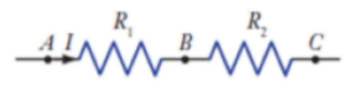
Complementi di fisica generale

VENERDÌ 14 MAGGIO ORE 8:30-10:00

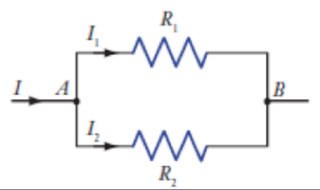
dalle 8:30 alle 8:40: OPIS 8URYRLQU

sviluppi in serie di potenze
sviluppi in armoniche di Fourier

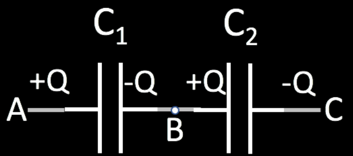
cenni onde elettromagnetiche -> ottica



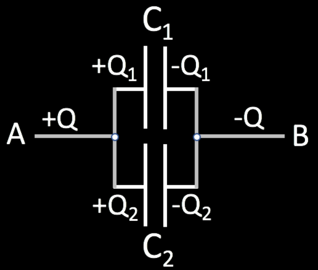
$$R_S = R_1 + R_2$$



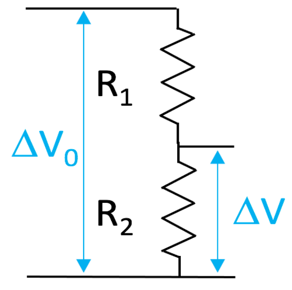
$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \qquad R_p = \frac{R_1 R_2}{R_1 + R_2}$$



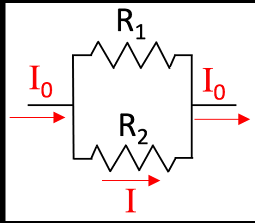
$$\frac{1}{C_S} = \frac{1}{C_1} + \frac{1}{C_2} \qquad C_S = \frac{C_1 C_2}{C_1 + C_2}$$



$$C_P = C_1 + C_2$$



$$\Delta V = \Delta V_0 \frac{R_2}{R_1 + R_2}$$



$$I = I_0 \frac{R_1}{R_1 + R_2}$$

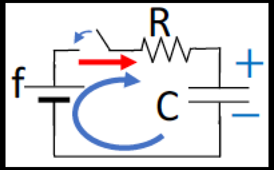
$$U = \frac{1}{2} C \, \Delta V^2$$

$$U = \frac{1}{2} L \, I^2$$

$$P_G = f \; I$$

$$P_R = R \, I^2$$

$$f_{med} = \frac{1}{T}\int_t^{t+T} f(t)\,dt \qquad f_{eff} = \sqrt{\frac{1}{T}\int_0^T f^2(t)\,dt} \qquad \textit{se } f(t) \text{ è armonica } f_{eff} = \frac{f_0}{\sqrt{2}}$$

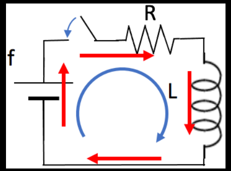


se $\Delta V_C(0) = Q(0)/C = 0$

$Q(t) = f\,C\,(1 - e^{-t/\tau})$

$I(t) = f/R\; e^{-t/\tau}$

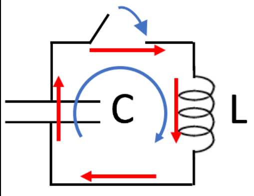
$\Delta V_C(t) = f\,(1 - e^{-t/\tau})$



se $I(0) = 0$

$I(t) = I(\infty)\,(1-e^{-t/\tau}) = f/R\,(1-e^{-t/\tau})$

$\Delta V_L(t) = L\, dI/dt = L\, I(\infty)/\tau\; e^{-t/\tau} = f\, e^{-t/\tau}$

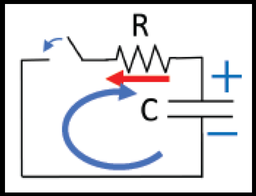


se $Q(0) = Q_0$ e $I(0) = 0$

$Q(t) = Q_0 \cos(\omega t)$

$I(t) = Q_0 \omega \sin(\omega t)$

$$\omega = \frac{1}{\sqrt{LC}}$$

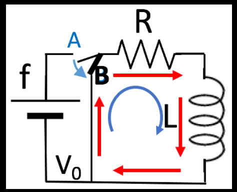


se $\Delta V_C(\infty) = Q(\infty)/C = 0$

$Q(t) = Q_0\, e^{-t/\tau}$

$I(t) = \Delta V_C(0)/R\; e^{-t/\tau}$

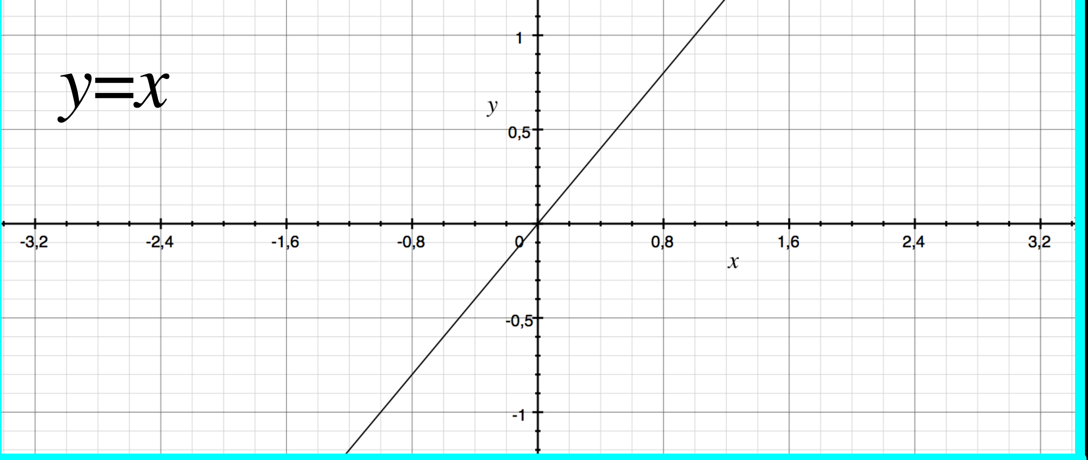
$\Delta V_C(t) = \Delta V_C(0)\; e^{-t/\tau}$

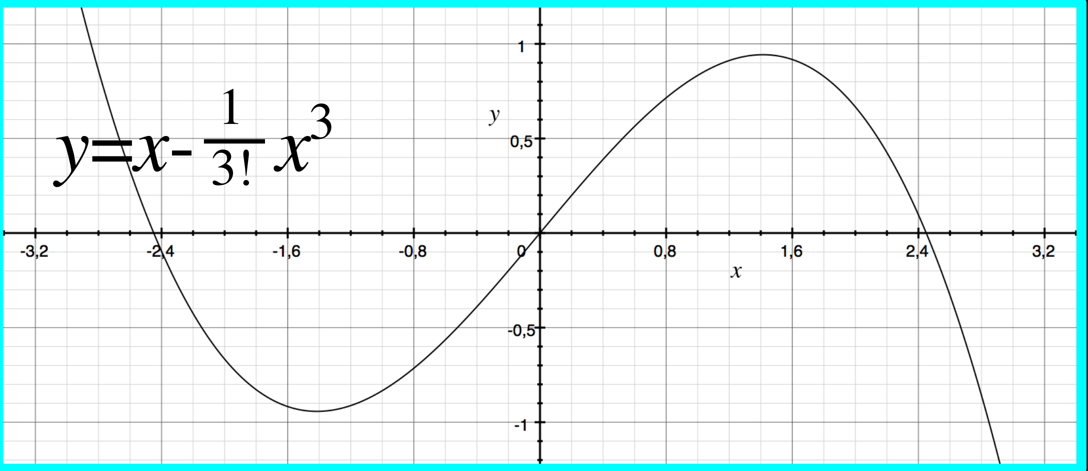


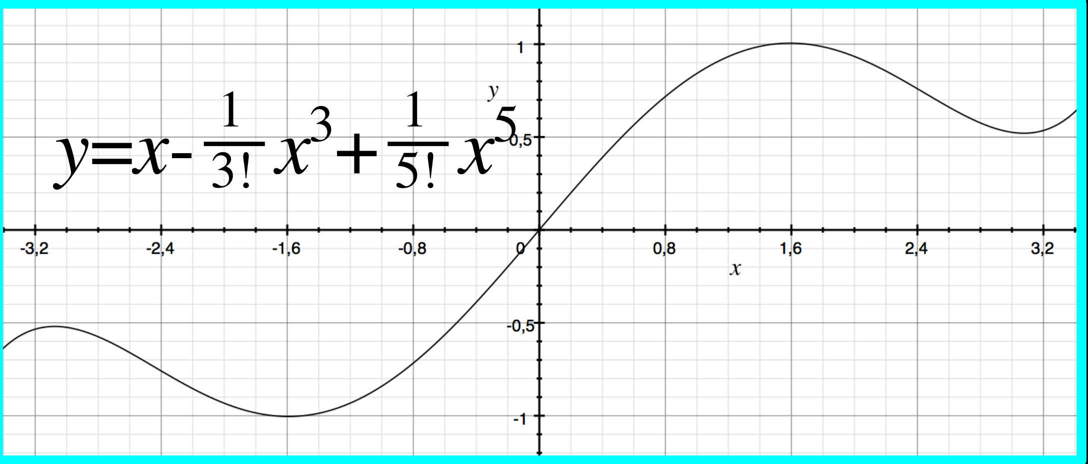
se $I(0) = I_0$ e $I_L(\infty) = 0$

$I(t) = I_0\, e^{-t/\tau}$

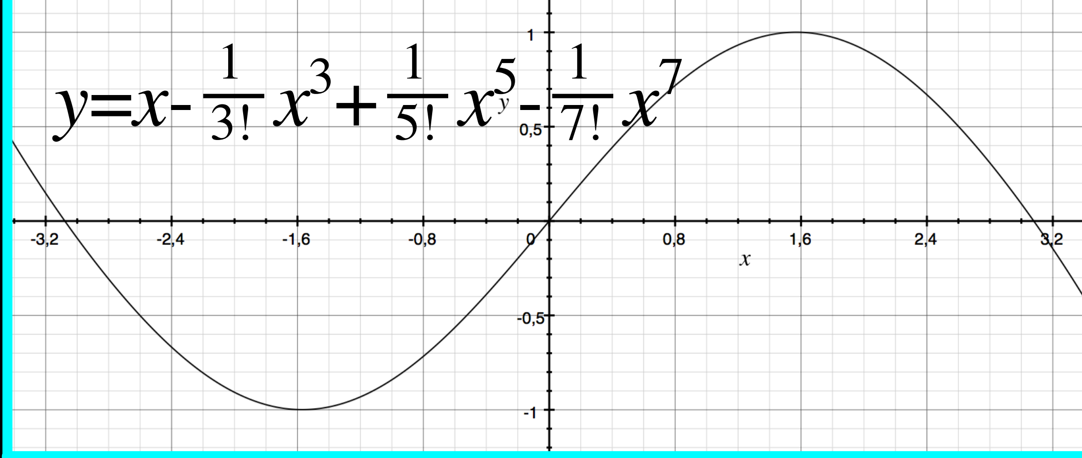
$\Delta V_L(t) = L\, dI/dt = L\, I_0/\tau\; e^{-t/\tau} = R\, I_0\, e^{-t/\tau}$

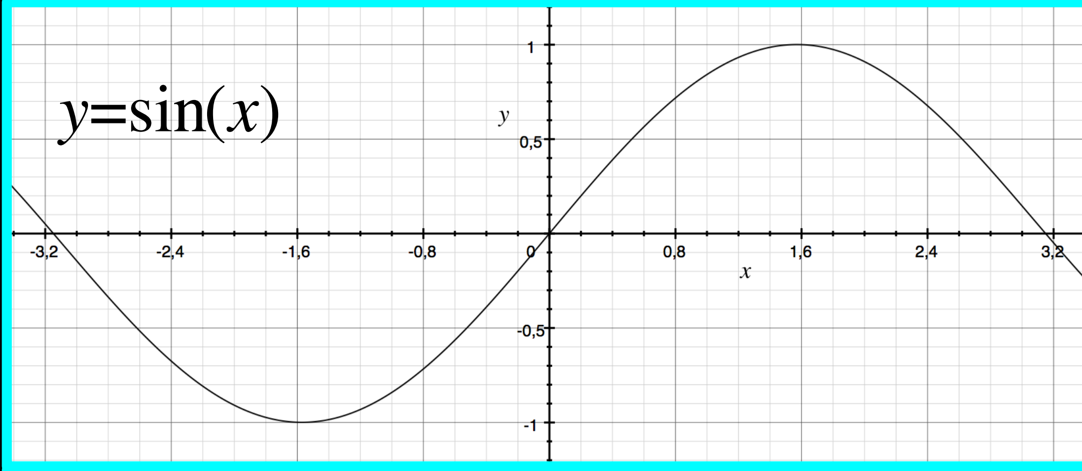


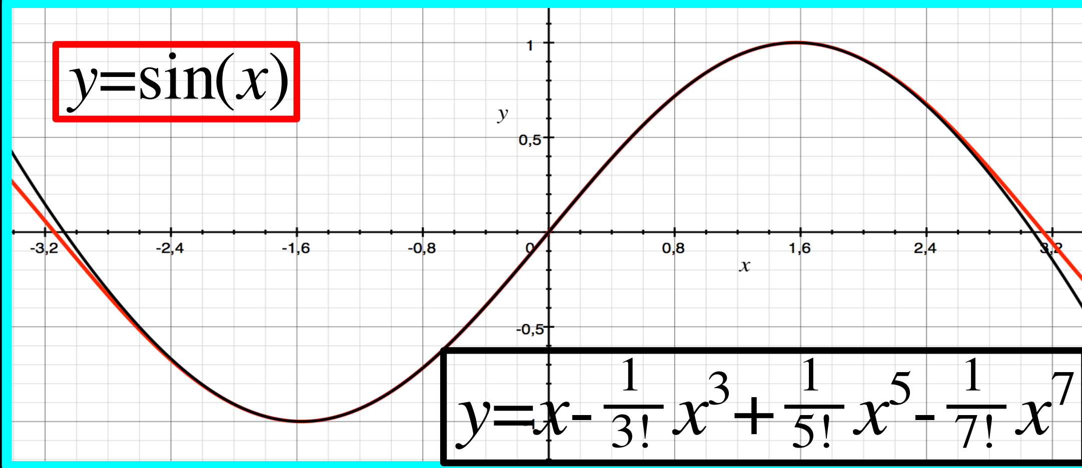




SVILUPPO IN SERIE DI POTENZE



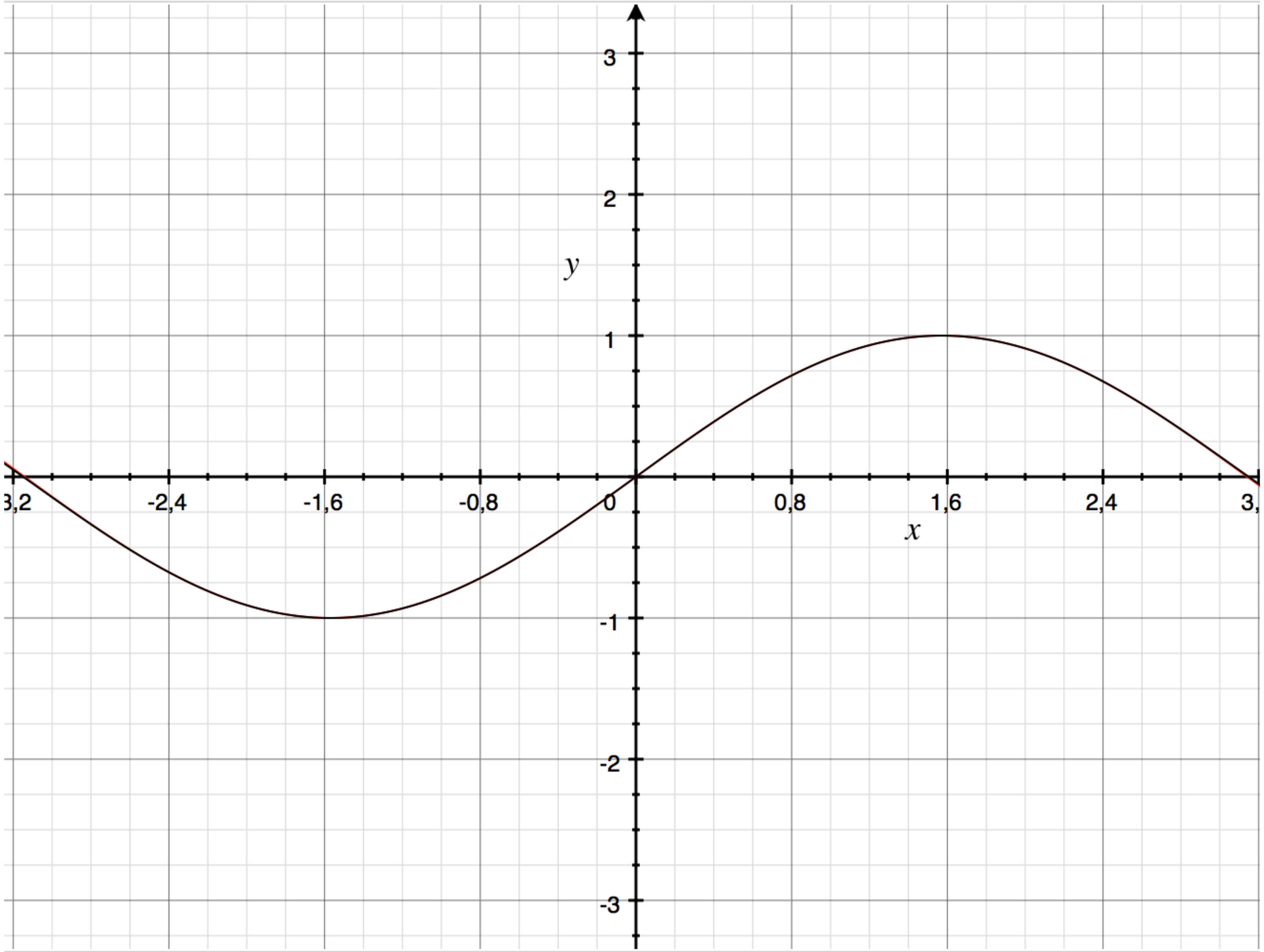




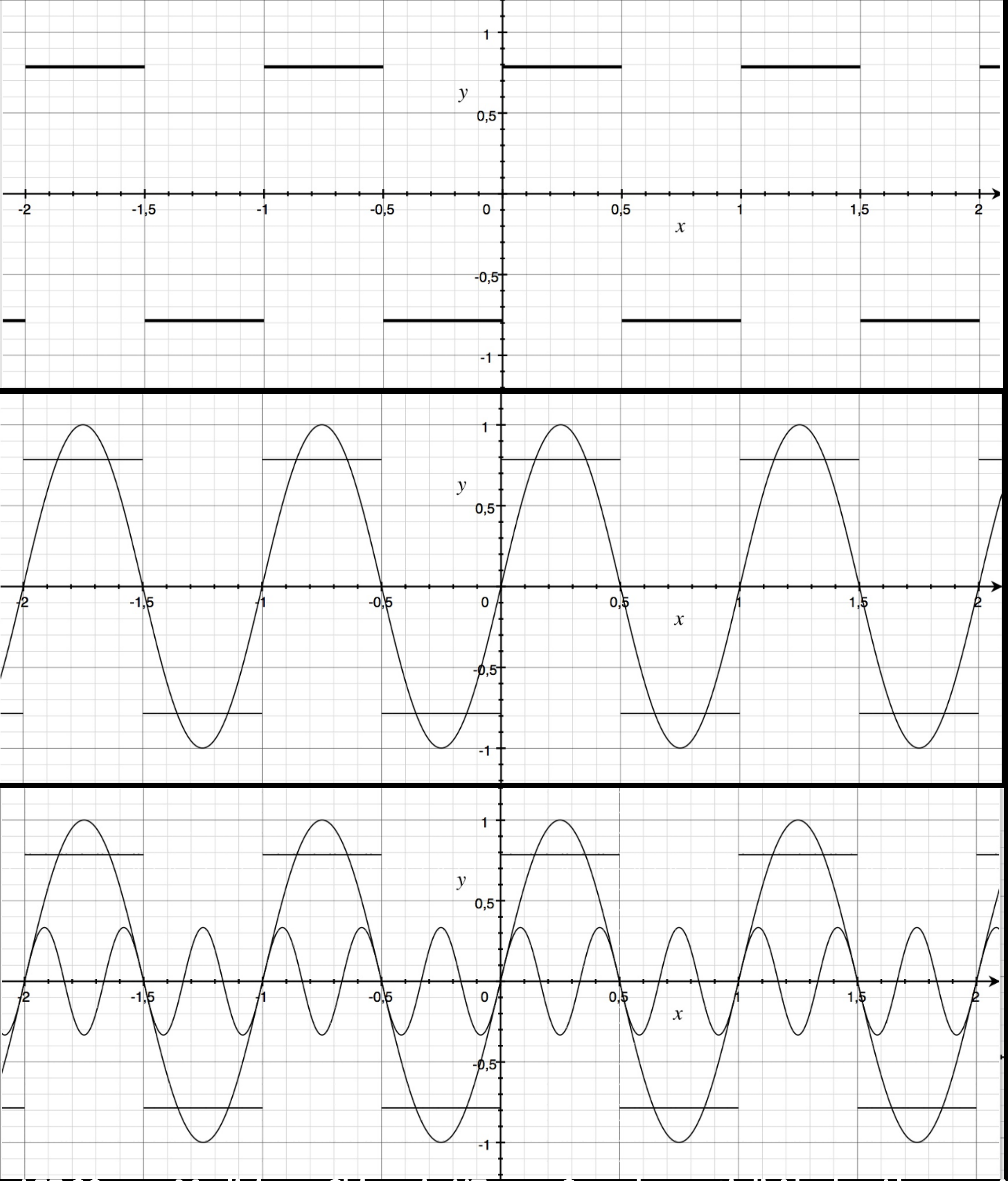
$y = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!}$

$y = \sin x$

SVILUPPO IN SERIE DI POTENZE



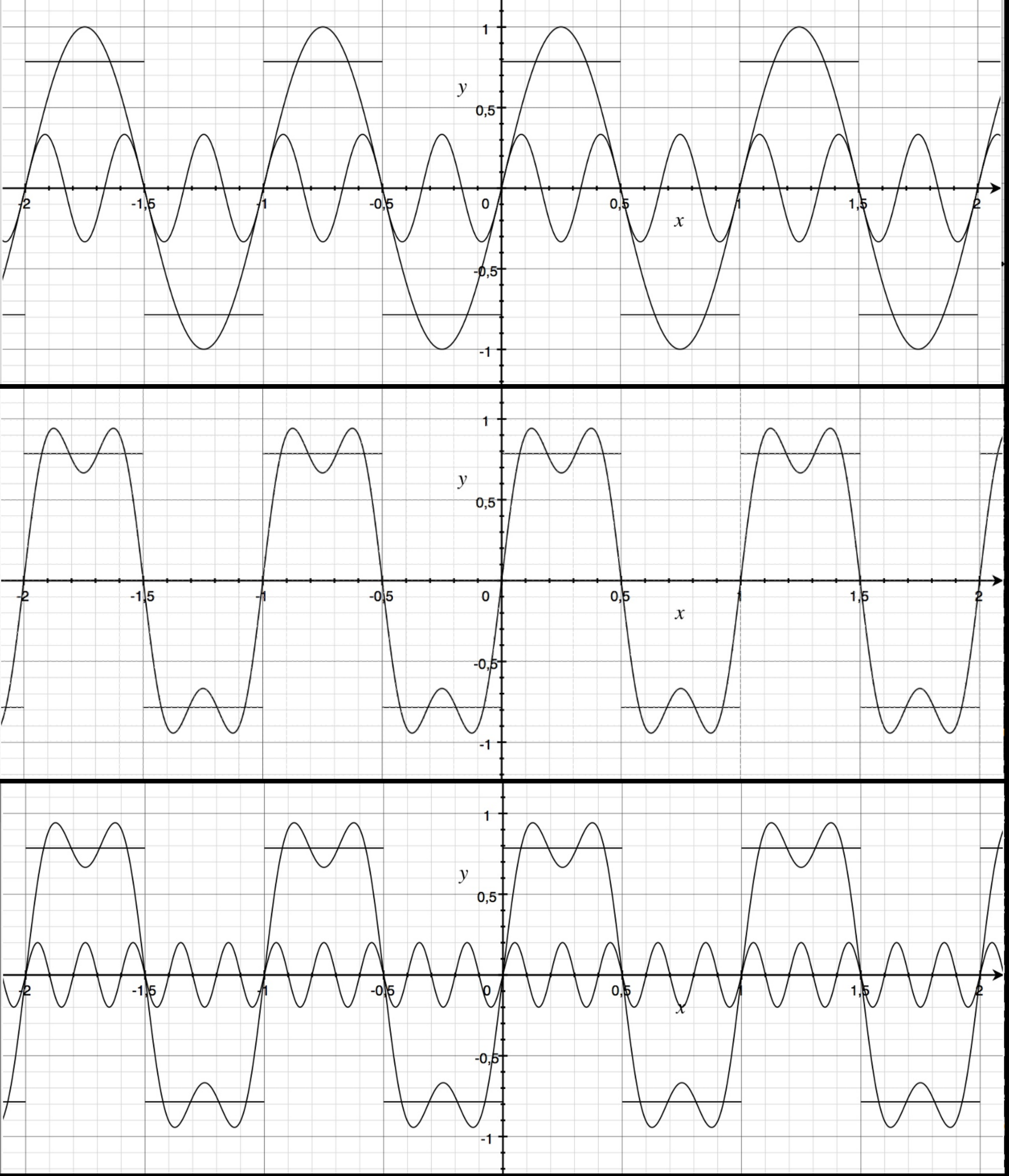
SVILUPPO IN ARMONICHE DI FOURIER



$$f(x) = \frac{\pi}{4}\text{sign}[\sin(2\pi x)]$$

$$f(x) = \sin(2\pi x)$$

$$f(x) = \frac{1}{3}\sin(3 \cdot 2\pi x)$$

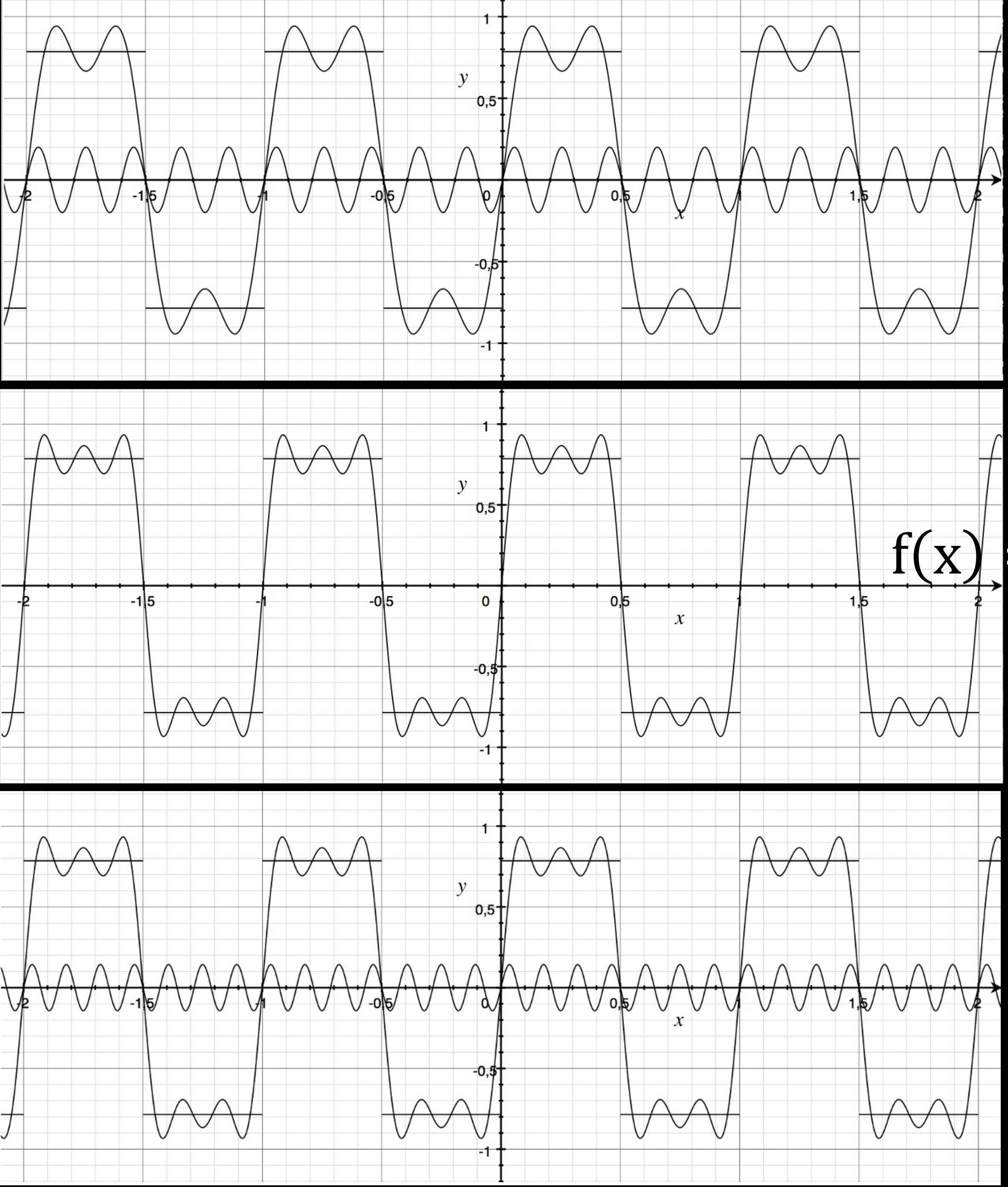


SVILUPPO IN ARMONICHE DI FOURIER

$$f(x) = \sin(2\pi x) + \frac{1}{3}\sin(3 \cdot 2\pi x)$$

$$f(x) = \frac{1}{5}\sin(5 \cdot 2\pi x)$$

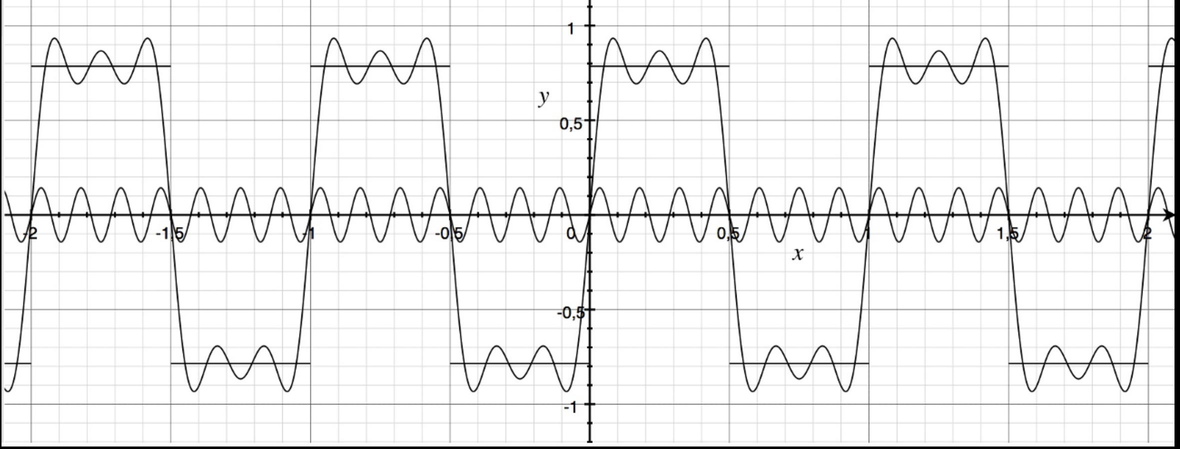
SVILUPPO IN ARMONICHE DI FOURIER

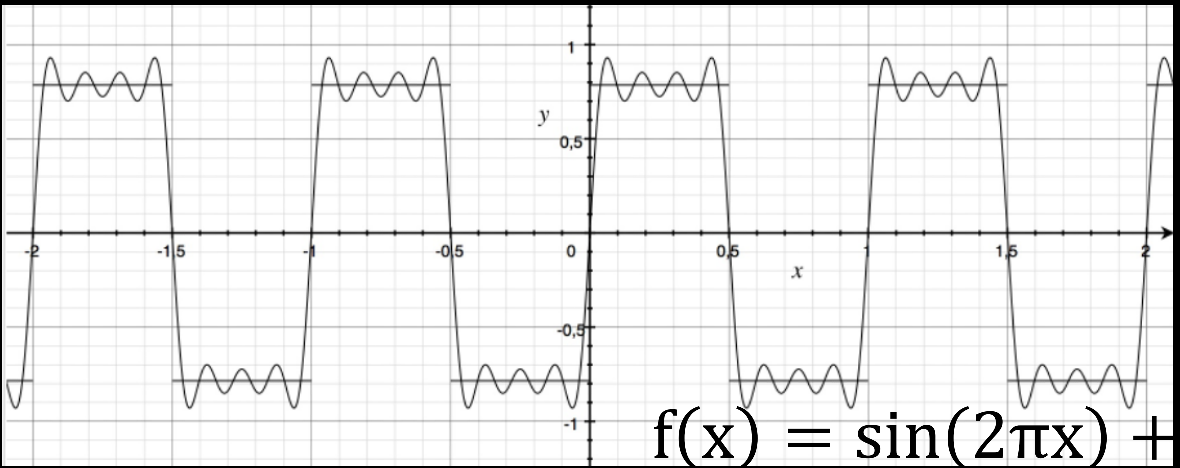


$$f(x) = \sin(2\pi x) + \frac{1}{3}\sin(3\cdot 2\pi x) + \frac{1}{5}\sin(5\cdot 2\pi x)$$

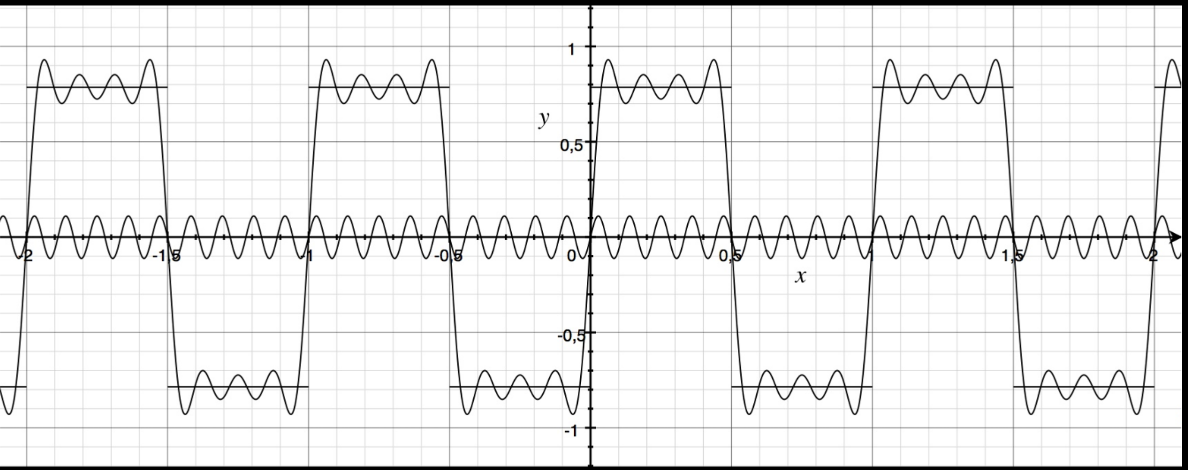
$$f(x) = \frac{1}{7}\sin(7\cdot 2\pi x)$$

SVILUPPO IN ARMONICHE DI FOURIER



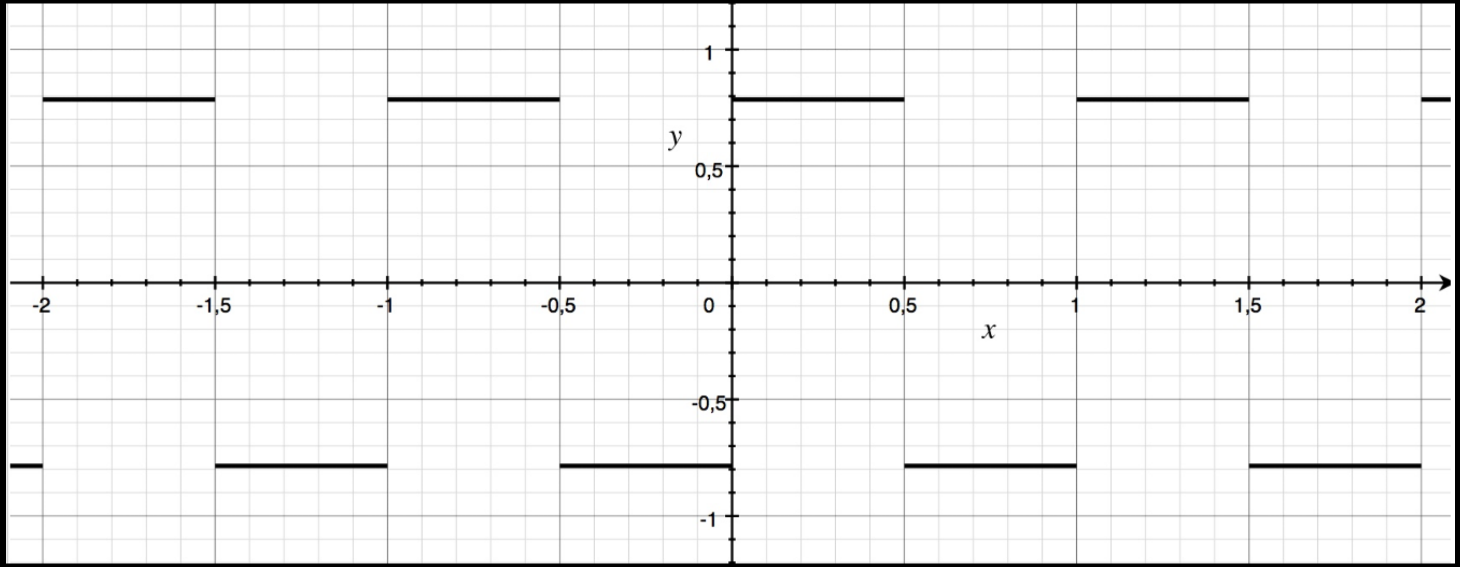


$$f(x) = \sin(2\pi x) + \frac{1}{3}\sin(3 \cdot 2\pi x) + \frac{1}{5}\sin(5 \cdot 2\pi x) + \frac{1}{7}\sin(7 \cdot 2\pi x)$$

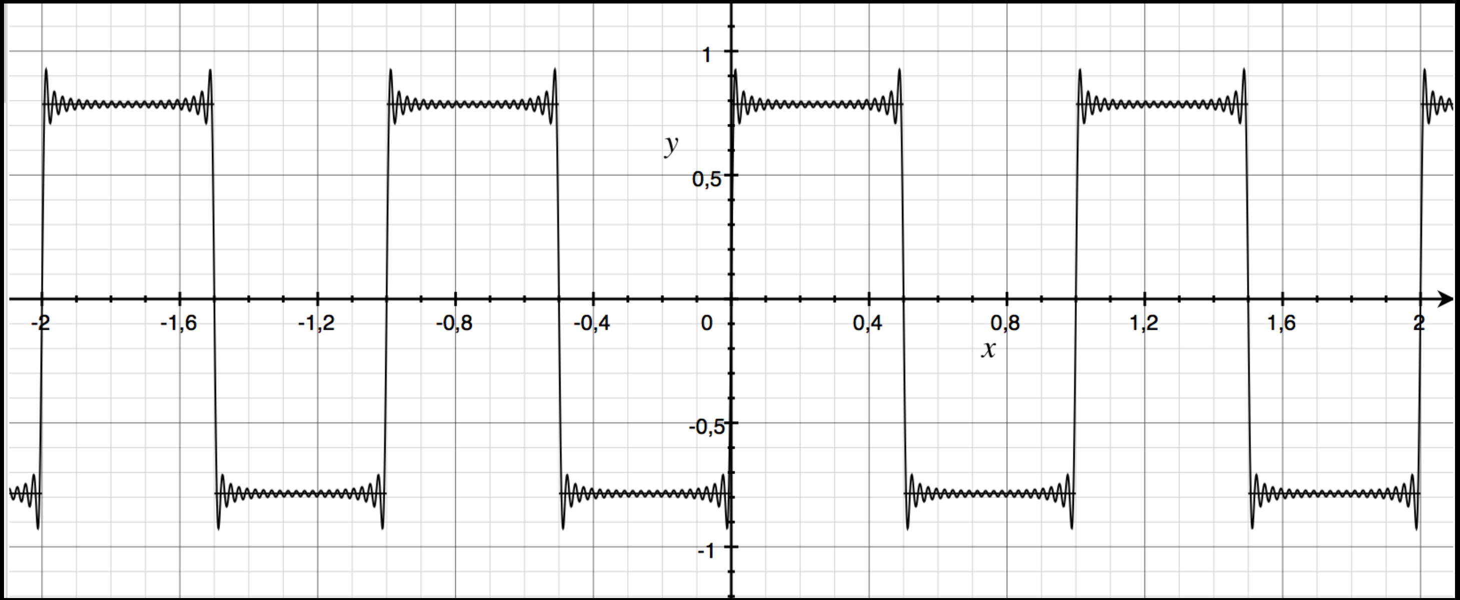


$$f(x) = \frac{1}{9}\sin(9 \cdot 2\pi x)$$

SVILUPPO IN ARMONICHE DI FOURIER

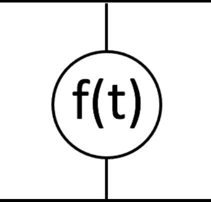


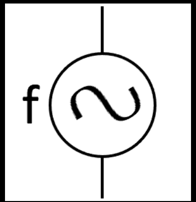
$$f(x) = \frac{\pi}{4} \text{sign}[\sin(2\pi\, x)]$$



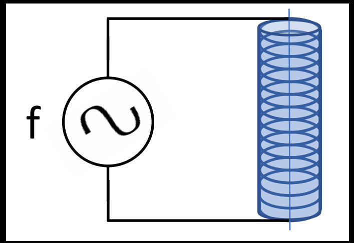
$$f(x) = \sum_{n=0}^{20} (2n+1)\sin[(2n+1)\; 2\pi x]$$

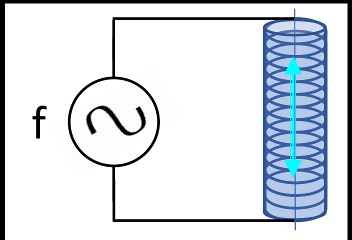
FUNZIONI ARMONICHE !!!



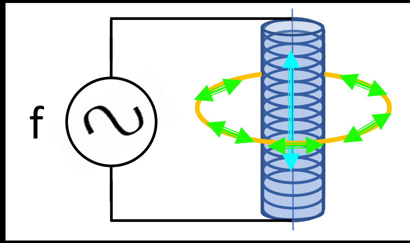


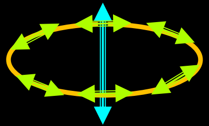
se f(t) è armonica
(Fourier)





B(t)





B(t) → E

$$\mathrm{rot}(\vec{E}) = -\frac{\partial \vec{B}}{\partial t}$$

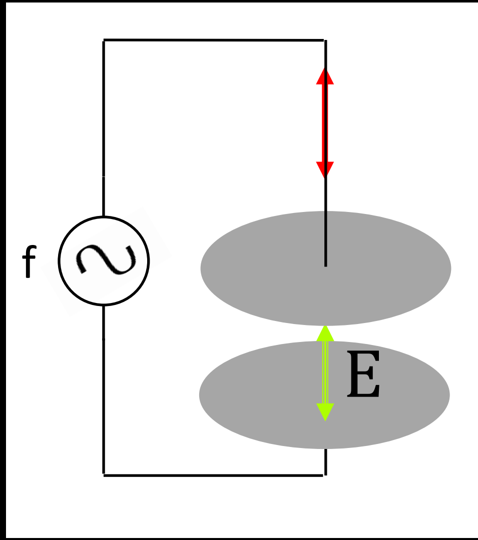
rotore

$$\mathrm{f.e.m.} = -\frac{d\Phi_S(\vec{B})}{dt} \qquad \oint_\gamma \vec{E}\,\vec{dl} = -\frac{d\left(\int_{S_\gamma} \vec{B}\,\hat{n}\,dS\right)}{dt}$$

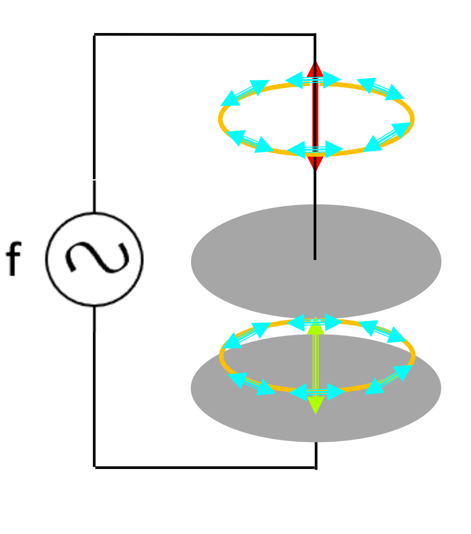
flusso attraverso Sγ

MAXWELL

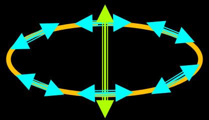
I = corrente di conduzione



E(t)



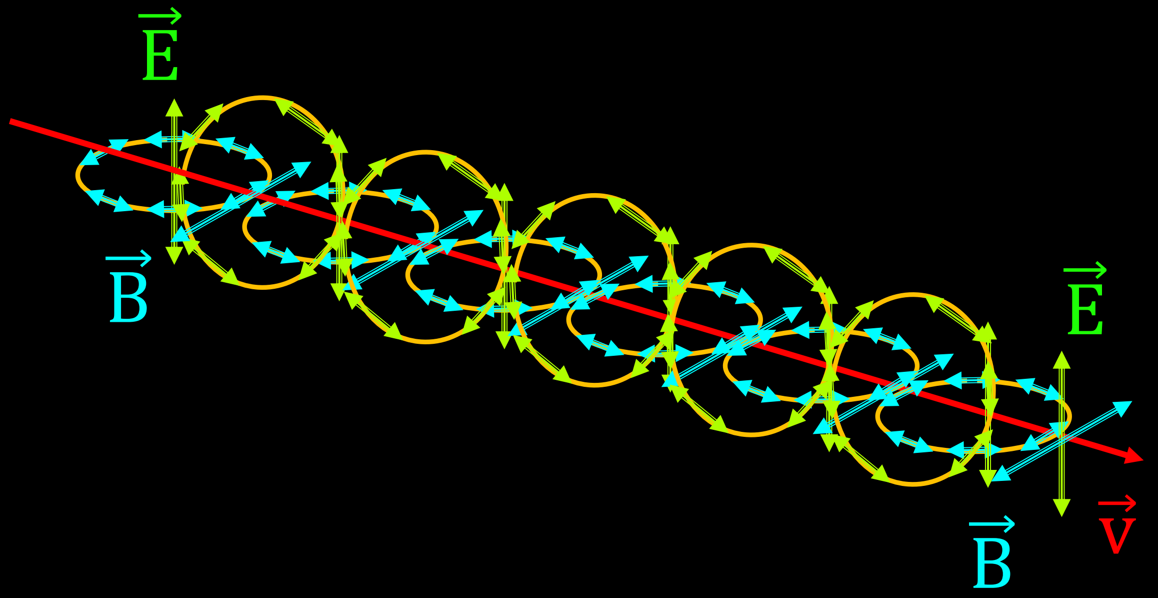
$$\oint_\gamma \vec{B}\,\vec{dl} = \mu_o I_{conc}$$

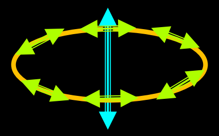


$$\mathrm{rot}(\vec{B}) = \frac{1}{c^2}\frac{\partial \vec{E}}{\partial t}$$

E(t) → B

E → corrente di spostamento





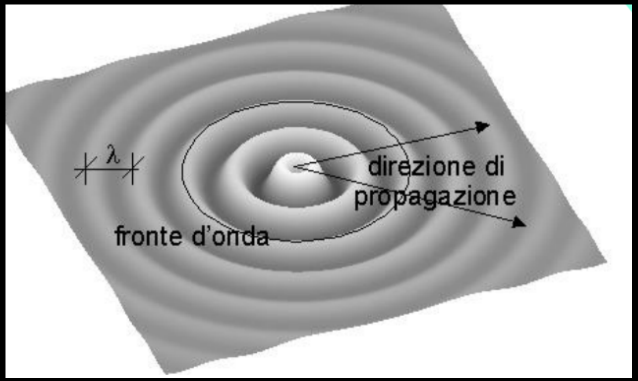
$$rot(\vec{E}) = -\frac{\partial \vec{B}}{\partial t}$$

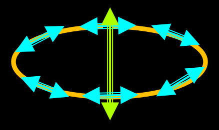
B(t) → E

$$\vec{E} = \vec{B} \times \vec{v}$$

MAXWELL

$$v_{vuoto} = c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}} = 3 \cdot 10^8 \text{ m/s}$$

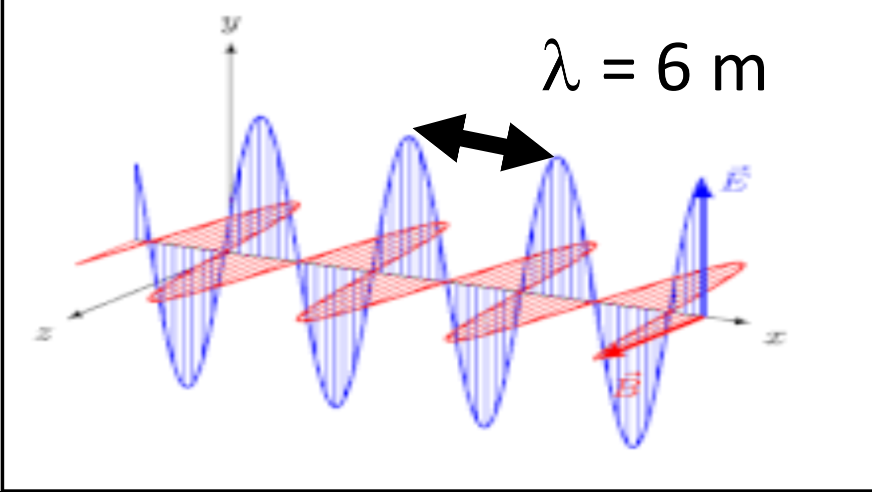




$$rot(\vec{B}) = \frac{1}{c^2}\frac{\partial \vec{E}}{\partial t}$$

E(t) → B

$\vec{E} = \vec{B} \times \vec{v}$



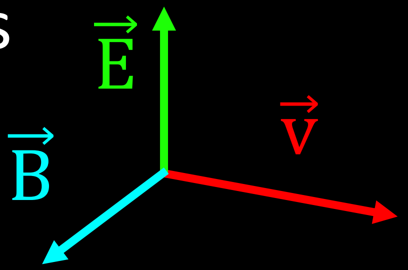
$$E_y(x,t) = E_0 \sin\left[2\pi\left(\frac{x}{\lambda} - \frac{t}{T}\right)\right] = E_0 \sin[kx - \omega t]$$

$$B_z(x,t) = B_0 \sin\left[2\pi\left(\frac{x}{\lambda} - \frac{t}{T}\right)\right] = B_0 \sin[kx - \omega t]$$

$\vec{J} = \dfrac{\vec{E}\times\vec{B}}{\mu_0}$ = vettore di Poynting (John Henry)

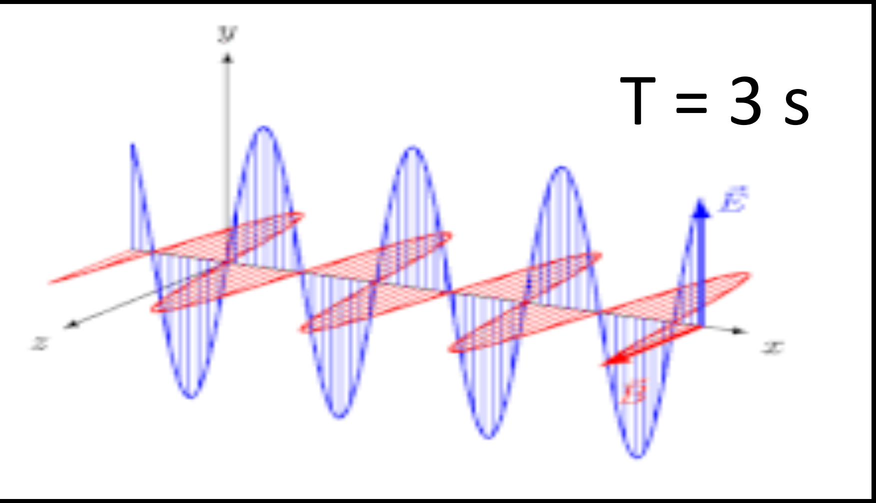
$v = \lambda/T = 6/3 = 2$ m/s

00:00



$\vec{J}$ ha direzione e verso di $\vec{v}$

$$E = Bv = Bc = \frac{B}{\sqrt{\varepsilon_0\mu_0}} \rightarrow B = E\sqrt{\varepsilon_0\mu_0}$$

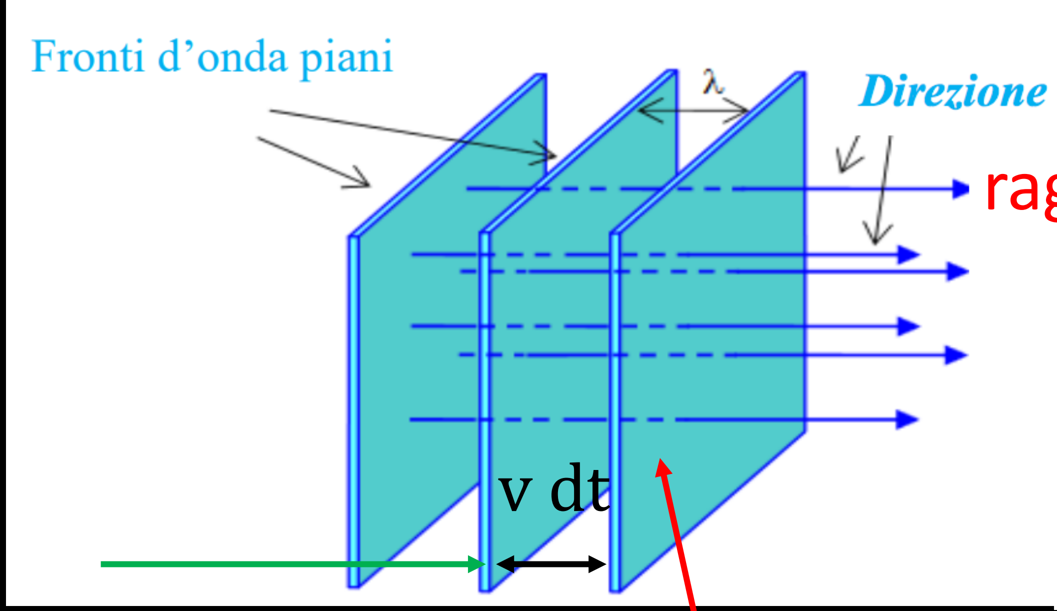


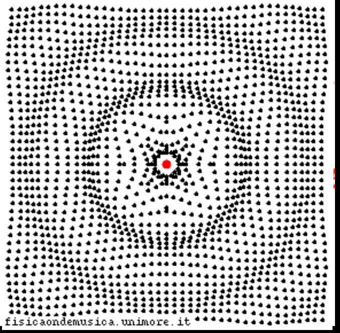
$$J = \frac{E\,B}{\mu_0} = \frac{E^2\sqrt{\varepsilon_0\mu_0}}{\mu_0} = \frac{E^2}{\sqrt{\frac{\mu_0}{\varepsilon_0}}} = \frac{E^2}{Z_0}$$

$$J = \frac{E^2}{Z_0}$$

$$Z_0 = \sqrt{\frac{\mu_0}{\varepsilon_0}} = 377\ \Omega$$

impedenza caratteristica del vuoto





$$\vec{E} = \vec{B} \times \vec{v}$$

$$\vec{J} = \frac{\vec{E} \times \vec{B}}{\mu_0} \qquad B = E\sqrt{\varepsilon_0 \mu_0}$$

$$\text{energia} \rightarrow u = \frac{1}{2}\,\varepsilon_0\,E^2 + \frac{1}{2}\frac{B^2}{\mu_0}$$

$$= \frac{1}{2}\,\varepsilon_0\,E^2 + \frac{1}{2}\frac{E^2 \varepsilon_0 \mu_0}{\mu_0} = \varepsilon_0\,E^2$$

$$d\tau = v\,dt\,S$$

$$dU = u\,d\tau = u\,v\,dt\,S$$

$$\frac{dU}{dt} = u\,v\,S = P\ (\text{potenza})$$

$$\frac{1}{S}\frac{dU}{dt} = u\,v = \varepsilon_0\,E^2 \frac{1}{\sqrt{\varepsilon_0 \mu_0}} = \frac{E^2}{\sqrt{\frac{\mu_0}{\varepsilon_0}}} = \frac{E^2}{Z_0}$$

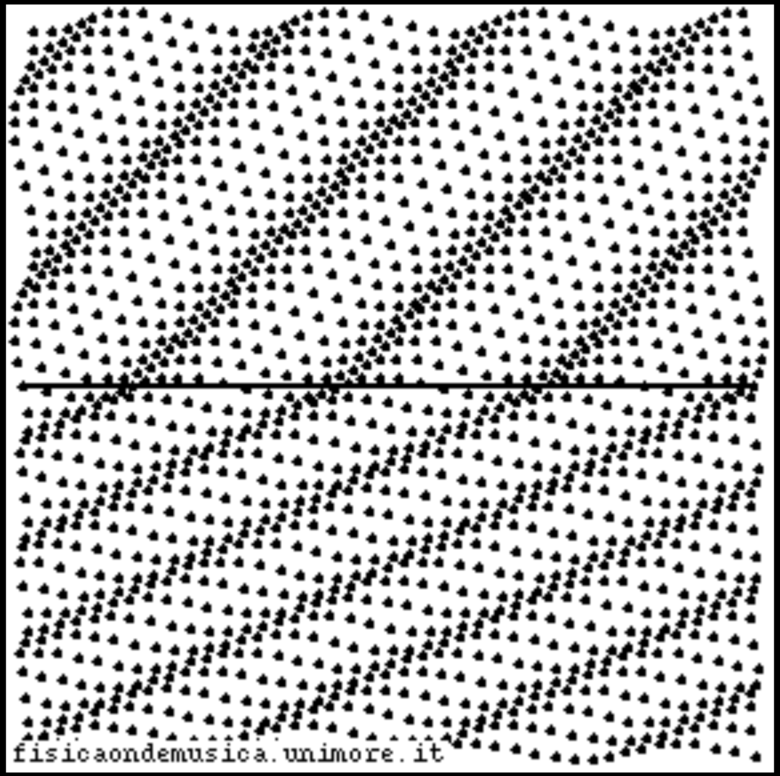
$$\frac{1}{S}\frac{dU}{dt} = \frac{P}{S} = u\,v = \text{densità superficiale di potenza o intensità dell'onda } (W/m^2)$$

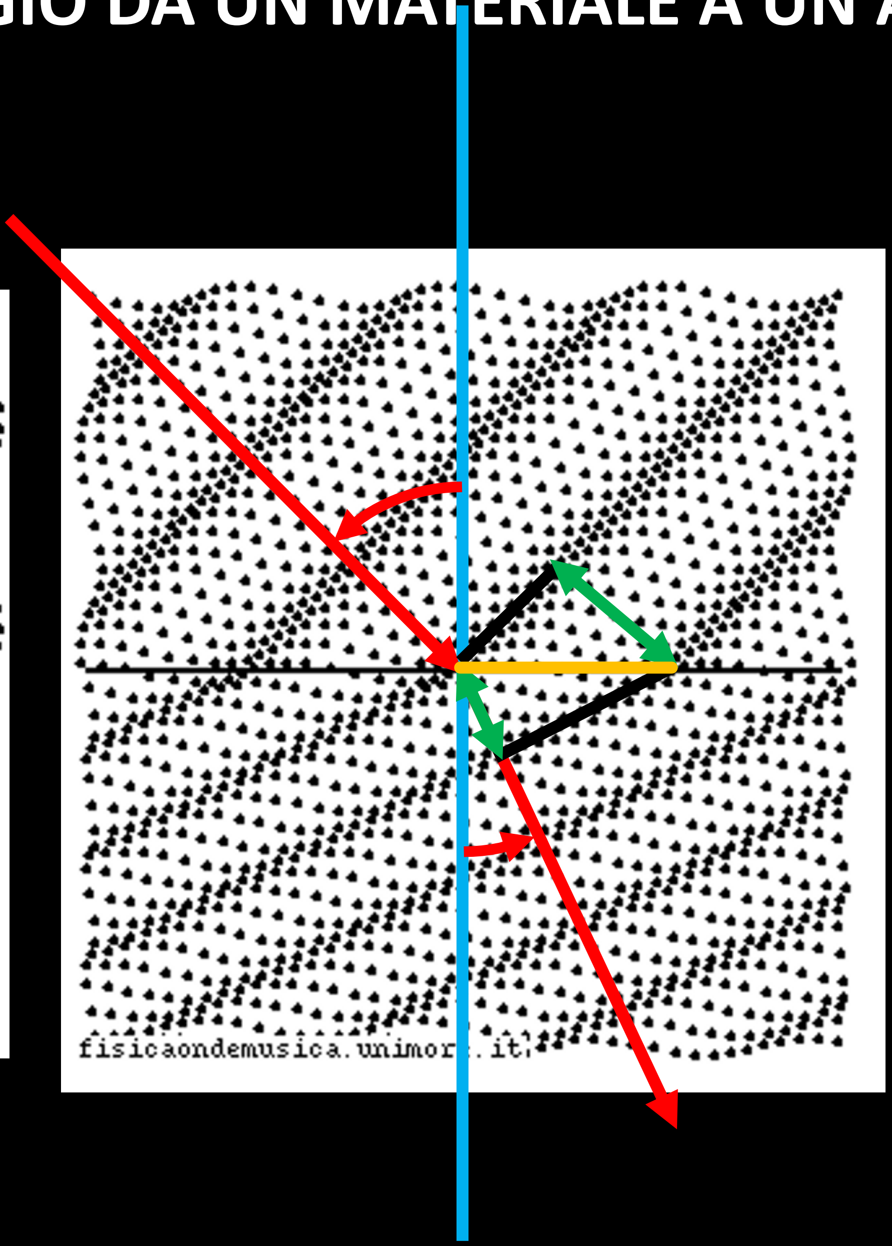
$$\frac{1}{S}\frac{dU}{dt} = \frac{E^2}{Z_0} = J$$

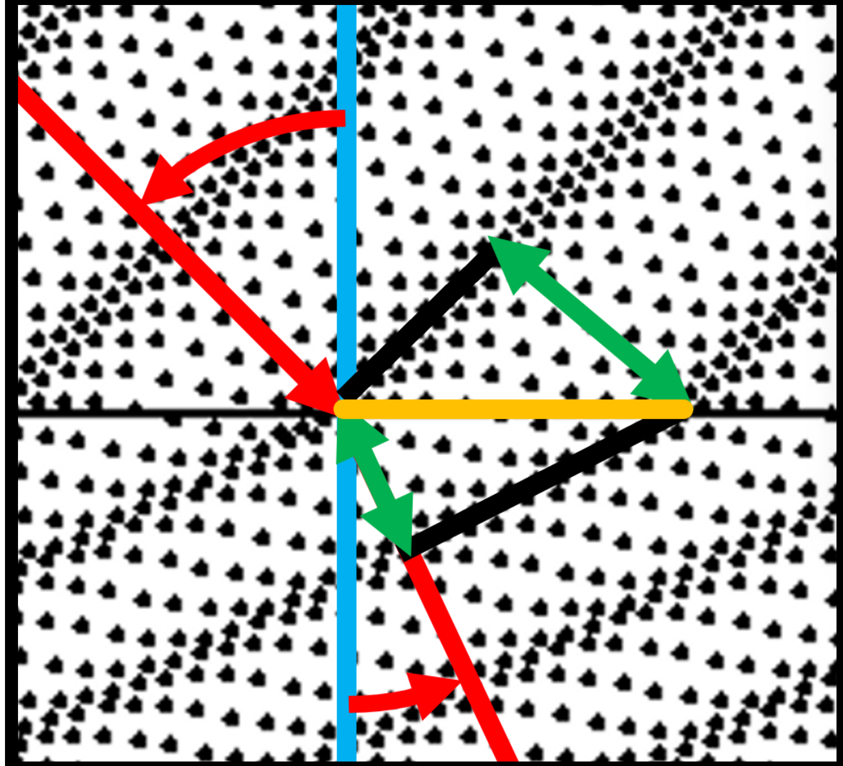
$$J = \frac{P}{S} \rightarrow J = \frac{dP}{dS} \qquad dP = J\,dS \qquad P = \int \vec{J}\,\hat{n}\,dS$$

RIFRAZIONE NEL PASSAGGIO DA UN MATERIALE A UN ALTRO

LEGGE DI SNELL







adalberto.sciubba@uniroma1.it

ESONERO SU CIRCUITI
sabato 15/5 16:30-18:30

LUNEDÌ 17 MAGGIO ORE 10 - 11

esercizi sulle onde elettromgnetiche