

# Appunti Fisica

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Parte I

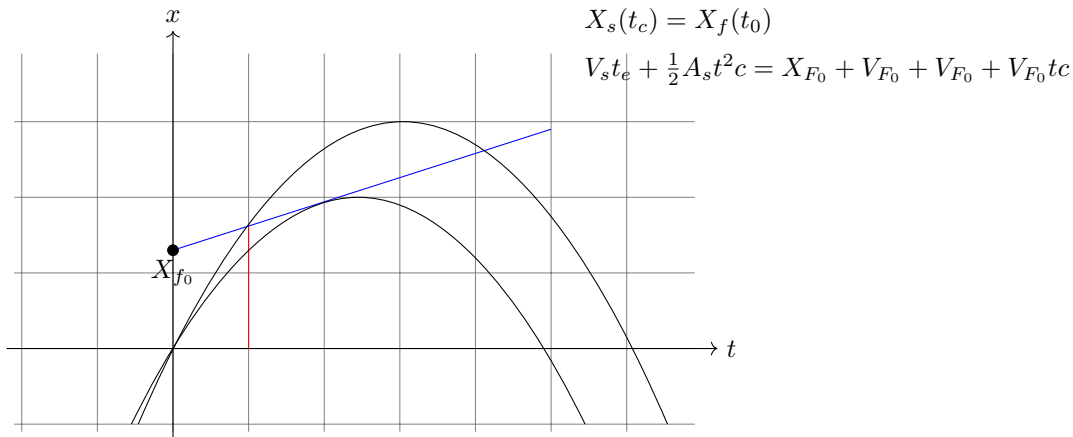
fisica 1



## 0.1 moto rettilineo uniformemente accelerato

Moto rettilineo uniformemente accelerato. La definizione di moto rettilineo uniformemente accelerato è: il moto di un corpo con accelerazione costante lungo una traiettoria retta sempre nella stessa direzione e identico verso.

$$\begin{aligned} V_{S_0} &= 30,0 \text{ m/s} & X_{F_0} &= I_{SF} = 155,5 \text{ m} & X_F(t) &= X_{F_0} + V_{F_0} t \\ V_F &= 5,00 \text{ m/s} & X_s(t) &= X_{S_0} + X_{S_0} t + \frac{1}{2} A_s t^2 \\ A_s &= -2,00 \text{ m/s}^2 & X_s(t) &= V_{S_0} + \frac{1}{2} A_s t^2 \end{aligned}$$



$$(x_f(t) - x_{f_0}) = X_f(t_0)$$

$$\alpha x^2 + \beta x + \gamma = 0$$

$$x = \frac{-\beta \pm \sqrt{\beta^2 - 4\alpha\gamma}}{2\alpha} \quad \Delta \geq 0$$

$$\tilde{x}^2 + 2\tilde{\beta}x + \gamma = 0$$

$$x = \sqrt{\tilde{\beta}}$$

$$\frac{1}{2}(V_{s_0} - V_{F_0})T_c - X_{F_0} = 0$$

$$t_c^2 + \frac{2}{|A_s|}(V_{s_0} - V_{f_0})t_c - \frac{2}{A_s}X_{f_0} = 0$$

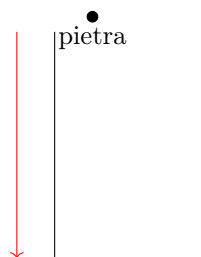
$$A_s = -|A_s|$$

$$t_c = -\left[-\frac{I}{A_s}(V_{s_0} - V_{f_0})\right] \pm \sqrt{(v_{s_0} - v_{f_0})/A_s^2 - \frac{2}{|A_s|}X_{f_0}} = 156,25 - 155 = 1,25$$

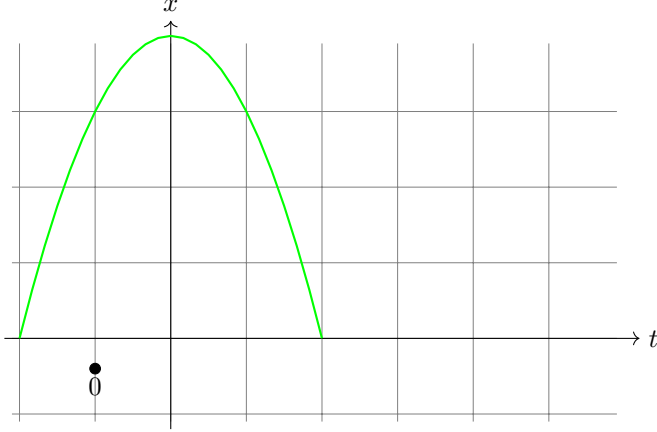
$$t_{c-} = 12,5 - 1,00 \text{ s} = 11,5 \text{ s}$$

### 0.1.1 Un problema d'esempio

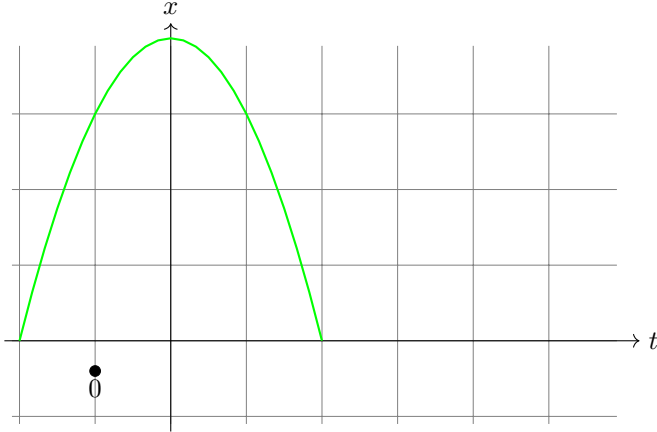
Si Lascia cadere un sasso in un pozzo. il tempo nell'acqua viene percepito con un ritardo di 7.40s, a quale distanza dall'imboccatura del pozzo si trova la superficie dell'acqua? La velocità del suono nell'aria è 336 m/s.



$$\begin{aligned}
V_s &= 336 \text{ m/s} \quad \Delta t_{tot} = 4,40 \text{ s} \\
y(t) &= y_0 + V_0 t + \frac{1}{2} a t^2 \\
y &= 0 \quad y_0 = 0 \quad V_0 = 0 \quad a = -g \\
y(t) &= h - \frac{1}{2} g t^2 \\
\Delta t_{tot} &= t_{caduta} + t_{suono} \\
h &= V_s * t_{suono} \\
t_{suono} &= h/V_s
\end{aligned}$$



$$\begin{aligned}
x(t) &= x_0 + V_{x_0} t \\
y(t) &= y_0 + V_{y_0} t \\
x - x_0 &= V_{x_0} \\
y - y_0 &= V_{y_0}
\end{aligned}$$



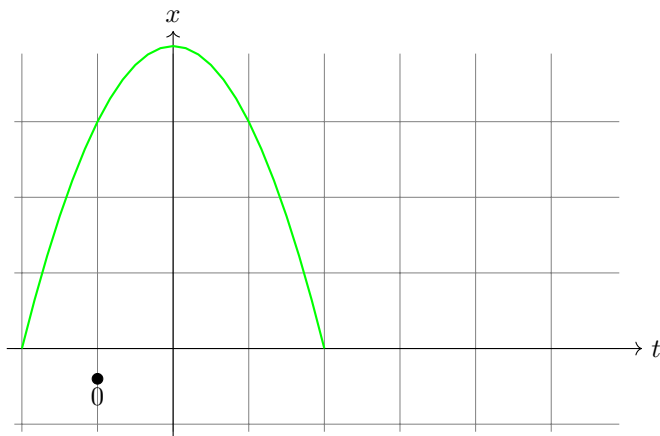
$$\begin{aligned}
A_y &= -g \\
y(t) &= y_0 + V_{y_0} t + \frac{1}{2} A_y t^2 \\
y_0 &= 0 \quad x_0 = 0 \\
V(t) &= V_{y_0} t - \frac{1}{2} g t^2 \\
x(t) &= x_0 + V_{x_0} t \\
x(t) &= V_{x_0} t \\
\begin{cases} x(t) = V_{x_0} t \\ y(t) = V_{y_0} t - \frac{1}{2} g t^2 \end{cases} \\
y - y_m &= \alpha(x - x_m)^2 \\
V_y(t) &= V_{y_0} - g t - V_m = \alpha x_m^2 \\
t &= \frac{x}{V_{y_0}} \\
y &= V_{y_0} - \frac{1}{2} g \frac{x^2}{V_{x_0}^2} \\
y - y_m &= \alpha x^2 + \alpha x_m^2 - 2\alpha x x_m
\end{aligned}$$

$$\begin{aligned}
\Delta t_{tot}^2 + \frac{h^2}{V_s^2} - \frac{2h}{v+V_x} \Delta t_{tot} &= \frac{2h}{g} \\
\frac{h^2}{V_s^2} - 2\left(\frac{\Delta t_{tot}}{V_s} + \frac{I}{g}\right)h + \Delta t_{tot}^2 &= 0 \\
h^2 - 2V_s^2\left(\frac{\Delta t_{tot}}{V_s} + \frac{I}{g}\right)h + \Delta t_{tot}^2 &= 0 \\
h = V_s^2\left(\frac{\Delta t_{tot}}{V_s} + \frac{I}{g}\right)h + V_s^2 \Delta t_{tot}^2 &= 0 \\
h &= \frac{V_s^2\left(\frac{\Delta t_{tot}}{V_s} + \frac{I}{g}\right) \pm \sqrt{\left[\frac{\Delta t_{tot}}{V_s} + \frac{I}{g}\right]^2 - \frac{2h}{v+V_x} \Delta t_{tot}}}{\Delta t_{tot} - \frac{h}{V_s}} > 0
\end{aligned}$$

$$\begin{aligned}
\frac{y-y_0}{x-x_0} &= \frac{V_{y_0}}{V_{x_0}} = \frac{ay}{ax} \\
\frac{1}{2} \frac{V_{y_0}}{g} &= -\frac{1}{2} \frac{g}{V_{x_0}^2} \frac{V_{x_0}^2 * V_{y_0}^2}{g^2} \\
y - y_m &= -\frac{1}{2} \frac{g}{V_{x_0}^2}
\end{aligned}$$

$$\begin{aligned}
\alpha &= -\frac{1}{2} \\
X_m &= \frac{V_{x_0} * V_{y_0}}{g} \\
t_m &= \frac{V_{y_0}}{g} \\
V_{y_0} - g t_m &= 0 \\
y_m &= V_{y_0} \frac{V_{y_0}}{g} - \frac{1}{2} g \frac{V_{y_0}^2}{g^2} \\
\frac{1}{2} \frac{V_{y_0}^2}{g} &= -\frac{1}{2} \frac{g}{V_{x_0}^2} \frac{V_{x_0}^2}{g^2} \\
y - y_m &= -\frac{1}{2} \frac{g}{V_{x_0}^2} (x - x_m)^2
\end{aligned}$$





$$X_p = r * \cos \sigma$$

$$\cos \sigma = \frac{x_p}{r}$$

$$y_p = r \sin \sigma$$

$$X_p^2 + y_p^2 = r^2$$

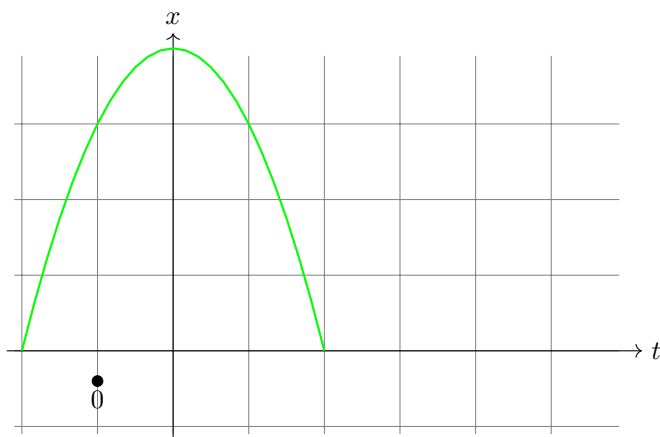
$$\frac{y_p}{x_p} = \frac{\sin \sigma}{\cos \sigma} = \tan \sigma$$

$$\cos \sigma = \cos -\sigma$$

$$\sin \sigma = -\sin -\sigma$$

## 0.2 I vettori

### 0.2.1 Proiezione dei vettori prodotto scalare



$$L * L = 1$$

$$J * J = 1$$

$$\vec{a} * \vec{i} = a_x$$

$$\vec{a} *$$

$$\vec{a} = \vec{a}_x \vec{i} + a_y \vec{j}$$

$$ax = \vec{a} * \vec{j} = ||a|| * ||\vec{j}|| \cos \phi =$$

$$||\vec{a}|| * \cos \phi$$

$$\vec{a} = a_x \vec{i} + a_y \vec{j}$$

$$\vec{b} = b_x \vec{i} + b_y \vec{j}$$

$$\vec{a} * \vec{b} = (a_x \vec{i} + a_y \vec{j}) * (b_x \vec{i} +$$

$$b_y \vec{j})$$

$$\vec{a} * \vec{b} = a_x * b_x + a_y b_y$$

$$||\vec{a}|| = a_x^2 + a_y^2 = \vec{a} * \vec{a}$$

$$\vec{r}(t) = \vec{r}_0 + V_0 t + \frac{1}{2} \vec{g} t^2$$

$$\vec{r} * \vec{j} = y = \vec{r} * \vec{j} + \vec{V}_0 * \vec{j}$$

$$\cos \frac{\pi}{2} * \phi = \sin \phi$$

$$x = x_0 + V_x t$$

$$y = y_0 + V_0 t - \frac{1}{2} g t^2$$

### Moto balistico

$$x = x_0 + V_{0x} t$$

$$y = y_0 + V_{0y} t - \frac{1}{2} g t^2$$

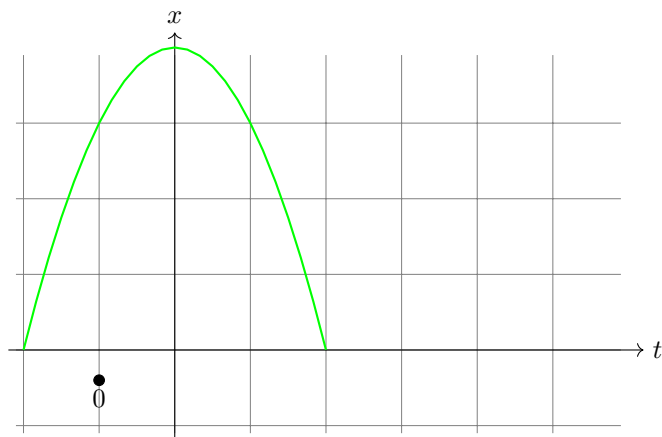
$$x = 0$$

$$y = h$$

$$V_{0y} = \vec{V}_0 * \vec{J} = ||\vec{V}|| * ||\vec{J}||$$

$$h = \frac{1}{2}gt^2$$

### 0.2.2 Primitive di una funzione



$$\frac{d}{dx} \mathcal{A}_x = f(x)$$

$$\mathcal{A}(x) = \int_{\gamma}^x i\mathcal{A}(x) = \int_{\gamma}^x f(x)dx = \text{integrale indefinita} \quad P(x_2) - P(x_1) = \mathcal{A}(x_2) + c - \mathcal{A}(x_1) - c = \mathcal{A}(x_2) - \mathcal{A}(x_1)$$

$$P(x) = \mathcal{A}(x) + c \rightarrow \text{costante arbitraria}$$

### Integrali definito

$$\mathcal{A}(x_2) - \mathcal{A}(x_1) = \int_{\mathcal{A}(x_1)}^{\mathcal{A}(x_2)} d\mathcal{A}(x) = \int_{\mathcal{A}(x_1)}^{\mathcal{A}(x_2)} f(x)dx$$

Teorema dell'energia cinetica  $\vec{F}_R$  risultante delle forze.

$$dL = \vec{F}_R * d\vec{r} \text{ lavoro elementare fonte della risultante.}$$

$$\begin{aligned} L_{1,2} &= \int_{\vec{r}_1}^{\vec{r}_2} F_R * d\vec{r} & m \int_{\vec{r}_1}^{\vec{r}_2} d\vec{v} * \vec{v} \frac{d}{dt} v^2 &= \frac{d}{dt} \vec{v} * \vec{v} = m \int_{\vec{V}_1}^{\vec{V}_2} d\vec{V} * \vec{V} \\ \vec{F}_R &= m \vec{a} = m \frac{d\vec{v}}{dt} & \frac{d}{dt} V^2 &= \frac{d}{dt} \vec{V} * \vec{V} = \frac{d}{dt} \vec{V} + \vec{V} \frac{d\vec{V}}{dt} = 2\vec{V} * \frac{d\vec{V}}{dt} \\ L_{1,2} &= m \int_{\vec{r}_1}^{\vec{r}_2} \frac{d\vec{v}}{dt} * d\vec{r} = m \int_{\vec{r}_1}^{\vec{r}_2} d\vec{v} * \frac{d\vec{r}}{dt} = \end{aligned}$$

Derivata del prodotto di funzione  $\sigma$

$$\bullet \frac{d}{dt}(f(t) * g(t)) = \left(\frac{d}{dt} * f(t)\right)g(t) + f(t) * \frac{d}{dt}g(t)$$

$$\bullet \frac{dV^2}{dt} = 2\vec{V} * \frac{d\vec{V}}{dt}$$

$$\bullet dV^2 = 2\vec{V} * d\vec{V} \quad \boxed{\vec{V} * d\vec{V} = \frac{1}{2}dV^2}$$

$$L_{1,2} = \frac{1}{2}m \int_{V_1^2}^{V_2^2} dV^2 = \frac{1}{2}m(V_2^2 - V_1^2)$$

$$\boxed{L_{1,2} = \frac{1}{2}mV_2^2 - \frac{1}{2}mV_1^2} \quad K = \frac{1}{2}mV^2 \text{ energia cinetica}$$

esempi  $\sigma$

### 0.2.3 Primitive di una funzione

$$ax = g \sin \sigma \quad F_r = m \vec{g} + \vec{F}n$$

$$F_{R_y} = 0 \quad F_{R_x} = ma_x = mg \sin \sigma$$

