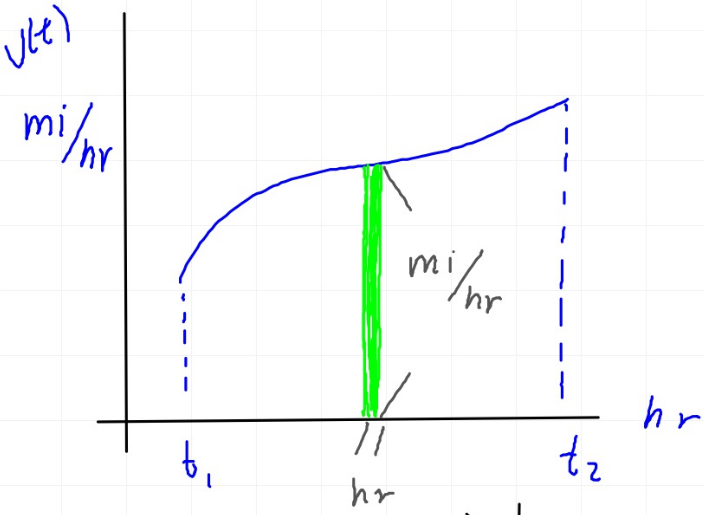
Applications of the Definite Integral as an Accumulator

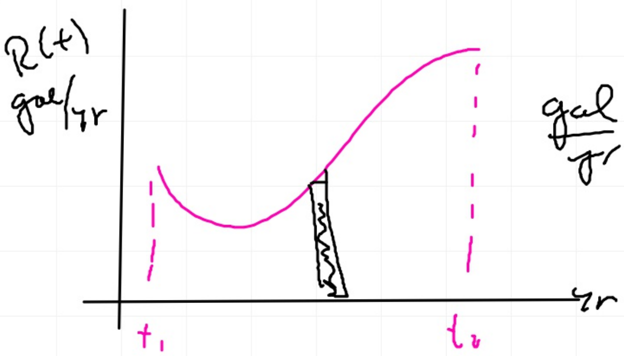
Rate functions - gal/day, in/year

$v(t)$ mi/hr, m/s

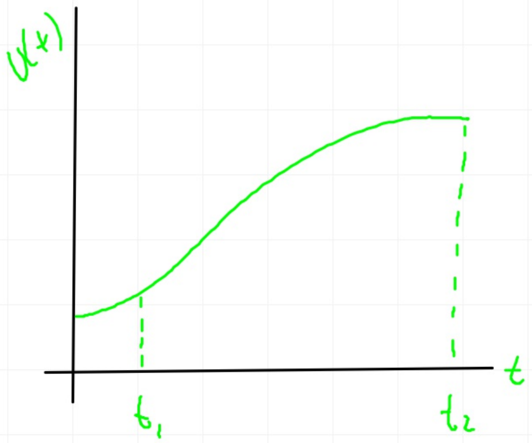
$$\int_{t_1}^{t_2} R(t)\,dt \rightarrow \text{TOTAL AMT.}$$



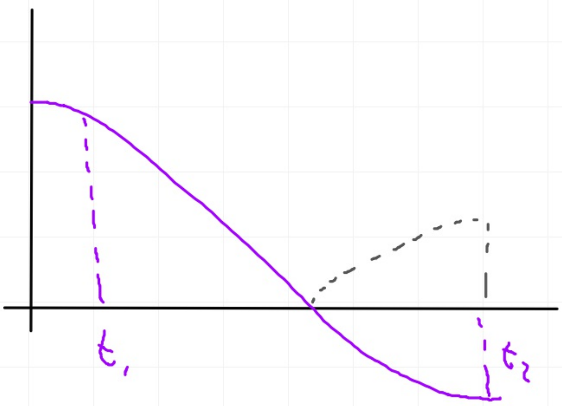
$$\frac{mi}{hr} \cdot hr = mi$$



$$\frac{gal}{yr} \cdot yr = gal.$$



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



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

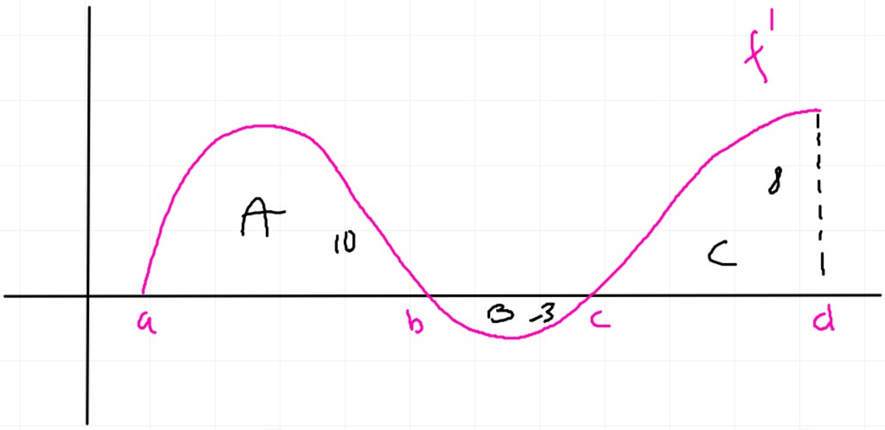
$$\int_{t_1}^{t_2} |v(t)|\,dt \to \text{tot. dist}$$

Where is it at t_2?

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

For any rate

$$A(t_2) = A(t_1) \pm \int_{t_1}^{t_2} A'(t)\,dt$$



A = 10 B = 3
C = 8

$$\int_a^d f'(x)\,dx = 15$$

Where does f have an abs. max?

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

Abs max occurs at $x = d$ because

$$\int_b^c |f'(x)|\,dx < \int_c^d f'(x)\,dx$$ ∴ f incr. more on (c, d)

than it decr. on (b, c).

2002 AB2

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

6004 people enterd by 5pm.

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

$\therefore$ \$104048 was collec~~ted~~.

(c) $H(t) = \int_0^t [E(x) - L(x)]\, dx \quad 9 \le t \le 23$

$H(17) = 3725$

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

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

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

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

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

$E(t) - L(t) = 0 \rightarrow t = 15.795$

$H(9) = 0$

$H(23) = 1.014$

$H(15.795) = 3950.680$

Since $H(t)$ is con on $[9, 23]$, by EVT

the number of peope lin park is max

at $t = 15.795$ hrs.