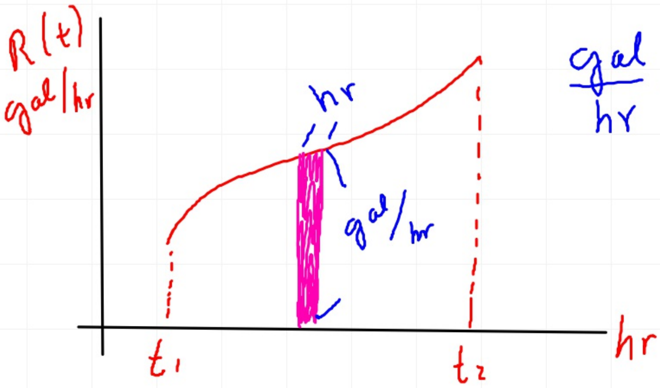
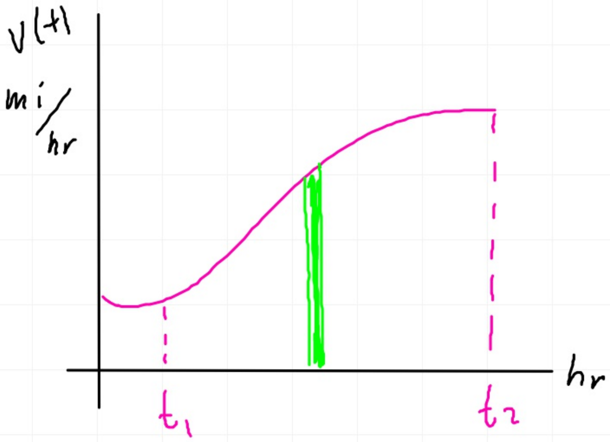
Applications of the Definite Integral as an Accumulator

Rate functions : ft/s , gal/hr, in/yr.

$$\int_{t_1}^{t_2} R(t)\,dt \longrightarrow \text{TOTAL AMT.}$$

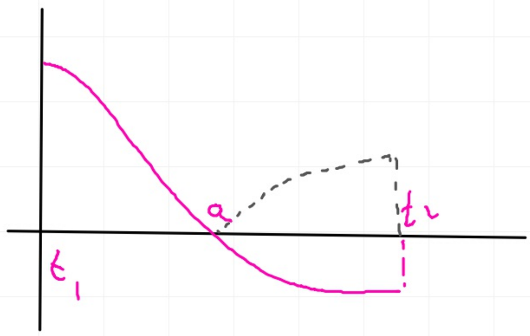


$\frac{gal}{hr} \cdot hr = \underline{gal}$



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

NET DIST.



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

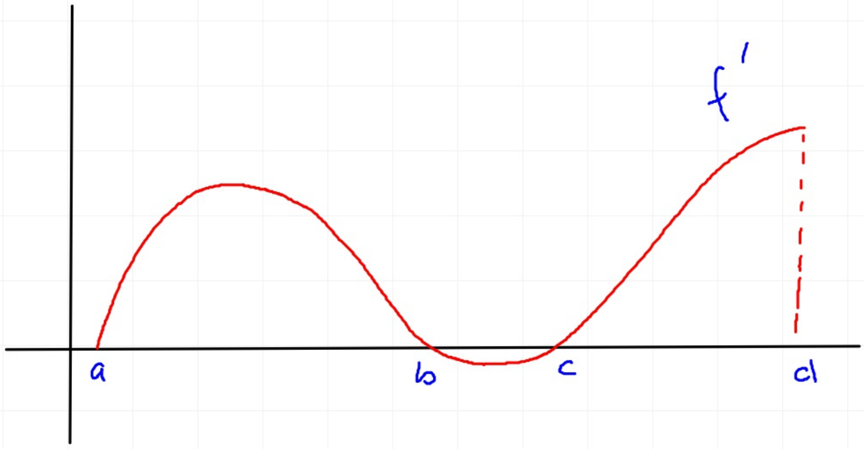
$$\int_{t_1}^{t_2} |v(t)|\,dt$$

Where is it?

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

How much is there now?

$$\text{origamt} \pm \int_{t_1}^{t_2} R(t)\,dt$$



Where does f have an abs. max.

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

Abs Max occurs at x=d because

$$\int_b^c |f'(x)|\,dx < \int_c^d f'(x)\,dx \quad \therefore \text{ f incr. more on } (c,d) \text{ than it decreas. on } (b,c).$$

2002 AB2

(a) $\int_9^{17} E(t)\,dt = 6004.270$

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

(b) $15\int_9^{17} E(t)\,dt + 11\int_{17}^{23} E(t)\,dt = 104048.165$

$\therefore$ \$104048 was collected from admissions.

(c) $H(t) = \int_{9}^{t} [E(x) - L(x)]\,dx$ $\qquad H(17) = 3725$

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

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

$H(17) = 3725$ means there were 3725 people in park at 5pm.

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

a) $H'(t) = 0$

$E(t) - L(t) = 0 \Rightarrow t = 15.795$ a $t = 46.454$

(not in $[9, 23]$)

$H(9) = 0$

$H(23) = 1.014$

$H(15.795) = 3950.680$

Since $H(t)$ is cont on $[9, 23]$

by EVT the max number of

people in park occurs at $t = 15.795$ hrs.