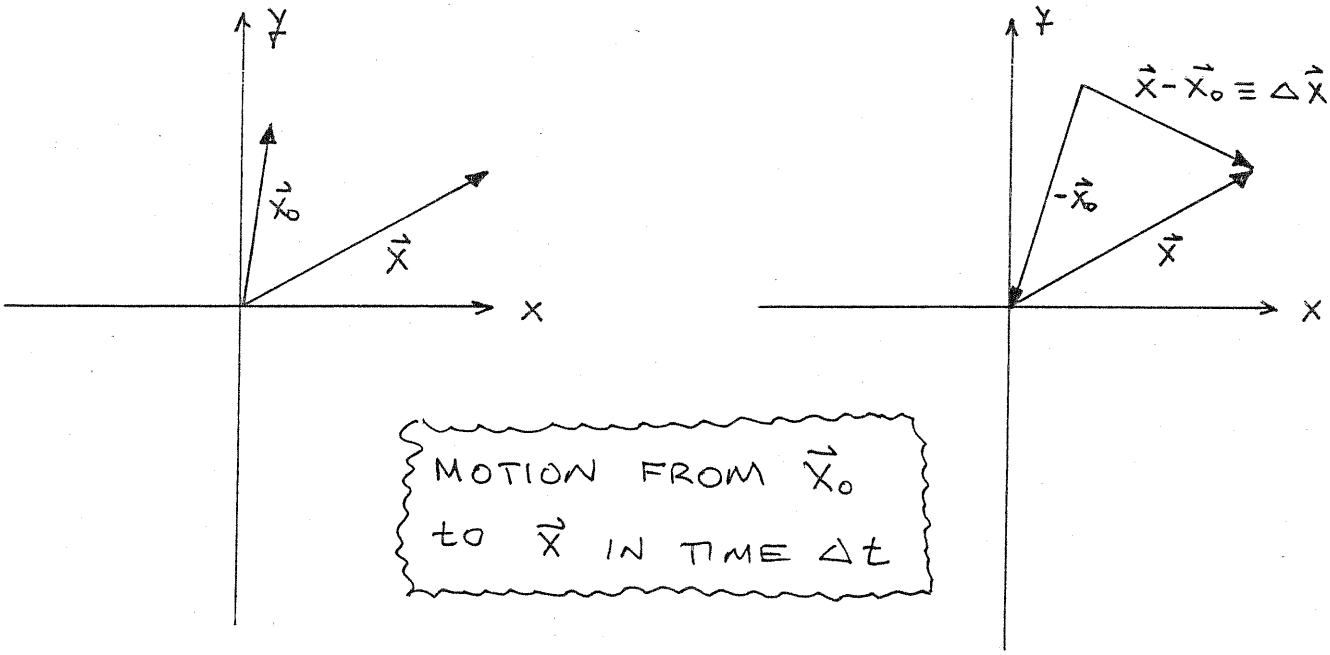
DISCUSSION 1.5

DISPLACEMENT, VELOCITY AND ACCELERATION



MOTION FROM $\vec{x}_0$ to $\vec{x}$ IN TIME Δt

$$\vec{v} \equiv \frac{\Delta\vec{x}}{\Delta t} = \frac{\vec{x} - \vec{x}_0}{t - t_0}$$

$$\vec{v} = \lim_{\Delta t \to 0} \frac{\Delta\vec{x}}{\Delta t} \equiv \frac{d\vec{x}}{dt}$$

$$\text{SPEED} \equiv \frac{\text{DISTANCE TRAVELED}}{\text{TIME}}$$

$$\bar{v} = \frac{|\Delta\vec{x}|}{\Delta t} \equiv \underline{\text{AVERAGE}} \text{ SPEED (POSITIVE SCALAR)}$$

$$\bar{v} \equiv \underline{\text{AVERAGE}} \text{ SPEED} \equiv |\bar{\vec{v}}|$$

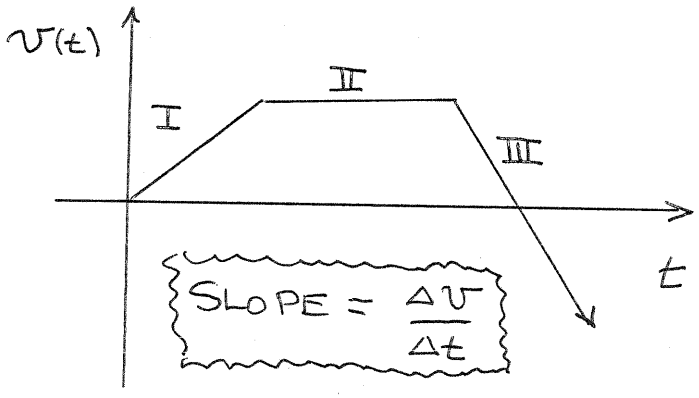
$$v \equiv \lim_{\Delta t \to 0} \frac{|\Delta\vec{x}|}{\Delta t} = |\vec{v}| \quad \underline{\text{INSTANTANEOUS}} \text{ SPEED.}$$

SIMILARLY FOR ACCELERATION

$$\vec{a} \equiv \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v} - \vec{v}_0}{t - t_0}$$ AVERAGE ACCELERATION

$$\vec{a} \equiv \lim_{\Delta t \to 0} \frac{\Delta \vec{v}}{\Delta t} \equiv \frac{d\vec{v}}{dt} \equiv \frac{d^2\vec{x}}{dt^2}$$ INSTANTANEOUS ACCELERATION

IN ONE DIMENSION a IS THE SLOPE OF A v VS. t GRAPH:

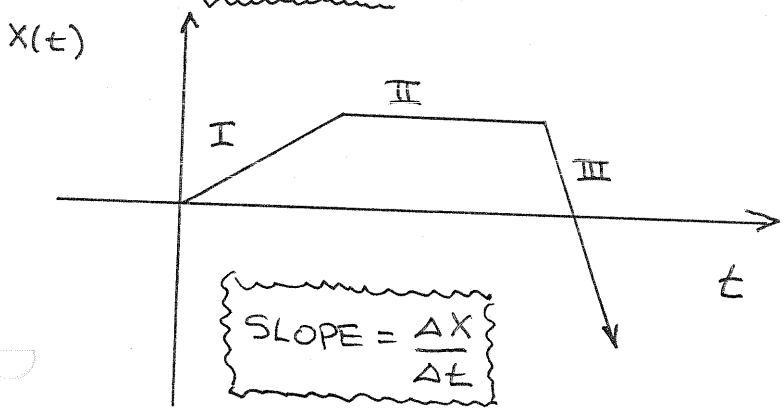


I. SLOPE IS NONZERO AND a (+) CONSTANT $\Rightarrow$ $a \equiv$ POSITIVE CONSTANT

II. SLOPE = 0 $\Rightarrow$ $a \equiv 0$

III SLOPE IS NONZERO AND a (−) CONSTANT $\Rightarrow$ $a \equiv$ NEGATIVE CONSTANT

IN ONE DIMENSION v IS THE SLOPE OF AN x VS. t GRAPH:



I. SLOPE IS A NONZERO (+) CONSTANT $\Rightarrow$ $v \equiv$ POSITIVE AND CONSTANT

II. SLOPE = 0 $\Rightarrow$ $v \equiv 0$

III SLOPE IS A NONZERO (−) CONSTANT $\Rightarrow$ $v \equiv$ NEGATIVE AND CONSTANT