Tutorato MATEMATICA APPLICATA

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Trasformata di Fourier

1) Eseguire i seguenti calcoli

- $\mathcal{F}^{-1}\left\{\dfrac{1}{k^2+4k+5}\right\}$
- $\mathcal{F}\{e^{6x}H(2-x)\}$
- $\mathcal{F}\left\{\dfrac{1}{9+x^2}\right\}$
- $\mathcal{F}^{-1}\left\{\dfrac{\sin(\pi(k-7))}{(k-7)e^{2ik}}\right\}$
- $\mathcal{F}\{e^{-2|x-3|-4\mathrm{i}x}\}$
- $\mathcal{F}\left\{\dfrac{4x}{x^2+9}\right\}$
- $\mathcal{F}^{-1}\left\{\dfrac{e^{7ik}}{5+(k+1)^2}\right\}$

SOLUZIONE:

$$\mathcal{F}^{-1}\left\{\frac{1}{k^2+4k+5}\right\} = \frac{1}{2}e^{-(2\mathrm{i}x+|x|)}$$

$$\mathcal{F}\{e^{6x}H(2-x)\} = \frac{e^{2(6-\mathrm{i}k)}}{6-\mathrm{i}k}$$

$$\mathcal{F}\left\{\frac{1}{9+x^2}\right\} = \frac{\pi}{3}e^{-3|k|}$$

$$\mathcal{F}^{-1}\left\{\frac{\sin(\pi(k-7))}{(k-7)e^{2ik}}\right\} = \frac{1}{2}e^{7\mathrm{i}(x-2)}\left[H(x-2+\pi)-H(x-2-\pi)\right]$$

$$\mathcal{F}\{e^{-2|x-3|-4\mathrm{i}x}\} = \frac{4}{4+(k+4)^2}e^{-3\mathrm{i}(k+4)}$$

$$\mathcal{F}\left\{\frac{4x}{x^2+9}\right\} = 4\pi\mathrm{i}\left[e^{3k}H(-k)-e^{-3k}H(k)\right] = \begin{cases} -4\pi\mathrm{i}e^{-3k}, & k\geq 0 \\ 4\pi\mathrm{i}e^{3k}, & k<0 \end{cases}$$

$$\mathcal{F}^{-1}\left\{\frac{e^{7ik}}{5+(k+1)^2}\right\} = \frac{\sqrt{5}}{10}e^{-\mathrm{i}(x+7)}e^{-\sqrt{5}|x+7|}$$