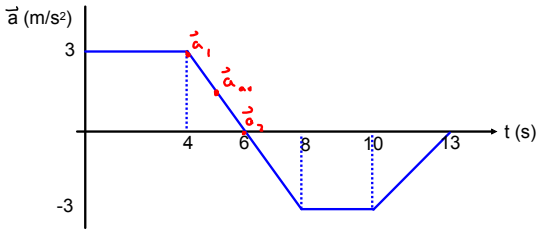
Acceleration-Time Graphs

Goal:

- to understand how to read acceleration-time graphs
- to find change in velocity and average acceleration from graph



What is the acceleration at 6 s? 10 s?

$0\ m/s^2$ & $-3\ m/s^2$

What is the change in velocity from 0 s to 4 s?

$\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$ $\quad 3\ m/s^2 = \frac{\Delta \vec{v}}{4\ s}$

$(3\ m/s^2)(4\ s) = \Delta \vec{v} = 12\ m/s$

What is the change in velocity from 4 s to 6 s?

$\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$ $\quad 1.5\ m/s^2 = \frac{\Delta \vec{v}}{2\ s}$ $\quad \Delta v = 3\ m/s$

↑ changing so use average $\vec{a}_{av} = \frac{\vec{a}_1 + \vec{a}_2}{2} = \frac{3\ m/s^2 + 0}{2} = 1.5\ m/s^2$

change in velocity = area of a-t graph

What is the average acceleration from 0 s to 13 s?

$\vec{a}_{av} = \frac{\Delta \vec{v}}{\Delta t}$

Two areas:

$\text{Area 1} = \frac{(6\ s + 4\ s)(3\ m/s^2)}{2} = 15\ m/s$

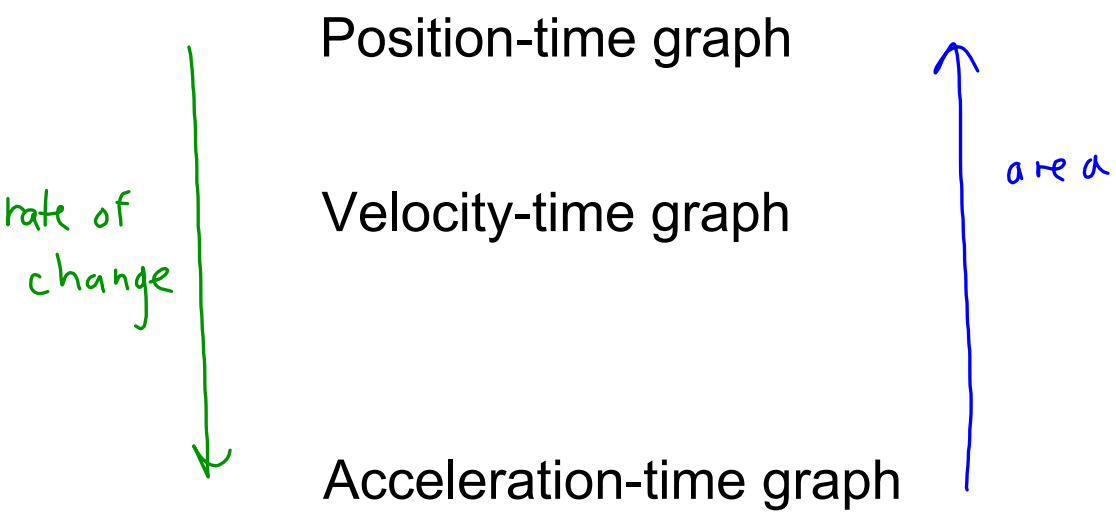
$\text{Area 2} = \frac{(7\ s + 2\ s)(-3\ m/s^2)}{2} = -13.5\ m/s$

$\Delta v = 15\ m/s + (-13.5\ m/s)$

$= 1.5\ m/s$

$\vec{a}_{av} = \frac{1.5\ m/s}{13\ s} = 0.12\ m/s^2$

CONCEPT MAP


Position-time graph
rate of change
Velocity-time graph
area
Acceleration-time graph