$s(t) = position; v(t) = velocity$

$v(t) = s'(t)$

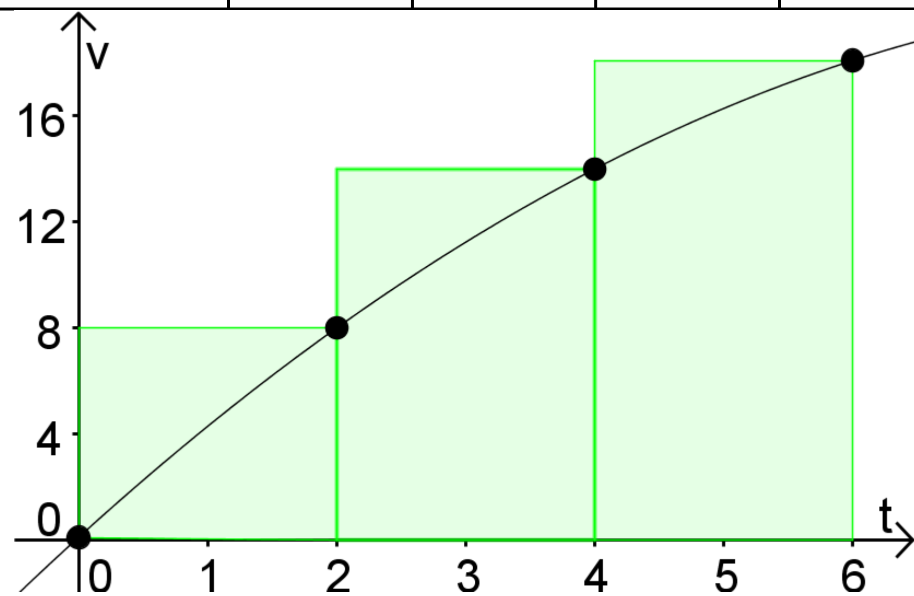
Change of $s(t)$ $from\ t = a\ to\ t = b$ $=$ $Area\ under\ graph\ of\ v(t)$ $from\ t = a\ to\ t = b$

In General:

Example: Velocities (in ft/sec) of a runner starting a race are:

How far did the runner travel from $t = 0$ to $t = 6$?

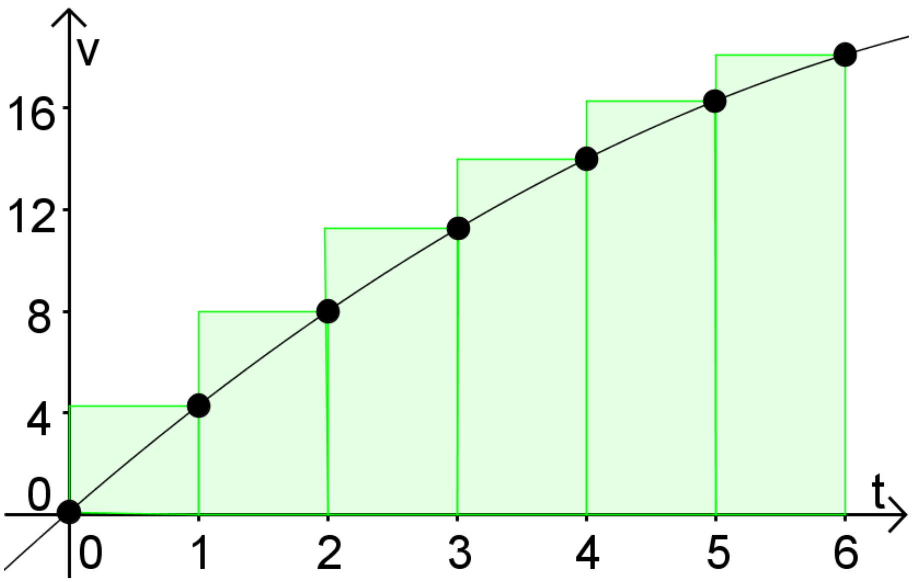
t **(sec)**	**0**	**2**	**4**	**6**
$v(t)$ (ft/s)	**0**	**8**	**14**	**18**



Example: Velocities (in ft/sec) of a runner starting a race are:

t (sec)	0	1	2	3	4	5	6
$v(t)$ (ft/s)	0	4.5	8	11	14	16.5	18

How far did the runner travel from $t = 0$ to $t = 6$?



Given their velocity $v(t)$, how far did the runner travel from $t = 0$ to $t = 6$?

To get a better approximation, we want to compute this for larger n.

$$Distance\ travelled \approx$$

Notation: $A_1 + A_2 + A_3 + A_4 + \cdots A_n = \sum$

$A_i =$

$\Delta t =$

$t_i =$

$Distance\ travelled \approx$

$Distance\ travelled =$

$$\begin{matrix} Distance\ Travelled \\ from\ t = 0\ to\ t = 6 \end{matrix} =$$

Note: $\sum_{i=1}^{n} v(t_i) \cdot \Delta t$ is called the right hand sum because we use the right-most point on each interval.

The left hand sum = $\sum_{i=0}^{n-1} v(t_i) \cdot \Delta t$ uses the left-most point.

The left hand sum is what was used as our underestimate.

$$\lim_{n\to\infty} Right\ Hand\ Sum = \lim_{n\to\infty} Left\ Hand\ Sum$$

Once we take the limit as $n \to \infty$ we call these Riemann Sums.

In General: for $F'(t) = f(t)$

$$\begin{matrix} area\ under\ graph\ of\ f(t) \\ from\ t = a\ to\ t = b \end{matrix} = \begin{matrix} change\ in\ F(t) \\ from\ t = a\ to\ t = b \end{matrix} = \lim_{n\to\infty} \sum_{i=1}^{n}$$

$$\Delta t =$$

$$t_i =$$

$$\int_a^b f(t)dt = \lim_{n\to\infty} \sum_{i=1}^{n} f(t_i) \cdot \Delta t$$

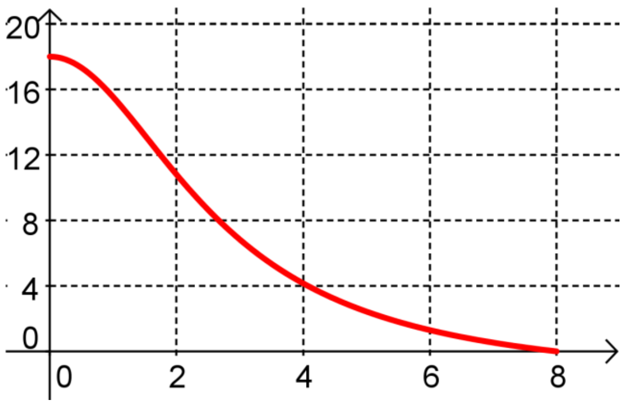
Def:

Recall: If we know a functions derivative, then for:

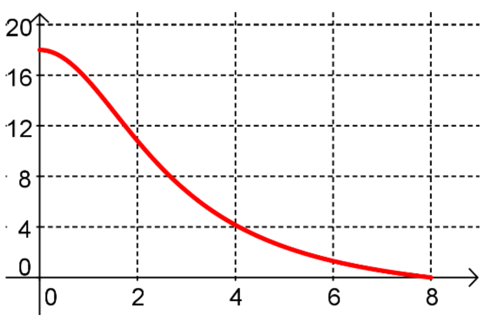
$$f(t) = F'(t)$$

$$\begin{matrix} \textit{area under graph of } f(t) \\ \textit{from } t = a \textit{ to } t = b \end{matrix} = \begin{matrix} \textit{change in } F(t) \\ \textit{from } t = a \textit{ to } t = b \end{matrix} = \int_a^b f(t)dt$$

Example: Suppose that the rate of sales of movie tickets (in 10,000 tickets per week) is graphically given by $s'(t)$ where t is the number of weeks since the movie was released.



1) How many tickets will the movie sell in the first 4 weeks?



2) How many tickets will the movie sell before it leaves the theater?