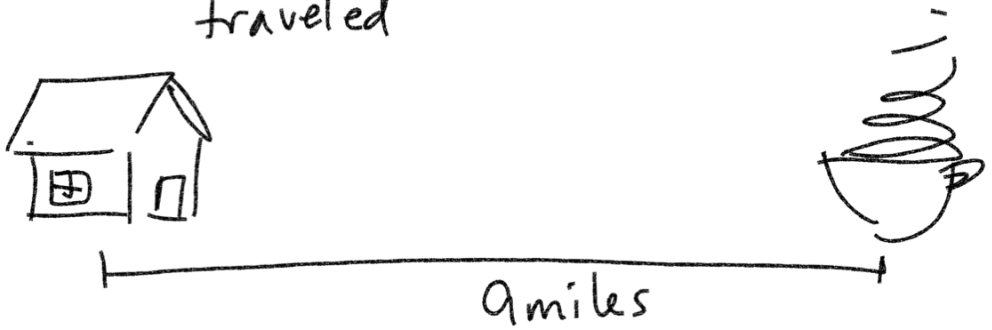
M-GP General Physics Week 5 10/10

Distance
total path length traveled

Displacement
net path length traveled



Distance: 18 miles
Displacement: 0 miles

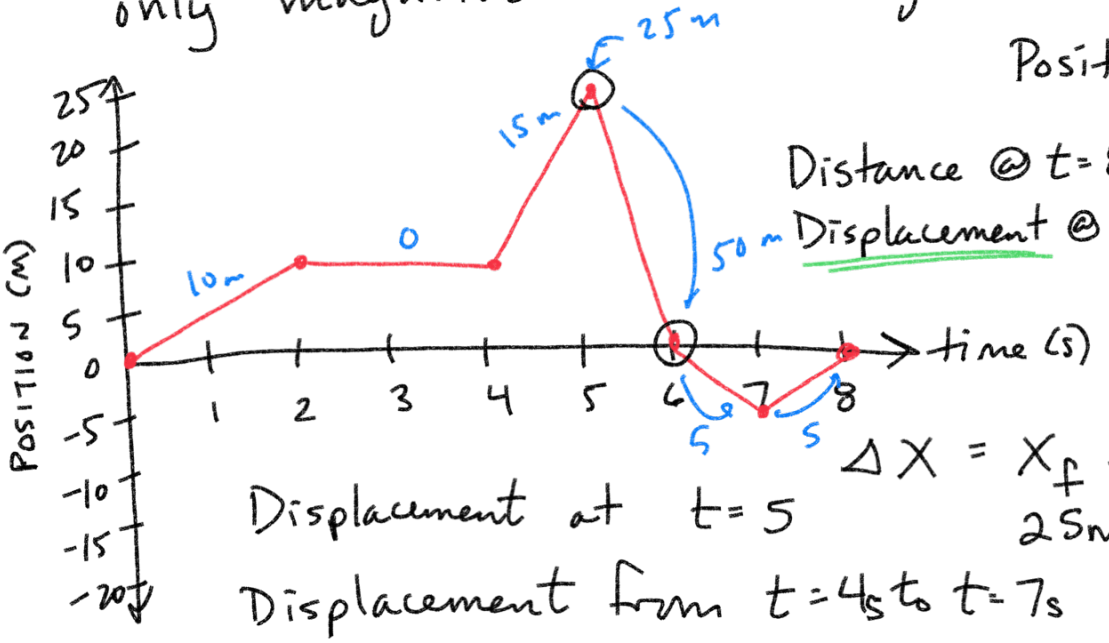
Delta → change

$$\text{Displacement} = \Delta X = X_f - X_i$$

X_f: final position
X_i: initial position

Distance
scalar quantity
(absolute values)
only magnitude

Displacement
vector quantity
magnitude and direction



Position vs Time Graph

Distance @ t=8s: 25+25+5+5 = 60m

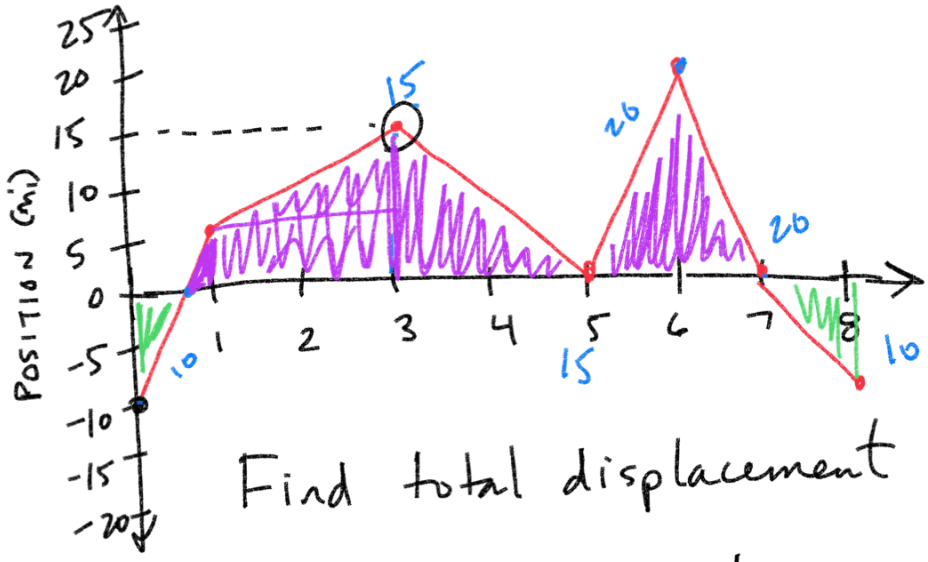
Displacement @ t=8s: 0m

Displacement at t=5

$\Delta X = X_f - X_i =$
$25m - 0m = \boxed{25m}$

Displacement from t=4s to t=7s

$X_f - X_i$
$-5m - 10m = \boxed{-15m}$



Find total distance

90 mi

$\Delta X = X_f - X_i$

Find total displacement at

$X_i = -10m$

$t = 3$

$X_f - X_i$

$15mi - (-10mi)$

$15mi + 10mi$

25 mi

$t = 5$

$X_f - X_i$

$0mi - (-10mi)$

$0mi + 10mi$

10 mi

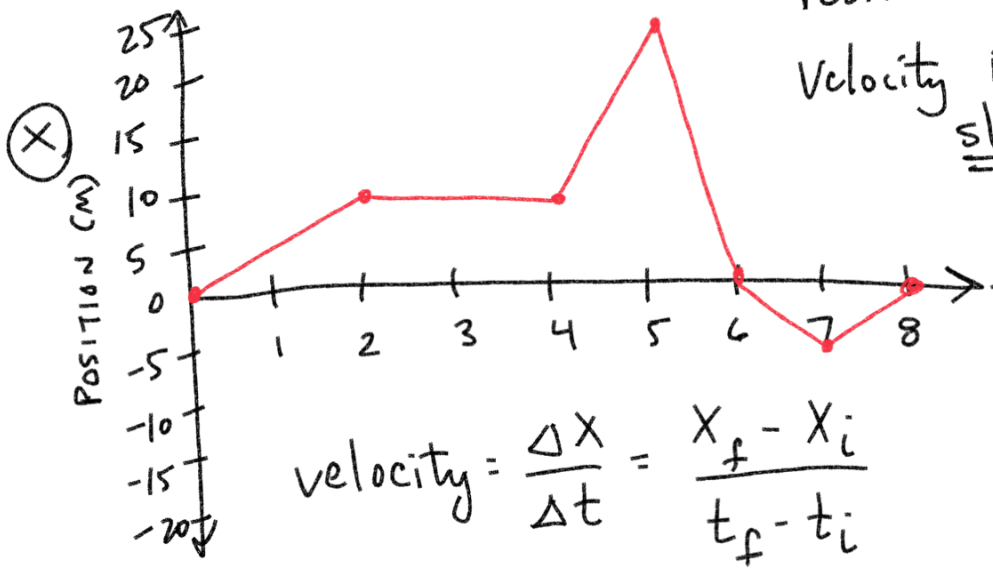
$t = 8$

$X_f - X_i$

$-10mi - (-10mi)$

$-10m + 10mi$

0 mi



Position vs Time

Velocity is the slope

$\frac{X}{t}$

distance / scalar

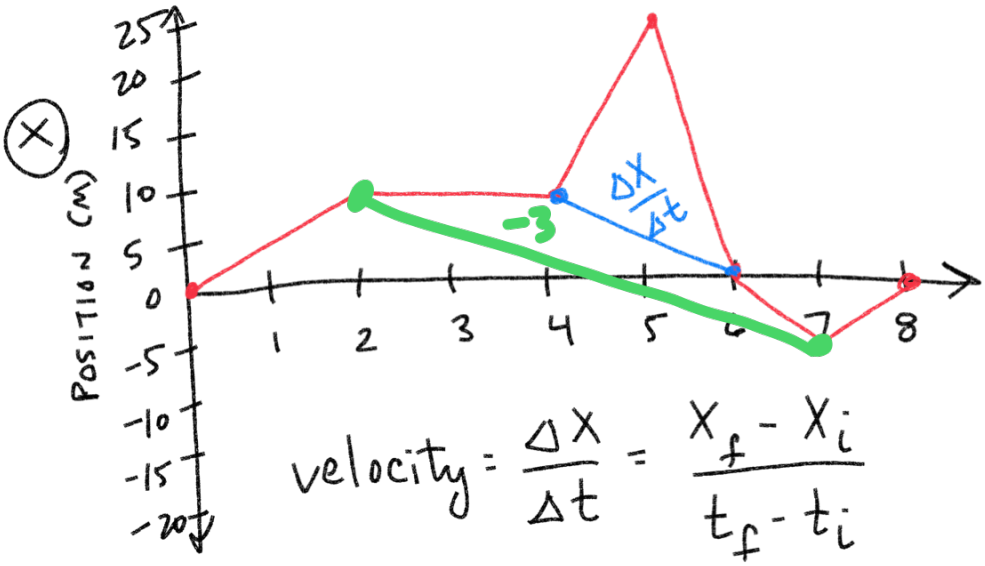
Displacement / vector

The change in distance = speed

The change in displacement = velocity

$$\text{velocity} = \frac{\Delta X}{\Delta t} = \frac{X_f - X_i}{t_f - t_i}$$

$$\text{slope} = \frac{\Delta y}{\Delta X} = \frac{y_2 - y_1}{X_2 - X_1}$$



Velocity $\begin{cases} t = 2s \\ t = 7s \\ X_f = -5m \\ X_i = 10m \end{cases}$

$$\text{velocity} = \frac{\Delta X}{\Delta t} = \frac{X_f - X_i}{t_f - t_i}$$

$$\frac{X_f - X_i}{t_f - t_i}$$

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{-5m - 10m}{7s - 2s}$$

$$\frac{-15m}{5s} = \boxed{-3\ m/s}$$

Velocity from $t_i = 0s$ to $t_f = 2s$

$$v = \frac{\Delta X}{\Delta t} = \frac{X_f - X_i}{t_f - t_i}$$

$X_f = 10m$ $\quad X_i = 0m$

$t_f = 2s$ $\quad t_i = 0s$

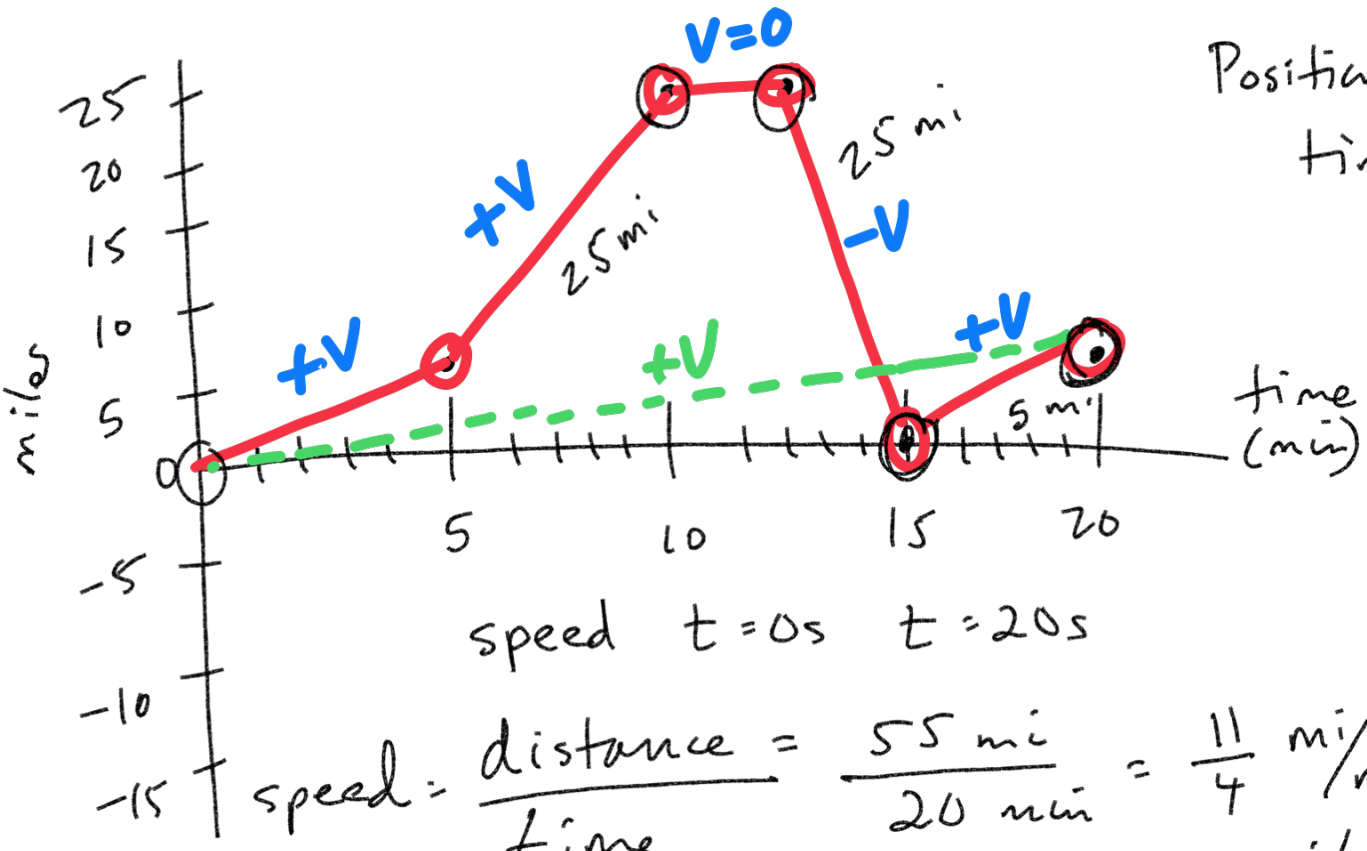
$$\frac{(10-0)m}{(2-0)s} = \frac{10}{2}\ m/s$$

$$\boxed{5\ m/s}$$

Velocity $t_i = 4s$ $\quad t_f = 6s$

$$\frac{X_f - X_i}{t_f - t_i} = \frac{0m - 10m}{6s - 4s} = \frac{-10}{2}\ m/s = \boxed{-5\ m/s}$$

Position vs time



speed $t = 0s$ $t = 20s$

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{55 \text{ mi}}{20 \text{ min}} = \frac{11}{4} \text{ mi/min}$$

2.75 mi/min

$\approx 3 \text{ mi/min}$