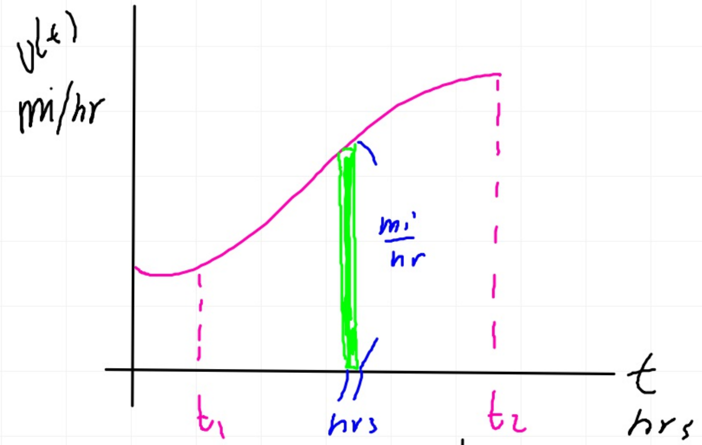
Applications of the Definite Integral as an Accumulator

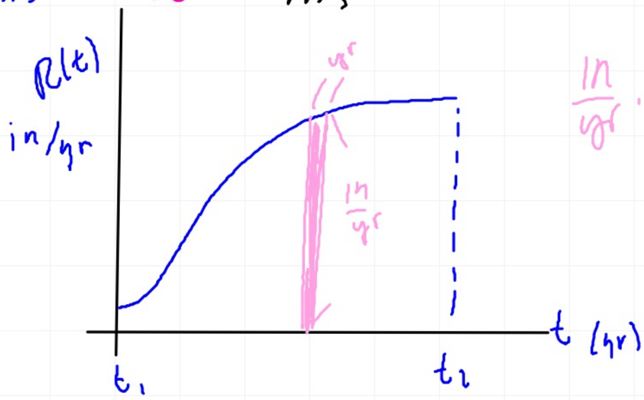
Rate functions : gal/hr , people/hr

in/yr , ft/sec , mi/hr , m/s

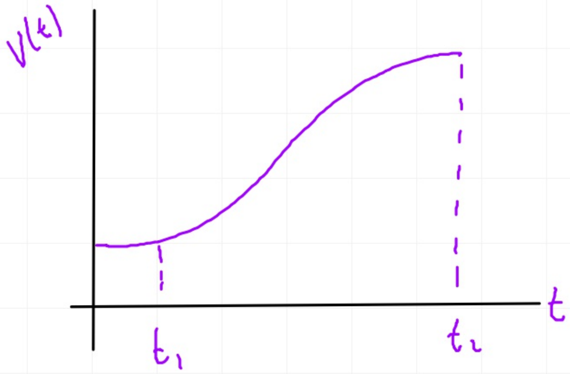
$$\int_{t_1}^{t_2} R(t)\,dt = \text{TOT } \underline{\text{AMT}}.$$



$$\frac{mi}{hr} \cdot hr = mi$$

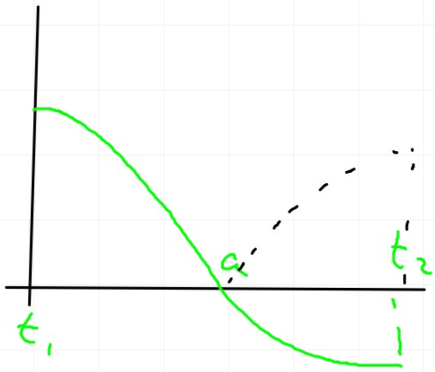


$$\frac{in}{yr} \cdot yr = \underline{in}$$



$$\int_{t_1}^{t_2} v(t)\,dt = \text{TOT DIST}$$

NET DIST



$$\int_{t_1}^{t_2} v(t)\,dt \to \text{NET.}$$

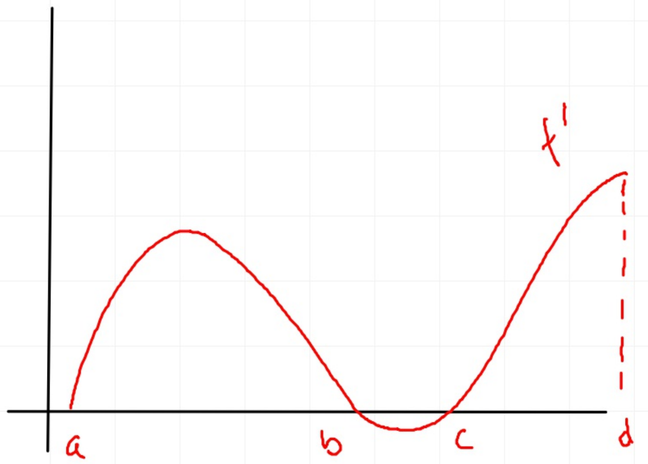
$$\int_{t_1}^{t_2} |v(t)|\,dt \to \text{TOT. DIST.}$$

Where something is at t_2

$$s(t_2) = s(t_1) + \int_{t_1}^{t_2} v(t)\,dt$$

How much stuff is there at t_2

$$A(t_2) = A(t_1) + \int_{t_1}^{t_2} A'(x)\,dx$$



Where does f have an abs. max?

Possible abs max at $x=b$ or $x=d$.

Abs max is at $x=d$ because

$$\int_b^c |f'(x)|\,dx < \int_c^d f'(x)\,dx \therefore f \text{ incr. more}$$

on (c,d) than it decr. on (b,c).

(a) $\displaystyle\int_{9}^{17} E(t)\,dt = 6004.270$

$\therefore$ 6004 people entered the park by 5 pm.

(b) $\displaystyle 15\int_{9}^{17} E(t)\,dt + 11\int_{17}^{23} E(t)\,dt = 104048.165$

$\therefore$ \$104048 is collected.

(c) $H(t) = \int_9^t [E(x) - L(x)]\,dx$

$H(17) = 3725$

$H'(t) = E(t) - L(t)$

$H'(17) = E(17) - L(17) = -380.281$

$H(17)$ is the total number of people in park at 5pm.

$H'(17) = -380.281$ mean that the number of people in the park is decreasing at 380.281 people/hr. at 5pm.

(d) $H'(t) = E(t) - L(t)$

$H'(t) = 0 \Rightarrow t = 15.795$

$H(9) = 0$
$H(23) = 1.014$
$H(15.795) = 3950.680$

Since $H(t)$ is cont on $9 \le t \le 23$, by EVT
the number of people in park is at
a maximum. at $t = 15.795$ hrs.