



Θέση: ίξονας,

αρχή, δευτερεύουσα

$$\Delta x = x_2 - x_1$$

$$\Delta x = +5m - (-3m) \Rightarrow$$

$$\Delta x = +8m$$

μεταβολή:  $\Delta A = A_2 - A_1$

$$\Delta \vec{A} = \vec{A}_{\text{Τελικό}} - \vec{A}_{\text{Αρχικό}}$$

ταχύτητα =  $\frac{\text{μετατόπιση}}{\text{χρονική διάρκεια}}$

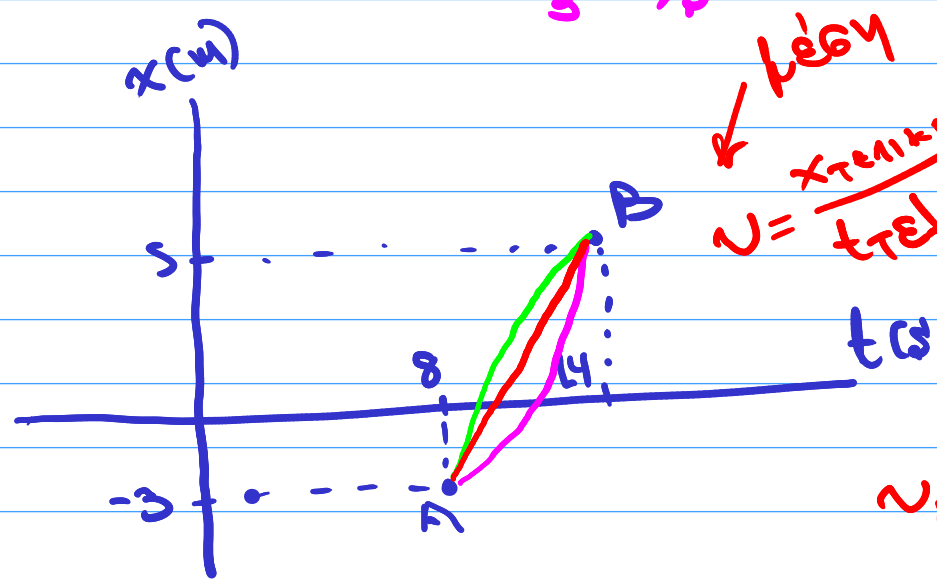
$$v = \frac{\Delta x}{\Delta t} \Rightarrow v = \frac{+8m}{6s} \Rightarrow$$

$$\Rightarrow v = \frac{4}{3} \text{ m/s}$$

$$\Delta t = t_2 - t_1$$

$$\Delta t = 14s - 8s$$

$$\Delta t = 6s$$

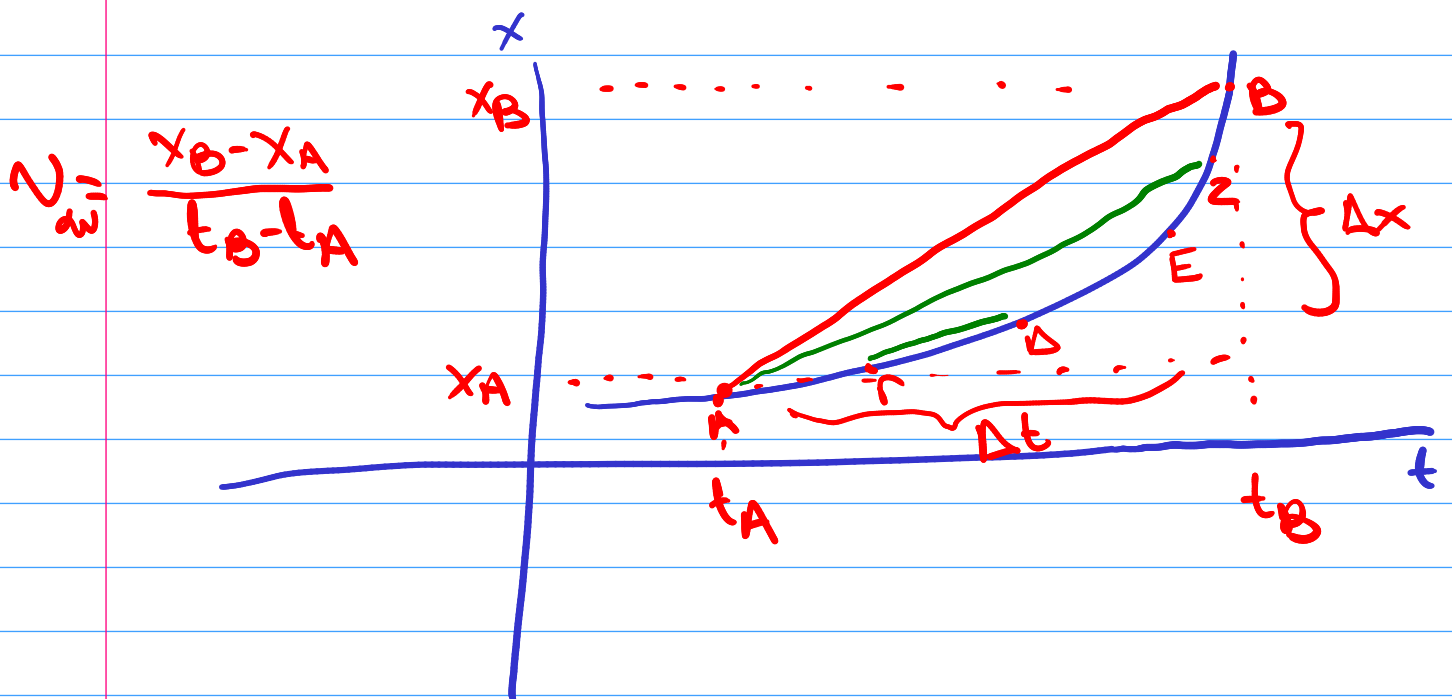


λέγεται

$$v = \frac{\text{x τελικό} - \text{x αρχικό}}{\text{t τελικό} - \text{t αρχικό}}$$

$$v_H = v_{\text{αυτ}} = \bar{v}$$

μέγεθος αριθμητική ταχύτητα =  $\frac{\text{συνολική απόσταση}}{\Delta t}$



Σειριακή ταχύτητα:  $\lim_{\Delta t \rightarrow 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$

$$v = \frac{dx}{dt}$$

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μέγεθος επιτάχυνση =  $\frac{v_2 - v_1}{t_2 - t_1} = \frac{\Delta v}{\Delta t}$

Σειριακή επιτάχυνση =  $\frac{dv}{dt}$

$$a = \frac{dv}{dt} \Rightarrow a = \frac{d}{dt} \left( \frac{dx}{dt} \right) \Rightarrow a = \frac{d^2 x}{dt^2}$$

Μεγεθῆ (μάζα, ἴσχυς, χρόνος, ...)

$$m = 5 \text{ kg}$$



$$80 \text{ kg}$$

$$m_0 = 1 \text{ kg}$$



$$1,5 \text{ kg}$$

$$m_1 = 80 \text{ kg}$$

$$m'_1 = 78 \text{ kg}$$

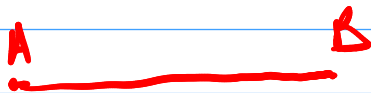
$$\Delta m = m'_1 - m_1$$

$$1 \text{ kg} = 1000 \text{ g}$$

$$1 \text{ g} = 1000 \text{ mg}$$

$$1 \text{ mg} = 1000 \text{ } \mu\text{g}$$

$$1 \text{ ton} = 1000 \text{ kg}$$



$$1 \text{ m} = 10 \text{ dm}$$

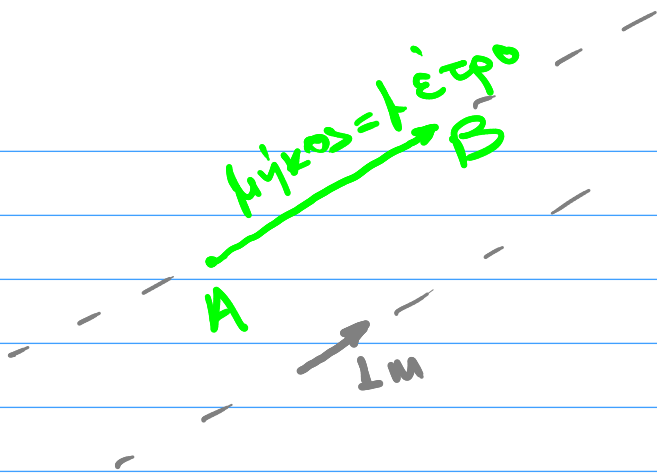
$$1 \text{ dm} = 10 \text{ cm}$$

$$1 \text{ cm} = 10 \text{ mm}$$

$$1 \text{ mm} = 1000 \text{ } \mu\text{m}$$

$$1 \text{ } \mu\text{m} = 1000 \text{ nm}$$

$$1 \text{ } \text{\AA} = 10^{-10} \text{ m}$$



Π.α

$$x = 2 - 8t + t^2 \quad (\text{m})$$

$$v = \frac{dx}{dt} \Rightarrow v = \frac{d}{dt} (2 - 8t + t^2) \Rightarrow$$

$$v = 0 - 8 + 2t \Rightarrow v = -8 + 2t \quad (\text{m/s})$$

$$a = \frac{dv}{dt} \Rightarrow a = \frac{d}{dt} (-8 + 2t) \Rightarrow$$

$$a = 2 \quad \text{m/s}^2$$

Π.β.

$$x = 4 - 27t + t^3$$

$$v = \frac{dx}{dt} = -27 + 3t^2$$

$$a = \frac{dv}{dt} = 6t$$

$$v = 0 \Rightarrow -27 + 3t^2 \Rightarrow$$

$$3t^2 = 27 \Rightarrow t = \pm \sqrt{9} = \pm 3 \text{ s}$$

$t = 3 \text{ s}$

$$\alpha = \frac{dv}{dt} \Rightarrow$$

$$dv = \alpha \cdot dt \Rightarrow$$

$$\int_{v_1}^{v_2} dv = \int_{t_1}^{t_2} \alpha \cdot dt \Rightarrow$$

$$v_2 - v_1 = \int_{t_1}^{t_2} \alpha \cdot dt$$

$$\Rightarrow v_2 = v_1 + \int_{t_1}^{t_2} \alpha \cdot dt$$

$$v = v_2$$

$$v = v_1 + \int_{t_1}^t \alpha dt$$

$$t_1 \rightarrow v_1, \alpha$$

$$t_{\text{apx}} = t_0 = 0$$

$$v_{\text{apx}} = v_1 = v_0$$

$$\left. \begin{array}{l} t_{\text{apx}} = t_0 = 0 \\ v_{\text{apx}} = v_1 = v_0 \end{array} \right\} \rightarrow v = v_0 + \int_0^t \alpha dt$$

$$v = \frac{dx}{dt} \Rightarrow \int_{x_1}^{x_2} dx = \int_{t_1}^{t_2} v \cdot dt \Rightarrow$$

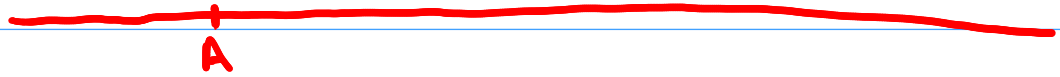
$$x_2 - x_1 = \int_{t_1}^{t_2} v dt \Rightarrow$$

$$x_2 = x_1 + \int_{t_1}^{t_2} v dt$$

$$t_0 \rightarrow x_1 = x_0$$

$$x = x_0 + \int_{t_1}^{t_2} v dt$$

$$x = 2 - 8t + t^2 \text{ (m)} \quad v = -8 + 2t \text{ (m/s)} \quad a = 2 \text{ (m/s}^2\text{)}$$



$$\vec{a} = 2 \text{ m/s}^2$$

$$\text{Essew pada } t_0 = 0 \quad v = v_0 = -8 \text{ m/s}$$

$$a = \frac{dv}{dt} \Rightarrow dv = a \cdot dt \Rightarrow \int_{v_0}^v dv = \int_{t_0}^t a \cdot dt \Rightarrow$$

$$v - v_0 = \int_{t_0}^t a dt \Rightarrow v = v_0 + \int_{t_0}^t a dt \Rightarrow$$

$$v = -8 + \int_0^t 2 \cdot dt \Rightarrow v = -8 + 2t$$

$$\text{Essew pada } t_0 = 0 \text{ si } x = x_0 = 2 \text{ m}$$

$$v = \frac{dx}{dt} \Rightarrow dx = v \cdot dt \Rightarrow \int_{x_0}^x dx = \int_{t_0}^t v \cdot dt \Rightarrow$$

$$x - x_0 = \int_{t_0}^t v \cdot dt \Rightarrow x = x_0 + \int_{t_0}^t v dt \Rightarrow$$

$$x = 2 + \int_0^t (-8 + 2t) dt$$



$$x = 2 + \int_0^t (-8) dt + \int_0^t 2t dt \Rightarrow$$

$$x = 2 + (-8)t \Big|_0^t + 2 \frac{t^2}{2} \Big|_0^t \Rightarrow \boxed{x = 2 - 8t + t^2}$$

$2 \int_0^t t dt = 2 \frac{t^2}{2} \Big|_0^t$

INX

$$t_0 = 0 \rightarrow v_0 = 0 \quad a = (5,00 \text{ m/s}^3)t$$

a)  $v = ?$     b)  $\Delta x$     c)  $v$  at  $t = 3,00 \text{ s}$

$$a = \frac{dv}{dt} \Rightarrow \int_{v_0}^v dv = \int_{t_0}^t a \cdot dt \Rightarrow v - v_0 = \int_{t_0}^t a dt \Rightarrow$$

$$v = v_0 + \int_{t_0}^t a dt \Rightarrow v = 0 + \int_0^t (5,00 \text{ m/s}^3)t dt$$

$$v = (5,00 \text{ m/s}^3) \int_0^t t dt \Rightarrow v = (5,00 \text{ m/s}^3) \frac{t^2}{2} \Big|_0^t$$

$$\boxed{v = 2,50 \frac{\text{m}}{\text{s}^3} \cdot t^2}$$

$$v = \frac{dx}{dt} \Rightarrow \int_{x_0}^x dx = \int_{t_0}^t v \cdot dt \Rightarrow \underbrace{x - x_0}_{\Delta x} = \int_{t_0}^t v \cdot dt$$

$$\Delta x = \int_0^t (2,50 \text{ m/s}^3) t^2 dt \Rightarrow$$

$$\Delta x = (2,50 \text{ m/s}^3) \int_0^t t^2 dt$$

$$\Delta x = (2,50 \text{ m/s}^3) \left. \frac{t^3}{3} \right|_0^t \Rightarrow$$

$$\Delta x = \left( \frac{2,50}{3} \text{ m/s}^3 \right) t^3$$

$$\int_0^5 x^2 dx \Rightarrow$$
$$\left. \frac{x^3}{3} \right|_0^5 = \frac{5^3}{3} - \frac{0^3}{3} = \frac{125}{3}$$

$$\frac{7,50}{2,5}$$

$$t = 3,00 \text{ s}$$

$$v = 2,50 \frac{\text{m}}{\text{s}^3} t^2 \Rightarrow v = 2,50 \frac{\text{m}}{\text{s}^3} (3,00 \text{ s})^2$$

$$v = 22,5 \frac{\text{m}}{\text{s}^2} \text{ s}^2$$

$$\Delta x = \frac{2,50}{3} \frac{\text{m}}{\text{s}^3} \cdot t^3 \Rightarrow \Delta x = \frac{2,50}{3} \frac{\text{m}}{\text{s}^3} (3,00 \text{ s})^3$$

$$= 22,5 \text{ m}$$

11X

$$x = 3,0 \frac{\text{m}}{\text{s}^2} t^2 - 2,0 \frac{\text{m}}{\text{s}^3} t^3$$

$$x=0 \quad t=0, t=\frac{3,0}{2,0} \text{ s} \\ t=1,5 \text{ s}$$

$$v = \frac{dx}{dt} \Rightarrow v = \frac{d}{dt} \left( 3,0 \frac{\text{m}}{\text{s}^2} t^2 - 2,0 \frac{\text{m}}{\text{s}^3} t^3 \right) \Rightarrow$$

$$v = 6,0 \frac{\text{m}}{\text{s}^2} t - 6,0 \frac{\text{m}}{\text{s}^3} t^2$$

$$v=0 \quad t=0 \\ t=1 \text{ s}$$

$$a = \frac{dv}{dt} \Rightarrow a = \frac{d}{dt} \left( 6,0 \frac{\text{m}}{\text{s}^2} t - 6,0 \frac{\text{m}}{\text{s}^3} t^2 \right)$$

$$a = 6,0 \frac{\text{m}}{\text{s}^2} - 12 \frac{\text{m}}{\text{s}^3} t$$

$$a=0 \quad t=0,5 \text{ s}$$

Актыб

$$a = (6,1 - 1,2 t) \quad (\text{m/s}^2)$$

$$0 \leq t \leq 6,0 \text{ s}$$

$$t=0 \quad v_0 = 2,7 \text{ m/s} \quad x_0 = 7,3 \text{ m}$$