 \cdot \Delta} + \underbrace{(t_2 - t_1) a t_1}_{\square} - \frac{1}{2} a (t_e - t)^2$~~

## 7.1.1.c

This is case a, but case b is same situation with $t_1 = t_2 = t_{1/2}$ !




$$s(t) = \int_0^t \dot{q}\,dt = \begin{cases} t < 0 \longrightarrow 0 \\ 0 < t \leq t_1 \longrightarrow \frac{1}{2}at^2 \\ t_1 < t \leq t_2 \longrightarrow \frac{1}{2}at_1^2 + at_1 \cdot (t-t_1) \\ t_2 < t \leq t_{end} \longrightarrow \underbrace{at_1 \cdot t_1}_{2 \cdot \triangle} + \underbrace{(t_2-t_1)a \cdot t_1}_{\square} - \frac{1}{2}a(t_e-t)^2 \end{cases}$$