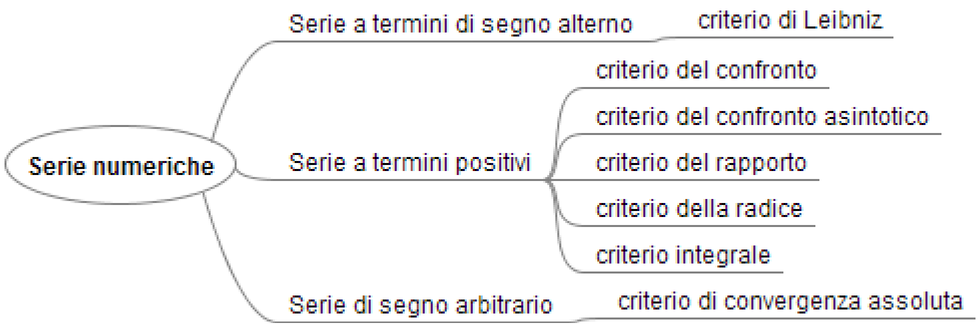
Serie numeriche



serie geometrica	serie di Mengoli
$\sum_{k=0}^{+\infty} q^k \begin{cases} \text{indeterminata} & \text{se } q \leq -1 \\ \text{converge a } \dfrac{1}{1-q} & \text{se } \lvert q \rvert < 1 \\ \text{diverge a } +\infty & \text{se } q \geq 1 \end{cases}$	$\sum_{k=1}^{+\infty} \frac{1}{k(k+1)} = 1$
serie armonica generalizzata	**serie armonica generalizzata di segno alterno**
$\sum_{k=1}^{+\infty} \frac{1}{k^\alpha} \begin{cases} \text{diverge} & \text{se } 0 < \alpha \leq 1 \\ \text{converge} & \text{se } \alpha > 1 \end{cases}$	$\sum_{k=1}^{+\infty} (-1)^k \frac{1}{k^\alpha} \begin{cases} \text{non converge} & \text{se } \alpha < 0 \\ \text{indeterminata} & \text{se } \alpha = 0 \\ \text{converge} & \text{se } \alpha > 0 \end{cases}$

Serie numeriche a termini positivi

criterio del confronto

$$a_k \le b_k, \forall k > k_0 \begin{cases} \sum_{k=0}^{+\infty} b_k \text{ converge} \Rightarrow \sum_{k=0}^{+\infty} a_k \text{ converge} \\ \sum_{k=0}^{+\infty} a_k \text{ diverge} \Rightarrow \sum_{k=0}^{+\infty} b_k \text{ diverge} \end{cases}$$

criterio del confronto asintotico

$$\exists \lim_k \frac{a_k}{b_k} \in \mathbb{R} - \{0\} \begin{cases} \sum_{k=0}^{+\infty} a_k \text{ converge} \Leftrightarrow \sum_{k=0}^{+\infty} b_k \text{ converge} \\ \sum_{k=0}^{+\infty} a_k \text{ diverge} \Leftrightarrow \sum_{k=0}^{+\infty} b_k \text{ diverge} \end{cases}$$

criterio del rapporto

$$\exists \lim_k \frac{a_{k+1}}{a_k} \begin{cases} \lim_k \frac{a_{k+1}}{a_k} < 1 \Rightarrow \sum_{k=0}^{+\infty} a_k \text{ converge} \\ \lim_k \frac{a_{k+1}}{a_k} > 1 \Rightarrow \sum_{k=0}^{+\infty} a_k \text{ diverge} \end{cases}$$

criterio della radice

$$\exists \lim_k \sqrt[k]{a_k} \begin{cases} \lim_k \sqrt[k]{a_k} < 1 \Rightarrow \sum_{k=0}^{+\infty} a_k \text{ converge} \\ \lim_k \sqrt[k]{a_k} > 1 \Rightarrow \sum_{k=0}^{+\infty} a_k \text{ diverge} \end{cases}$$

$$\exists \lim_k a_k \neq 0 \Rightarrow \sum_{k=0}^{+\infty} a_k \text{ diverge}$$

criterio integrale (o di Maclaurin)

$a_k = f(k), \forall k \ge k_0 \land f$ positiva, decrescente e continua in $[k_0, +\infty)$

$$\begin{cases} \int_{k_0}^{+\infty} f(x)dx \text{ converge} \Leftrightarrow \sum_{k=k_0}^{+\infty} a_k \text{ converge} \\ \int_{k_0}^{+\infty} f(x)dx \text{ diverge} \Leftrightarrow \sum_{k=k_0}^{+\infty} a_k \text{ diverge} \end{cases}$$

Convergenza delle successioni di funzioni

convergenza puntuale	convergenza uniforme
$\{f_n\}$ converge a f puntualmente in $A \Leftrightarrow \lim_n \lvert f_n - f\rvert = 0, \forall x \in A$	$\{f_n\}$ converge a f uniformemente in $A \Leftrightarrow \lim_n \sup_{x\in A}\lvert f_n - f\rvert = 0$
$\forall x \in A, \forall \varepsilon > 0 \longrightarrow \exists \bar{n} = \bar{n}(\varepsilon, x): \forall n \geq n_0, n > \bar{n} \Rightarrow \lvert f_n - f\rvert < \varepsilon$	$\forall \varepsilon > 0 \longrightarrow \exists \bar{n} = \bar{n}(\varepsilon): \forall n \geq n_0, n > \bar{n} \Rightarrow \sup\limits_{x\in A}\lvert f_n - f\rvert < \varepsilon$ $\forall x \in A, \forall \varepsilon > 0 \longrightarrow \exists \bar{n} = \bar{n}(\varepsilon): \forall n \geq n_0, n > \bar{n} \Rightarrow \lvert f_n - f\rvert < \varepsilon$

Proprietà converg. uniforme	passaggio al limite sotto segno di integrale	passaggio al limite sotto segno di derivata
$\begin{cases} f_n \text{ continue} \\ \{f_n\} \text{ unif. conv. a } f \end{cases} \Rightarrow f \text{ continua}$	$\begin{cases} f_n \text{ integrabili} \\ \{f_n\} \text{ unif. conv. a } f \end{cases} \Rightarrow \begin{cases} f \text{ integrabile} \\ \lim\limits_n \int f_n dx = \int \lim\limits_n f_n\, dx = \int f dx \end{cases}$	$\begin{cases} f_n \in \mathcal{C}^1 \\ \{f_n\} \text{ punt. conv. a } f \\ \{f_n'\} \text{ unif. conv. a } g \end{cases} \Rightarrow \begin{cases} f \in \mathcal{C}^1 \\ \{f_n\} \text{ unif. conv. a } f \\ f' = \left(\lim\limits_n f_n\right)' = \lim\limits_n f_n' = g \end{cases}$

Convergenza delle serie di funzioni

convergenza puntuale	convergenza uniforme	convergenza assoluta
$\sum_{k=k_0}^{+\infty} f_k$ converge a s (puntualmente) in $A \Leftrightarrow$ $\Leftrightarrow \{s_n\}$ converge a s puntualmente in A	$\sum_{k=k_0}^{+\infty} f_k$ converge a s uniformemente in $A \Leftrightarrow$ $\Leftrightarrow \{s_n\}$ converge a s uniformemente in A	$\sum_{k=k_0}^{+\infty} f_k$ converge assolutamente in $A \Leftrightarrow$ $\Leftrightarrow \sum_{k=k_0}^{+\infty}\lvert f_k\rvert$ converge $\forall x \in A$

Proprietà convergenza uniforme	**integrazione per serie** (serie integrabile termine a termine)
$\begin{cases} f_k \text{ continue} \\ \sum\limits_{k=k_0}^{+\infty} f_k \text{ unif. conv. a } s \end{cases} \Rightarrow s \text{ continua}$	$\begin{cases} f_k \text{ integrabili} \\ \sum\limits_{k=k_0}^{+\infty} f_k \text{ unif. conv. a } s \end{cases} \Rightarrow \begin{cases} s \text{ integrabile} \\ \sum\limits_{k=k_0}^{+\infty} \int f_k dx = \int \sum\limits_{k=k_0}^{+\infty} f_k\, dx = \int s dx \end{cases}$

derivazione per serie (serie derivabile termine a termine)

$$\begin{cases} f_k \in \mathcal{C}^1 \\ \sum\limits_{k=k_0}^{+\infty} f_k \text{ punt. conv. a } s \\ \sum\limits_{k=k_0}^{+\infty} f_k' \text{ unif. conv. a } g \end{cases} \Rightarrow \begin{cases} s \in \mathcal{C}^1 \\ \sum\limits_{k=k_0}^{+\infty} f_k \text{ unif. conv. a } s \\ s' = \left(\sum\limits_{k=k_0}^{+\infty} f_k\right)' = \sum\limits_{k=k_0}^{+\infty} f_k' = g \end{cases}$$

Serie di potenze

	serie geometrica	serie logaritmica	serie esponenziale	serie binomiale
$\sum_{k=1}^{+\infty} k^k x^k$ $\quad A = \{0\}$, $R = 0$	$\sum_{k=0}^{+\infty} x^k$ $\quad A = (-1,1)$, $R = 1$	$\sum_{k=1}^{+\infty} \frac{x^k}{k}$ $\quad A = [-1,1)$, $R = 1$	$\sum_{k=0}^{+\infty} \frac{x^k}{k!}$ $\quad A = \mathbb{R}$, $R = +\infty$	$\sum_{k=0}^{+\infty} \binom{\alpha}{k} x^k$ $\quad A = (-1,1)$, $R = 1$

criterio del rapporto	criterio della radice
$\exists \lim_k \frac{\lvert a_{k+1}\rvert}{\lvert a_k\rvert} \begin{cases} \lim_k \frac{\lvert a_{k+1}\rvert}{\lvert a_k\rvert} = 0 & \Rightarrow R = +\infty \\ \lim_k \frac{\lvert a_{k+1}\rvert}{\lvert a_k\rvert} = l \in \mathbb{R}^+ & \Rightarrow R = \frac{1}{l} \\ \lim_k \frac{\lvert a_{k+1}\rvert}{\lvert a_k\rvert} = +\infty & \Rightarrow R = 0 \end{cases}$	$\exists \lim_k \sqrt[k]{\lvert a_k\rvert} \begin{cases} \lim_k \sqrt[k]{\lvert a_k\rvert} = 0 & \Rightarrow R = +\infty \\ \lim_k \sqrt[k]{\lvert a_k\rvert} = l \in \mathbb{R}^+ & \Rightarrow R = \frac{1}{l} \\ \lim_k \sqrt[k]{\lvert a_k\rvert} = +\infty & \Rightarrow R = 0 \end{cases}$

serie somma	serie prodotto *(alla Cauchy)*	serie derivata	serie integrale
$\begin{cases} R_1 = R_2 = R & \Rightarrow R_{12} \geq R \\ R_1 \neq R_2 & \Rightarrow R_{12} = \min\{R_1, R_2\} \end{cases}$	$R_{12} \geq \min\{R_1, R_2\}$	$R_{\text{derivata}} = R$	$R_{\text{integrale}} = R$

Sviluppi di Maclaurin

$T(0) = \sum_{k=0}^{+\infty} \frac{f^{(k)}(0)}{k!} x^k$	
$(1+x)^\alpha = \sum_{k=0}^{+\infty} \binom{\alpha}{k} x^k$ $\quad A = \begin{cases} (-1,1) & \alpha \le -1 \\ (-1,1] & -1 \le \alpha < 0 \\ [-1,1] & \alpha > 0 \end{cases}$ $\quad R = 1$	$\frac{1}{1+x} = \sum_{k=0}^{+\infty} (-1)^k x^k$ $\quad A = (-1,1)$ $\quad R = 1$
$\frac{1}{1-x} = \sum_{k=0}^{+\infty} x^k$ $\quad A = (-1,1)$ $\quad R = 1$	$\ln(1+x) = \sum_{k=1}^{+\infty} (-1)^{k-1} \frac{x^k}{k}$ $\quad A = (-1,1]$ $\quad R = 1$
$e^x = \sum_{k=0}^{+\infty} \frac{x^k}{k!}$ $\quad A = \mathbb{R}$ $\quad R = +\infty$	$\operatorname{arctg} x = \sum_{k=0}^{+\infty} (-1)^k \frac{x^{2k+1}}{2k+1}$ $\quad A = (-1,1]$ $\quad R = 1$
$\cosh x = \sum_{k=0}^{+\infty} \frac{x^{2k}}{(2k)!}$ $\quad A = \mathbb{R}$ $\quad R = +\infty$	$\cos x = \sum_{k=0}^{+\infty} (-1)^k \frac{x^{2k}}{(2k)!}$ $\quad A = \mathbb{R}$ $\quad R = +\infty$
$\operatorname{senh} x = \sum_{k=0}^{+\infty} \frac{x^{2k+1}}{(2k+1)!}$ $\quad A = \mathbb{R}$ $\quad R = +\infty$	$\operatorname{sen} x = \sum_{k=0}^{+\infty} (-1)^k \frac{x^{2k+1}}{(2k+1)!}$ $\quad A = \mathbb{R}$ $\quad R = +\infty$

Funzioni non esprimibili elementarmente

funzione degli errori
$\operatorname{Erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt = \frac{2}{\sqrt{\pi}} \sum_{k=0}^{+\infty} \frac{(-1)^k}{k!} \int_0^x t^{2k} dt$
funzione seno integrale
$\operatorname{Si}(x) = \int_0^x \frac{\operatorname{sen} t}{t} dt = \sum_{k=0}^{+\infty} \frac{(-1)^k}{(2k+1)!} \int_0^x t^{2k} dt$
funzione seno integrale di Fresnel
$\mathrm{S}(x) = \int_0^x \operatorname{sen}\left(\frac{\pi}{2} t^2\right) dt = \sum_{k=0}^{+\infty} \frac{(-1)^k}{(2k+1)!} \left(\frac{\pi}{2}\right)^{2k+1} \int_0^x t^{4k+2} dt$
funzione coseno integrale di Fresnel
$\mathrm{C}(x) = \int_0^x \cos\left(\frac{\pi}{2} t^2\right) dt = \sum_{k=0}^{+\infty} \frac{(-1)^k}{(2k)!} \left(\frac{\pi}{2}\right)^{2k} \int_0^x t^{4k} dt$

<u>Spazi vettoriali</u>	$\mathbb{R}^n = \{\vec{v} = (x_1 \cdots x_n) \mid x_1, \cdots, x_n \in \mathbb{R}\}$	$\tilde{\mathcal{C}}_{2\pi} = \{f\colon \mathbb{R} \longrightarrow \mathbb{R} \mid f$ continua a tratti, periodica di periodo 2π, regolarizzata$\}$
prodotto scalare	$\vec{v}_A \cdot \vec{v}_B = \sum_{k=1}^{n} x_{A_k} x_{B_k}$	$(f, g) = \int_0^{2\pi} f(x) g(x) dx$ (prodotto scalare integrale)
norma	$\lVert\vec{v}\rVert = \sqrt{\vec{v} \cdot \vec{v}} = \sqrt{\sum_{k=1}^{n} x_k^2}$	$\lVert f\rVert_2 = \sqrt{(f, f)} = \sqrt{\int_0^{2\pi} [f(x)]^2 dx}$ (norma quadratica)
distanza	$d(\vec{v}_A, \vec{v}_B) = \lvert\vec{v}_B - \vec{v}_A\rvert = \sqrt{\sum_{k=1}^{n} \left(x_{A_k} - x_{B_k}\right)^2}$	$d(f, g) = \lVert f - g\rVert_2 = \sqrt{\int_0^{2\pi} [f(x) - g(x)]^2 dx}$ (distanza quadratica)
base ortogonale	$\mathcal{B}_{\mathbb{R}^n} = \{k_1\vec{e}_1, \cdots, k_n\vec{e}_n\}$	$\mathcal{F} = \{\varphi_0(x); \varphi_1(x), \cdots; \psi_1(x), \cdots\}$ $\varphi_0(x) = 1$ $\varphi_k(x) = \cos(kx)$ $\psi_k(x) = \mathrm{sen}(kx)$
base ortonormale	$\mathcal{B}^{\mathcal{C}}_{\mathbb{R}^n} = \{\vec{e}_1, \cdots, \vec{e}_n\}$	$\hat{\mathcal{F}} = \{\hat{\varphi}_0(x); \hat{\varphi}_1(x), \cdots; \hat{\psi}_1(x), \cdots\}$ $\hat{\varphi}_0(x) = \frac{1}{\sqrt{2\pi}}$ $\hat{\varphi}_k(x) = \frac{1}{\sqrt{\pi}}\cos(kx)$ $\hat{\psi}_k(x) = \frac{1}{\sqrt{\pi}}\mathrm{sen}(kx)$
sottospazio vettoriale	$\vec{v} = \sum_{k=1}^{3} x_k\vec{e}_k = x\vec{e}_1 + y\vec{e}_2 + z\vec{e}_3 \in \mathbb{R}^3$ $x = \vec{v} \cdot \vec{e}_1$ $y = \vec{v} \cdot \vec{e}_2$ $z = \vec{v} \cdot \vec{e}_3$	$p_n = a_0\hat{\varphi}_0(x) + \sum_{k=1}^{n} \left[a_k\hat{\varphi}_k(x) + b_k\hat{\psi}_k(x)\right] \in \mathcal{P}_n$ $a_0 = \left(p_n, \hat{\varphi}_0(x)\right)$ $a_k = \left(p_n, \hat{\varphi}_k(x)\right)$ $b_k = \left(p_n, \hat{\psi}_k(x)\right)$

Serie di Fourier *(di funzioni periodiche di periodo $T > 0$)*

$$f(x) \approx \sum_{k=0}^{+\infty} a_k \varphi_k + \sum_{k=1}^{+\infty} b_k \psi_k = a_0 + \sum_{k=1}^{+\infty} \left[a_k \cos\left(k \frac{2\pi}{T} x\right) + b_k \operatorname{sen}\left(k \frac{2\pi}{T} x\right) \right]$$

$$a_0 = \frac{1}{T}(f, \varphi_0) = \frac{1}{T}\int_0^T f(x)dx$$

$$a_k = \frac{2}{T}(f, \varphi_k) = \frac{2}{T}\int_0^T f(x)\cos\left(k \frac{2\pi}{T} x\right)dx$$

$$b_k = \frac{2}{T}(f, \psi_k) = \frac{2}{T}\int_0^T f(x)\operatorname{sen}\left(k \frac{2\pi}{T} x\right)dx$$

$f(x)$ pari

$$f(x) \approx \sum_{k=0}^{+\infty} a_k \varphi_k = a_0 + \sum_{k=1}^{+\infty} a_k \cos\left(k \frac{2\pi}{T} x\right)$$

$$a_0 = \frac{2}{T}\int_0^{T/2} f(x)dx$$

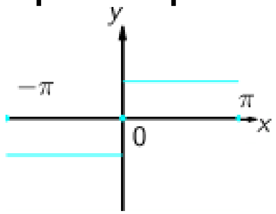
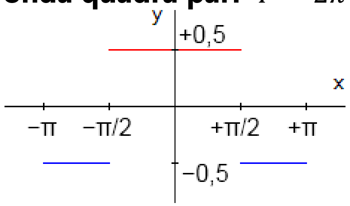
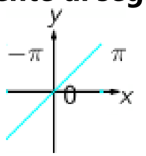
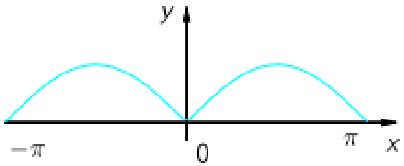
$$a_k = \frac{4}{T}\int_0^{T/2} f(x)\cos\left(k \frac{2\pi}{T} x\right)dx$$

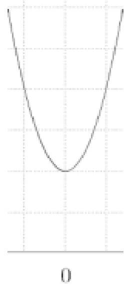
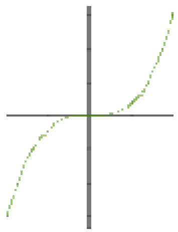
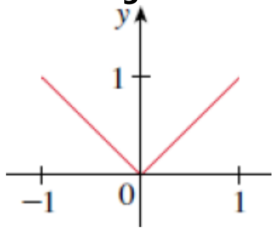
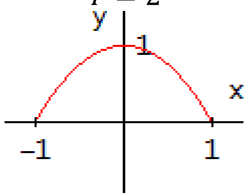
$f(x)$ dispari

$$f(x) \approx \sum_{k=1}^{+\infty} b_k \psi_k = \sum_{k=1}^{+\infty} b_k \operatorname{sen}\left(k \frac{2\pi}{T} x\right)$$

$$b_k = \frac{4}{T}\int_0^{T/2} f(x)\operatorname{sen}\left(k \frac{2\pi}{T} x\right)dx$$

$\sum_{k=1}^{+\infty} \frac{1}{k^2} = \frac{\pi^2}{6}$	$\sum_{k=1}^{+\infty} \frac{1}{k^4} = \frac{\pi^4}{90}$	$\sum_{k=1}^{+\infty} \frac{1}{4k^2 - 1} = \frac{1}{2}$	$\sum_{k=1}^{+\infty} \frac{(-1)^{k+1}}{k^2} = \frac{\pi^2}{12}$	$\sum_{k=0}^{+\infty} \frac{1}{(2k+1)^4} = \frac{\pi^4}{96}$	$\sum_{k=0}^{+\infty} \frac{(-1)^k}{2k+1} = \frac{\pi}{4}$

Onde I	**Espressione della funzione**	**Serie di Fourier**	**Serie numeriche**
onda quadra dispari $T = 2\pi$ 	$f(x) = \begin{cases} -\frac{1}{2} & \text{se } -\pi < x < 0 \\ +\frac{1}{2} & \text{se } 0 < x < \pi \end{cases}$	$f(x) \approx \frac{2}{\pi} \sum_{k=0}^{+\infty} \frac{1}{2k+1} \operatorname{sen}[(2k+1)x]$	$\sum_{k=0}^{+\infty} \frac{(-1)^k}{2k+1} = \frac{\pi}{4}$
onda quadra pari $T = 2\pi$ 	$f(x) = \begin{cases} -\frac{1}{2} & \text{se } \frac{\pi}{2} < \lvert x \rvert < \pi \\ +\frac{1}{2} & \text{se } \lvert x \rvert < \frac{\pi}{2} \end{cases}$	$f(x) \approx \frac{2}{\pi} \sum_{k=1}^{+\infty} \frac{\operatorname{sen}\left(k\frac{\pi}{2}\right)}{k} \cos(kx)$	
onda a dente di sega $T = 2\pi$ 	$f(x) = x \quad \text{se } -\pi < x < \pi$	$f(x) \approx 2 \sum_{k=1}^{+\infty} \frac{(-1)^{k+1}}{k} \operatorname{sen}(kx)$	$\sum_{k=1}^{+\infty} \frac{1}{k^2} = \frac{\pi^2}{6}$
onda raddrizzata $T = 2\pi$ 	$f(x) = \lvert \operatorname{sen} x \rvert$	$f(x) \approx \frac{2}{\pi} - \frac{4}{\pi} \sum_{k=1}^{+\infty} \frac{1}{4k^2 - 1} \cos(2kx)$	$\sum_{k=1}^{+\infty} \frac{1}{4k^2 - 1} = \frac{1}{2}$

Onde II	**Espressione della funzione**	**Serie di Fourier**	**Serie numeriche**
onda parabolica $T = 2\pi$ 	$f(x) = x^2 \quad \text{se} -\pi < x < \pi$	$f(x) \approx \frac{\pi^2}{3} + 4\sum_{k=1}^{+\infty} \frac{(-1)^k}{k^2}\cos(kx)$	$\sum_{k=1}^{+\infty} \frac{(-1)^{k+1}}{k^2} = \frac{\pi^2}{12}$ $\sum_{k=1}^{+\infty} \frac{1}{k^4} = \frac{\pi^4}{90}$
onda cubica $T = 2\pi$ 	$f(x) = x^3 \quad \text{se} -\pi < x < \pi$	$f(x) \approx 2\sum_{k=1}^{+\infty} (-1)^k \frac{6 - \pi^2 k^2}{k^3}\text{sen}(kx)$	
onda triangolare $T = 2$ 	$f(x) = \lvert x \rvert \quad \text{se} \ -1 < x < 1$	$f(x) \approx \frac{1}{2} - \frac{4}{\pi^2}\sum_{k=1}^{+\infty} \frac{1}{(2k-1)^2}\cos[(2k-1)\pi x]$	$\sum_{k=1}^{+\infty} \frac{1}{k^2} = \frac{\pi^2}{6}$ $\sum_{k=0}^{+\infty} \frac{1}{(2k+1)^4} = \frac{\pi^4}{96}$
$T = 2$ 	$f(x) = 1 - x^2 \quad \text{se} \ -1 < x < 1$	$f(x) = \frac{2}{3} + \frac{4}{\pi^2}\sum_{k=1}^{+\infty} \frac{(-1)^{k+1}}{k^2}\cos(k\pi x)$	$\sum_{k=1}^{+\infty} \frac{1}{k^4} = \frac{\pi^4}{90}$ $\sum_{k=1}^{+\infty} \frac{(-1)^{k+1}}{k^2} = \frac{\pi^2}{12}$

Conica	**Quadrica:** $\alpha x^2 + \beta y^2 + \gamma z^2 + \delta = 0$, $\alpha x^2 + \beta y^2 + 2\delta z = 0$	
(nel piano xy)	**non degenere**	**degenere**
ellisse: $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ circonferenza: $x^2 + y^2 = r^2$	ellissoide: $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ sfera: $x^2 + y^2 + z^2 = r^2$	cilindro ellittico: $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ cilindro circolare: $x^2 + y^2 = r^2$
iperbole: $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ (con asse x per asse focale) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$ (con asse y per asse focale)	iperboloide: $\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1$ (a una falda) $\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = -1$ (a due falde)	cilindro iperbolico: $\frac{x^2}{a^2} - \frac{y^2}{b^2} = \pm 1$ cono doppio ellittico: $\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 0$
parabola: $y = \frac{x^2}{a^2}$ (con concavità verso l'alto) $y = -\frac{x^2}{a^2}$ (con concavità verso il basso)	paraboloide ellittico: $z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$ paraboloide iperbolico: $z = \frac{x^2}{a^2} - \frac{y^2}{b^2}$	cilindro parabolico: $y = \pm \frac{x^2}{a^2}$