

## 5.1 Distances

- You know  $\text{distance} = \text{velocity} \times \text{time}$  but only if the velocity is constant.
- Calculating a distance is more complicated if the velocity is not constant

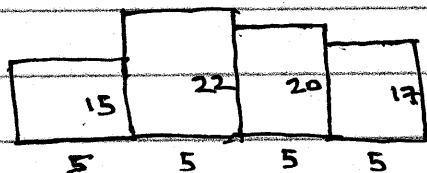
Suppose we measure our velocity on a bike at 5 sec intervals:

time (s)	5	10	15	20
vel. (ft/s)	15	22	20	17
distance	75	110	100	85

(this assumes our velocity was constant on the intervals  $[0, 5]$ ,  $[5, 10]$ ,  $[10, 15]$  and  $[15, 20]$ )

- total distance over 20 seconds: 370 ft

We can draw a picture related to an area under a curve



This looks like an approximation to the area under a function (the velocity)

## Distances 2

$$\begin{aligned}\text{Total distance } D &\approx D_1 + D_2 + D_3 + D_4 \\ &= 15 * 5 + 22 * 5 + 20 * 5 + 17 * 5 \\ &= v(5)\Delta t + v(10)\Delta t + v(15)\Delta t + v(20)\Delta t\end{aligned}$$

using a definite integral, we can write

$$D = \int_0^{20} v(t) dt$$

units:  $ft = \frac{ft}{s} \cdot s$