INSTITUTO POLITÉCNICO NACIONAL

**ESCUELA SUPERIOR DE CÓMPUTO**

# Transformada de Fourier

Evidencia 1.6


**Integrantes:**

Luis Fernando Reséndiz Chávez


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Teoría de Comunicaciones y Señales

**Profesor:**

Arzate Gordillo Jacqueline

**Grupo:**

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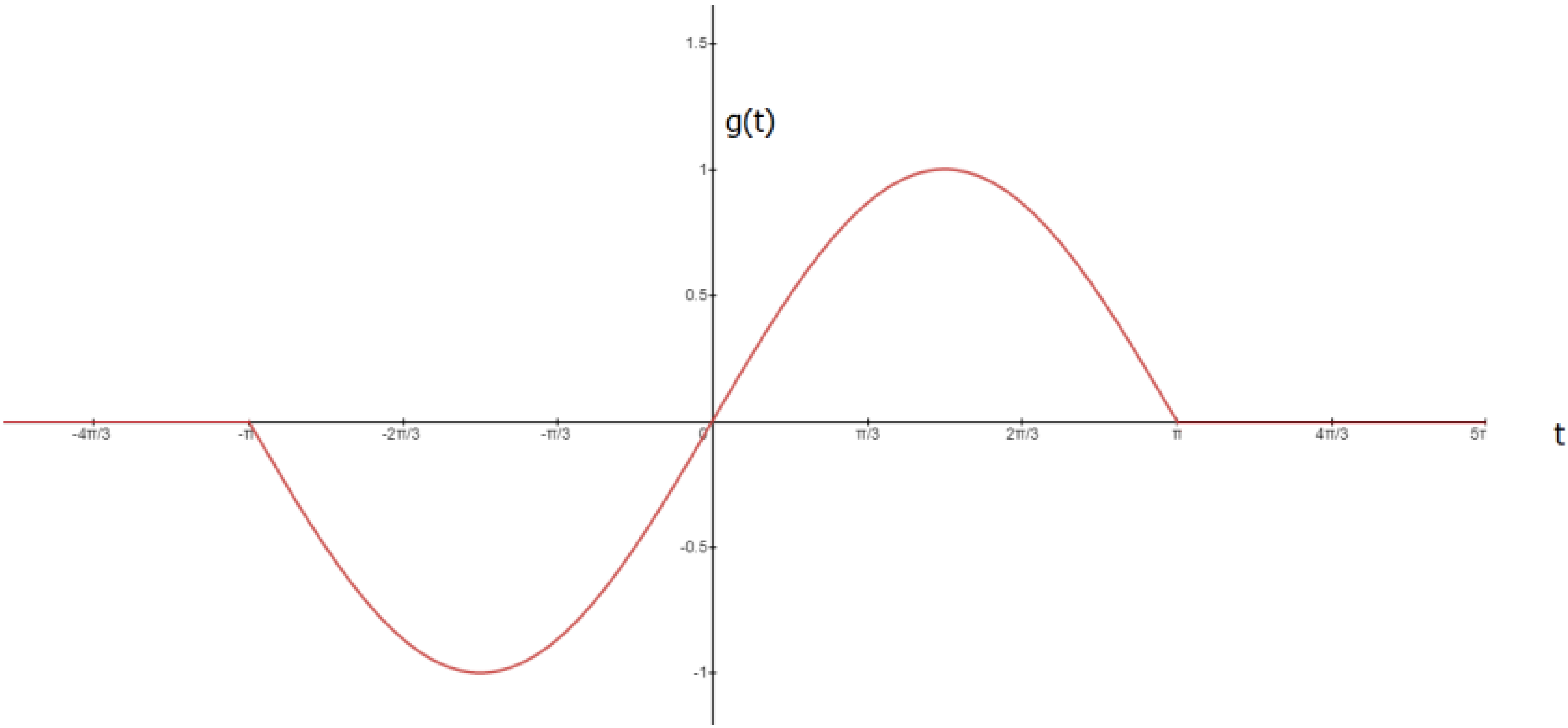
## Evidencia 1.6

Determina la transformada de Fourier de la función g(t) y gráfica su espectro de frecuencias



$$g(t) = \begin{cases} \text{sen}(t) & , -\pi < t < \pi \\ \emptyset & , \text{ otro caso} \end{cases}$$

$$\mathcal{F}\{g(t)\} = \int_{-\infty}^{\infty} g(t)\, e^{-j\omega t}\, dt = G(\omega)$$

$$G(\omega) = \int_{-\infty}^{-\pi} \emptyset\, e^{-j\omega t}\, dt + \int_{-\pi}^{\pi} \text{sen}(t)\, e^{-j\omega t}\, dt + \int_{\pi}^{\infty} \emptyset\, e^{-j\omega t}\, dt$$

$$G(\omega) = \int_{-\pi}^{\pi} \text{sen}(t)\, e^{-j\omega t} = \int_{-\pi}^{\pi} \left(\frac{e^{jt} - e^{-jt}}{2j}\right) e^{-j\omega t}\, dt$$

$$= \int_{-\pi}^{\pi} \left(\frac{e^{jt - j\omega t} - e^{-jt - j\omega t}}{2j}\right)$$

$$G(\omega) = \frac{1}{2j}\left[\int_{-\pi}^{\pi} e^{jt(1-\omega)}\, dt - \int_{-\pi}^{\pi} e^{-jt(1+\omega)}\, dt\right]$$

$$G(\omega) = \left[\frac{1}{2j[j(1-\omega)]} \cdot e^{jt(1-\omega)} - \frac{1}{2j[-j(1+\omega)]} \cdot e^{-jt(1+\omega)}\right]\Bigg|_{-\pi}^{\pi}$$

$$G(\omega) = \left[-\frac{e^{jt(1-\omega)}}{2-2\omega} - \frac{e^{-jt(1+\omega)}}{2+2\omega}\right]\Bigg|_{-\pi}^{\pi}$$

$$G(\omega) = -\frac{e^{j\pi(1-\omega)}}{2-2\omega} - \frac{e^{-j\pi(1+\omega)}}{2+2\omega} + \frac{e^{-j\pi(1-\omega)}}{2-2\omega} + \frac{e^{j\pi(1+\omega)}}{2+2\omega}$$

$$= -\left(\frac{-e^{-j\pi(1-\omega)} + e^{j\pi(1-\omega)}}{2-2\omega}\right) + \frac{e^{j\pi(1+\omega)} - e^{-j\pi(1+\omega)}}{2+2\omega}$$

$$= -\frac{2j\,\text{sen}[\pi(1-\omega)]}{2-2\omega} + \frac{2j\,\text{sen}[\pi(1+\omega)]}{2+2\omega}$$

$$G(\omega) = \frac{-j\,\text{sen}(\pi(1-\omega))}{1-\omega} + \frac{j\,\text{sen}(\pi(1+\omega))}{1+\omega}$$

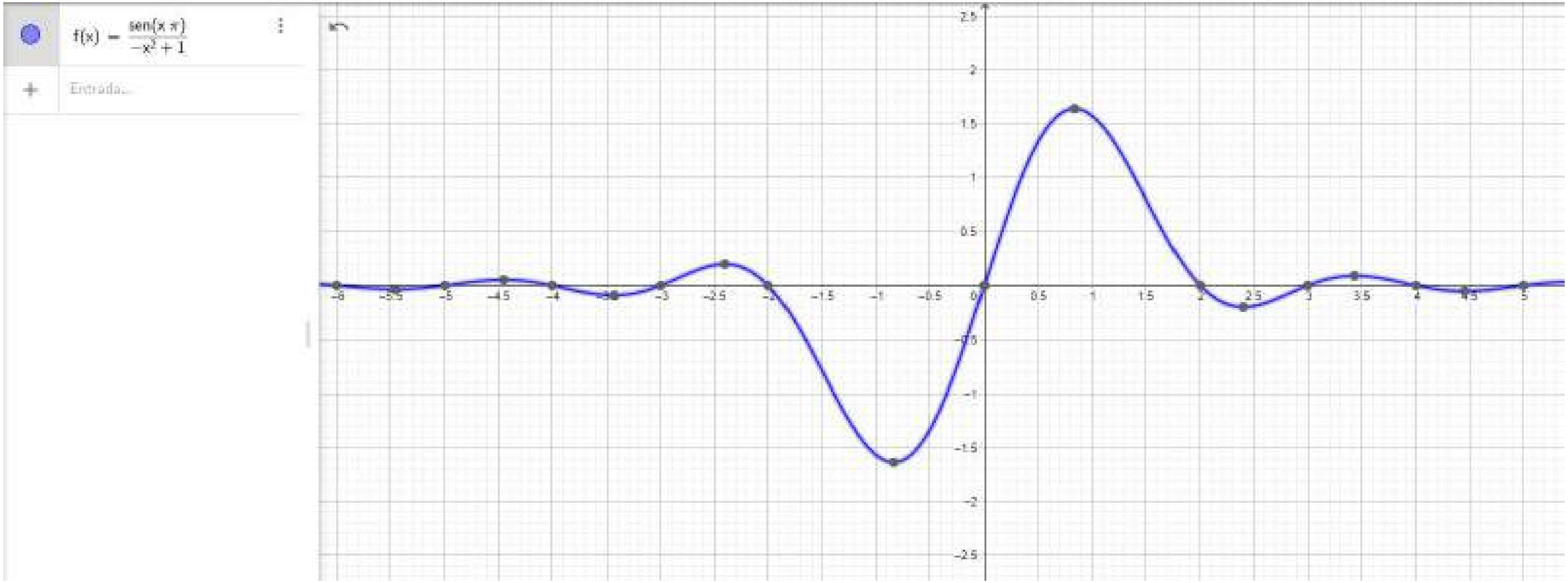
$$G(\omega) = \frac{(1+\omega)j\,\text{sen}(\pi(1-\omega)) + (1-\omega)j\,\text{sen}(\pi(1+\omega))}{-\omega^2+1}$$

$$G(\omega) = \frac{j\,\text{sen}(\pi\omega) + j\,\text{sen}(\pi\omega) + \omega j\,\text{sen}(\pi\omega) - \omega j\,\text{sen}(\pi\omega)}{-\omega^2+1}$$

$$G(\omega) = \frac{2j\,\text{sen}(\pi\omega)}{-\omega^2+1}$$

$$C_n = \frac{1}{2}\left(\frac{2j\,\text{sen}(\pi\omega)}{-\omega^2+1}\right) = \frac{j}{\omega^2-1}\,\text{sen}(\pi\omega) \quad \forall\, n$$

$$\theta = \tan^{-1}\frac{Im\{C_n\}}{Re\{C_n\}} = \tan^{-1}\frac{Im\{C_n\}}{0} = \tan^{-1}(\infty) = 90^\circ$$



f(x) = sen(x π) / (−x² + 1)
Entrada...