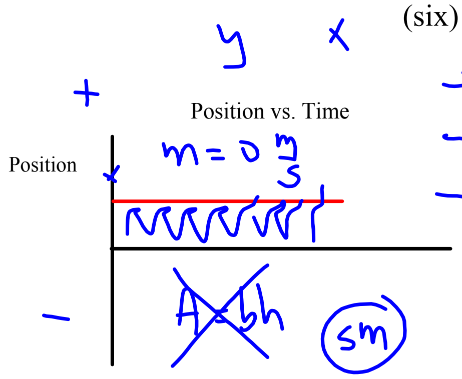
Unit 1 - Kinematics

Section 2

Graphical Analysis

Position-Time Graphs
(six)

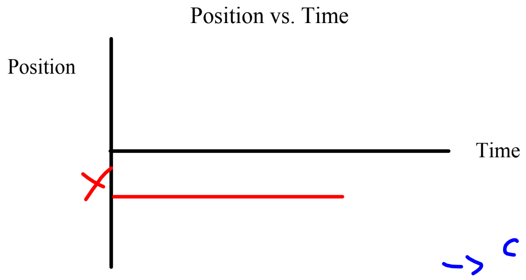


→ has a positive position

→ no motion

→ $m = \frac{\Delta \vec{d}}{\Delta t} = \vec{v}$

$\frac{m}{s}$

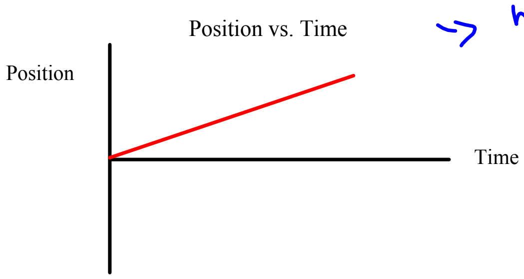


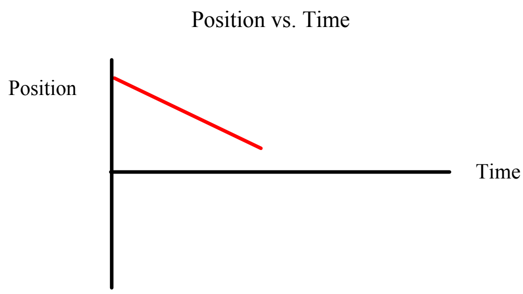
→ change in position

→ $m = \vec{v}$ (+) constant

positive direction

uniform motion





→ position changes

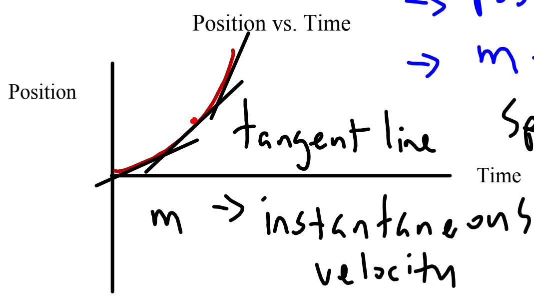
→ $m = \vec{v}$ not constant

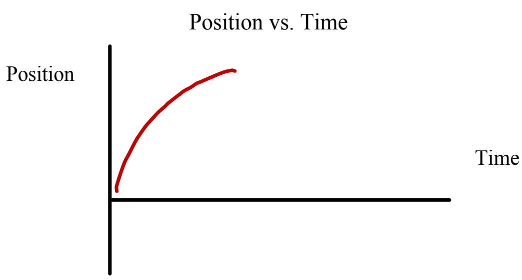
Speeding up

⇓

uniform acceleration

(uniformly acc'd motion)

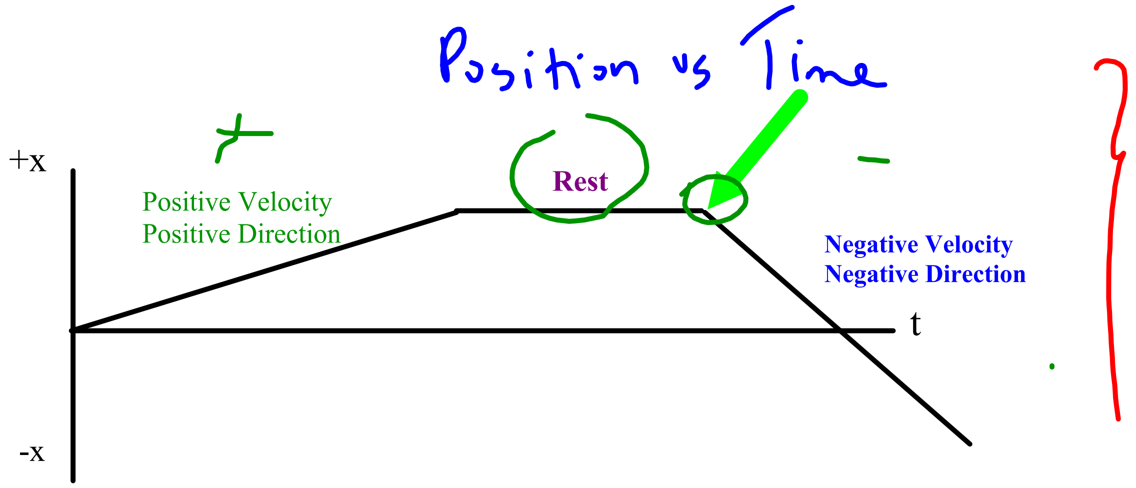




Position-Time Graphs

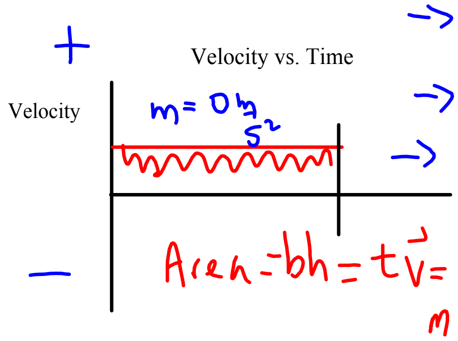
Direction of Motion

If the velocity of an object changes from positive to negative (or vice versa) it simply means that it has changed direction. On a position-time graph this occurs when the velocity changes signs.



Velocity-Time Graphs

(six)



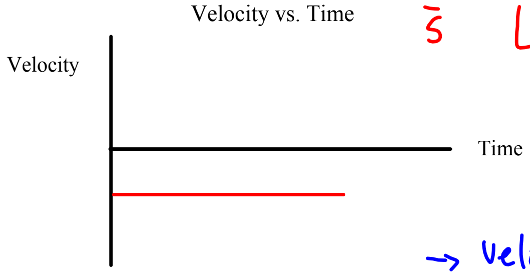
→ positive, constant velocity

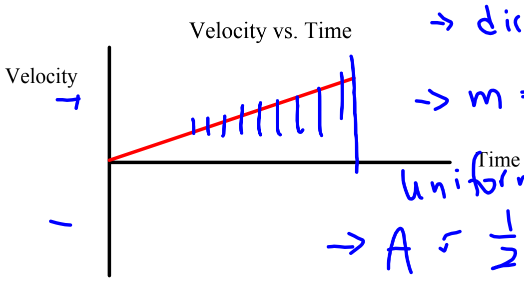
→ uniform motion

→ $m = \frac{\Delta \vec{v}}{\Delta t} = \vec{a}$; $\frac{m/s}{s}$ = m/s²

Area = bh = $t\vec{v} = \vec{v}t$

$\frac{m}{s} \cdot s$ = (m) → displacement





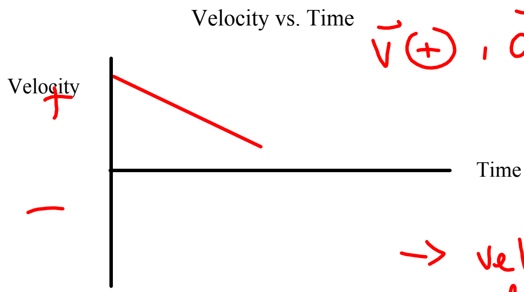
→ velocity is changing

→ direction of motion: +ve

→ $m = \vec{a}$ (+) → constant

uniformly acc'd motion.

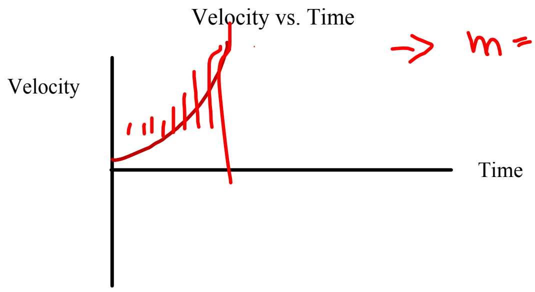
→ $A = \frac{1}{2}bh$ → displacement

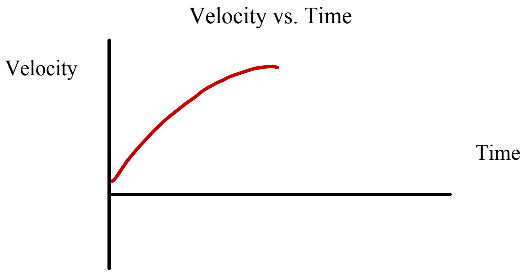


$\vec{v}$ (+), $\vec{a}$ (−) slowing down.

→ velocity (+) and changing

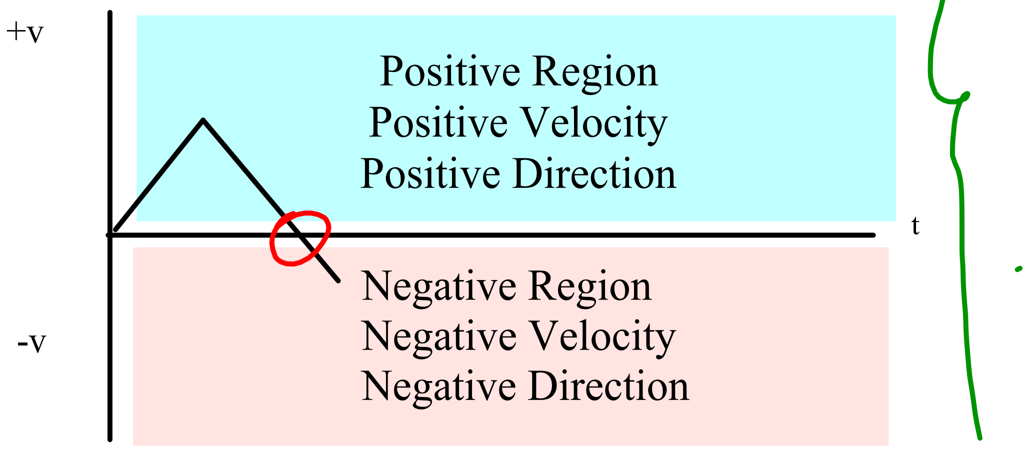
→ $m = \vec{a}$ is changing





Velocity-Time Graphs

Direction of Motion



If the graph line crosses the time axis from the positive region to the negative region (or vice versa), then the object has changed directions.

Velocity-Time Graph Calculations

slope => acceleration

$(t_1, \vec{v}_1)$, $(t_2, \vec{v}_2)$

$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{t_2 - t_1}$$

$m = \frac{\Delta y}{\Delta x}$

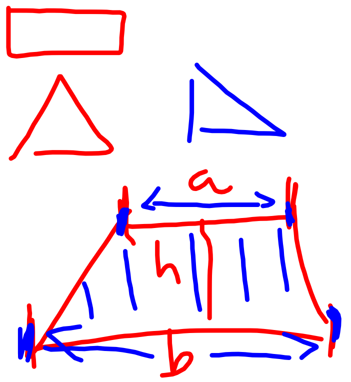
$(x_1, y_1), (x_2, y_2)$ ✓

area => distance or displacement

$A = lw$ $= bh$

$A = \frac{1}{2}bh$ $= \frac{bh}{2}$

$A = \frac{1}{2}(a + b)h$



distance = A1 + A2 + A3 + ...

displacement = A1 ± A2 ± A3 ± ...

average speed = $\frac{\text{distance}}{\text{time}}$

average velocity = $\frac{\text{displacement}}{\text{time}}$

Worksheet: Velocity-Time Graph #1

1. max speed 24 m/s
2. max velocity 24 m/s, west
3. 15 s
4. a) 12 m/s, east
   b) 12 m/s, west
5. a) 1.8 m/s^2, E
   b) 1.2 m/s^2, W
   c) 2.4 m/s^2, W
   d) 0 m/s^2
   e) 1.2 m/s^2, E
   f) 1.0 m/s^2, W
6. east 85 s
   west 50 s
7. 190 m, East
8. 1870 m ⇒ 1.87×10^3 m
9. 1.27 m/s, East
10. 12.5 m/s
11. 0.080 m/s^2, E
12. 16.8 m/s, W

$A_1 =$ — $A_2 =$ $A_3 =$ $A_4 =$

* distance $= A_1 + A_2 + A_3 + A_4$

* displacement $= +A_1 - A_2 + A_3 + A_4$

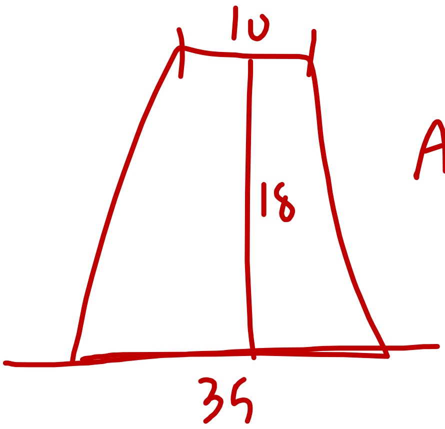
#12. average velocity ⇒ between 45 s and 95 s

ave. vel. ⇒ $\frac{-A_2}{95-45}$ $\frac{\text{displ.}}{\text{time}}$

#11. ave. acc.? 25 s and 125 s.

#9. $\vec{V}_{ave} = \frac{\Delta \vec{d}}{150 s} = \frac{A_1 - A_2 + A_3 + A_4}{150 s}$

average speed $= \frac{\text{distance}}{\text{time}} = \frac{A_1 + A_2 + A_3 + A_4}{150 s}$



$A = \frac{1}{2}(18)(10+35)$

$A = 405$

$\vec{d} = 405\ m, E$

displacement = $A_1 + A_2 + A_3$
(+) (−) (+)

distance = $A_1 + A_2 + A_3$

velocity = $\frac{\text{displacement}}{\text{time}}$

speed = $\frac{\text{distance}}{\text{time}}$

average acceleration ⇒ slope

Attachments

Physics 112- C2 Graphical Rep of Vectors.doc

Physics 112 - Analytical Man of Vectors.doc

Physics 112 - Analytical Man of Vectors (Answers).doc

Physics 111- C2 Graphical Rep of Vectors.doc

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j0388453[1].wav

Phyiscs 112 - Velocity Time Graph #1.pdf