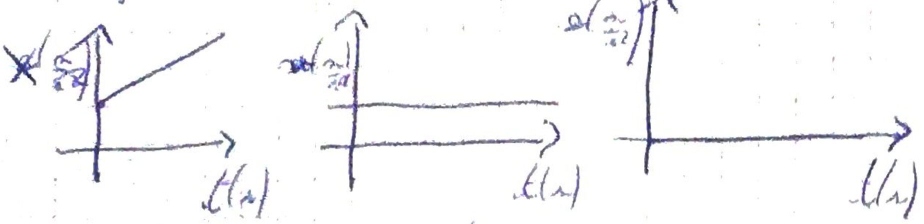
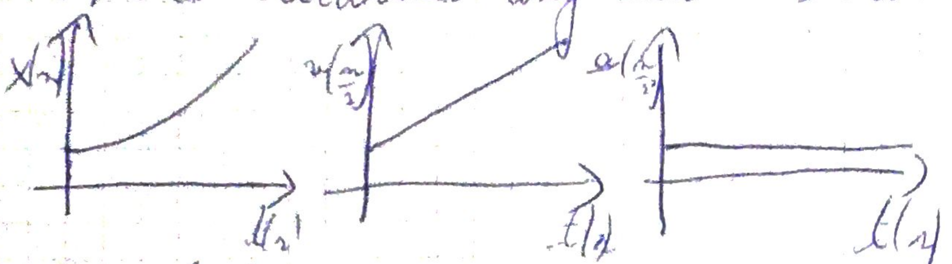
Moto rettilineo costante



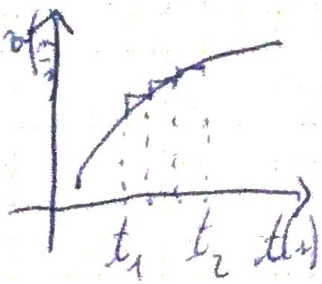
$$x(t) = x_0 + v t$$

Moto rettilineo uniformemente accelerato



$$x(t) = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$v(t) = a \cdot t$$



$$\Delta x = \lim_{\Delta t \to 0} \sum_{i=1}^{N} \Delta x_i$$

$$= \int_{t_1}^{t_2} v_i \, dt$$

$$\Delta x_1 = \overline{v_1} \Delta t$$

$$\Delta x_2 = \overline{v_2} \Delta t$$

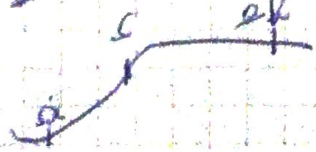
$$\Delta x_3 = \overline{v_3} \Delta t$$

$$\Delta x \simeq \Delta x_1 + \Delta x_2 + \Delta x_3$$

$$\int_a^b k f(x) dx \Rightarrow k \int_a^b f(x) dx$$

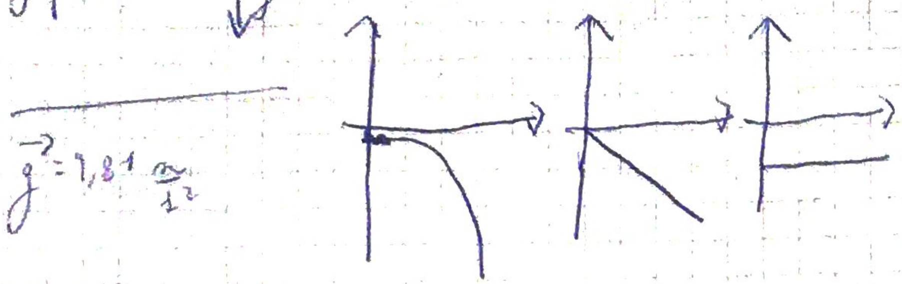
$$\int_a^b f(x) + g(x) dx \Rightarrow \int_a^b f(x) dx + \int_a^b g(x) dx$$

$$\int_a^b f(x) dx \Rightarrow \int_a^c f(x) dx + \int_c^b f(x) dx$$



$y \uparrow$ $\cdot h$ $\downarrow g$

Caduta Libera



$\vec{g} = 9{,}81 \frac{m}{s^2}$

$v_0 = 0$

$y(t) = y_0 + v_0 t - \frac{1}{2} g t^2$

$y(t) = h - \frac{1}{2} g t^2$ $\quad v(t) = -gt$

$0 = h - \frac{1}{2} g t^2$

$h = \frac{1}{2} g t^2$

$t^2 = \frac{2h}{g}$

$t = \sqrt{2 \frac{h}{g}}$ $\quad v = -g\sqrt{\frac{2h}{g}} = -\sqrt{2hg}$

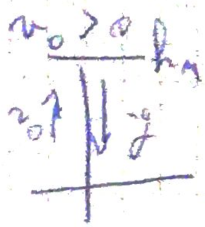
$v_0 < 0$

$y(t) = y_0 - v_0 t - \frac{1}{2} g t^2$

$y_0 - v_0 t - \frac{1}{2} g t^2 = 0$

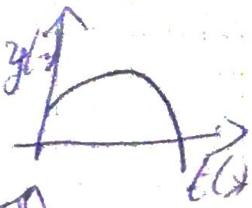
$t_0 = -\frac{v_0}{g} + \sqrt{\frac{v_0^2}{g^2} + \frac{2y_0}{g}}$

$v(t) = -v_0 - gt$



$v(t) = v_0 - gt$

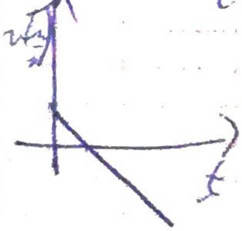
$y(t) = y_0 - v_0 t - \frac{1}{2} g t^2$



$t_M = \frac{v_0}{g}$ $\quad v(t) = v_0 - gt$

$0 = v_0 - gt$

$t = \frac{v_0}{g}$



$y(t) = y_0 - v_0 t - \frac{1}{2} g t^2$

$y(t) = y_0 + \frac{v_0^2}{2g}$

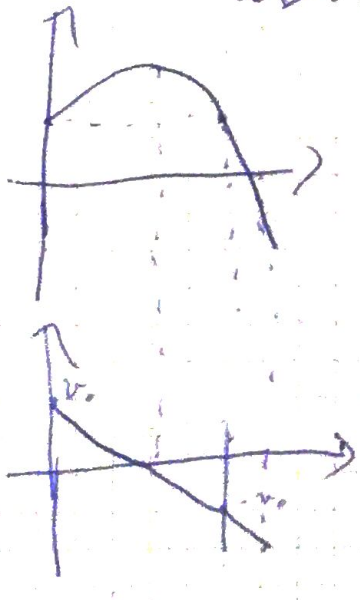
$y(t_d) = 0 \Rightarrow y_M = \frac{1}{2} g t_d^2$

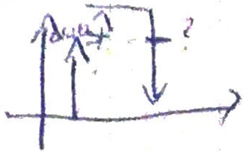
$t_d = \sqrt{\frac{2h_M}{g}}$

$t_d = \frac{v_0}{g}$

$v(t_d) = -g t_d$

$v(t_d) = -v_0$





$a = 10\, m/s^2$

$h = 20\, Km = 20 \cdot 10^3\, m$

$y_0 = ?$

$y_1 = ?$

40Km

1291

2191

-377 m/s

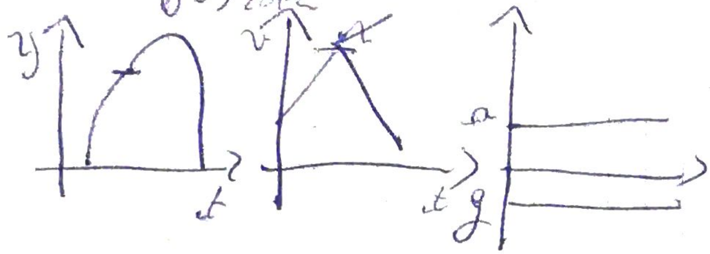
$y(t) = y_0 + v_0 t + \frac{1}{2} a t^2$

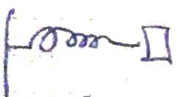
$y(t) = \frac{1}{2}\, a\, t^2$

$h = \frac{1}{2} a t^2$

$t = \sqrt{\frac{2h}{a}}$

0 -> 20 km



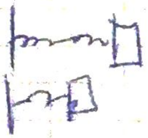


Armonico

Periodo T

Periodico

$[Hz] = \frac{1}{[s]}$



$x(t) = a \cos(\omega t + \varphi)$

a = Ampiezza

ω = Pulsazione

φ = Fase

$T =$

$\nu = \frac{1}{T}\, [Hz]$

$x(t) = x(t+T)$

$\varphi = 0$

$\cancel{a} \cdot \cos(\omega t) = \cancel{a} \cdot \cos(\omega(t+T))$

$P(\cos) = 2\pi$

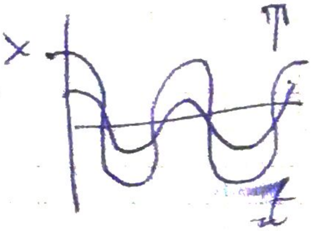
$\omega(t) + 2\pi = \omega(t+T)$

$\omega \cancel{t} + 2\pi = \omega \cancel{t} + \omega T$

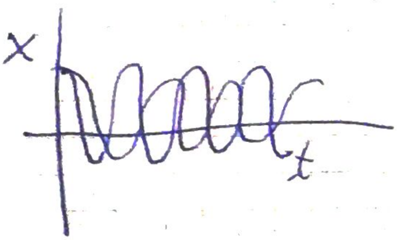
$2\pi = \omega T$

$T = \frac{\omega}{2\pi}$

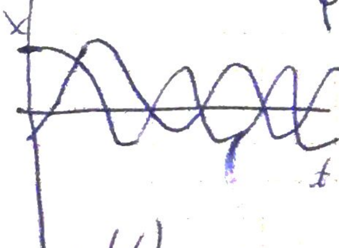
$\omega = \frac{2\pi}{T} \frac{[rad]}{[s]}$



$A \neq A'$
$\omega = \omega'$
$\varphi = \varphi'$



$A = A'$
$\omega \neq \omega'$
$\varphi = \varphi'$



$A = A'$
$\omega = \omega'$
$\varphi \neq \varphi'$

$x(t) = a \cdot \cos(\omega t + \varphi)$

$a(t) = \frac{dv(t)}{dx}$

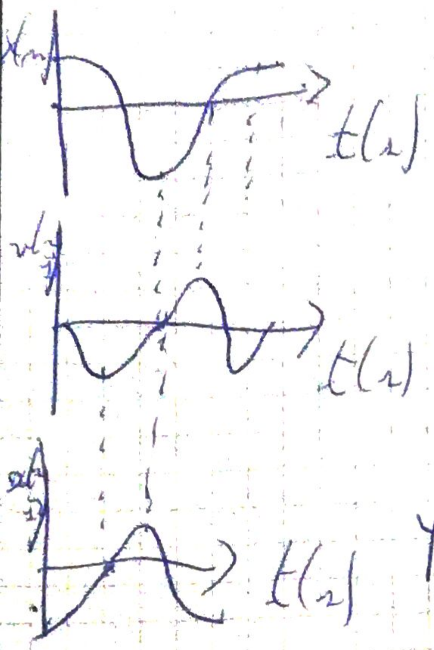
$v = \frac{dx(t)}{dt} = -\omega a \operatorname{sen}(\omega t + \varphi)$

$a(t) = -\omega^2 a \cos(\omega t + \varphi)$

$a(t) = -x(t)\,\omega^2$

$\frac{d^2 x}{dt^2} + \omega x = 0$ Equazione Differenziale 2° ordine

Moto armonico Semplice



$\varphi = \frac{\pi}{2}$

$\varphi = \frac{\pi}{2}$

$\varphi = \pi$

$x_0 = -8{,}5\,cm \qquad x(t) = a \cdot \cos(\omega t + \varphi)$

$v_0 = -0{,}92\, m/s \qquad x_0 = x(0)$

$a_0 = 47\, m/s^2 \quad 1 \quad x_0 = a \cdot \cos(\omega \cdot 0 + \varphi)$

$\omega = ? \qquad x_0 = a \cos(\varphi)$

$\varphi = ? \qquad 2 \quad v(t) = -a\omega \sin(\omega t + \varphi)$

$a = ? \qquad v_0 = -a\omega \sin(\varphi)$

$\frac{x_0}{v_0} = -\frac{1}{\omega \tan(\varphi)} \qquad a_0 = a(0)$

$3 \quad a(t) = -a\omega^2 \cos(\omega t + \varphi)$

$\frac{x_0}{a_0} \quad \frac{1}{-\omega^2} \qquad \omega^2 = -\frac{a_0}{x_0} \qquad \omega = \sqrt{-\frac{a_0}{x_0}}$

$\frac{x_0}{v_0} = \frac{1}{-\omega \tan(\varphi)} \qquad \tan(\varphi) = -\frac{v_0}{x_0 \omega} \qquad \varphi = \tan\left(-\frac{v_0}{x_0 \omega}\right)$

1.27 1.28. 1.29. 130 1.31