Indian Institute of Space Science and Technology
Thiruvananthapuram

MA 211 (Fourier series, Fourier Transform and Laplace Transform)

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1. Use the Fourier transform to show that for $a, b > 0$,

$$\int_{-\infty}^{\infty} \frac{dt}{(t^2 + a^2)(t^2 + b^2)} = \frac{\pi}{ab(a+b)}.$$

2. Consider the piecewise continuous function $f(x)$, defined by

$$f(x) = \begin{cases} 2x^2, & \text{for} \quad 0 \le x < 3, \\ x + 4, & \text{for} \quad 3 \le x < 5, \\ 9, & \text{for} \quad x \ge 5. \end{cases}$$

Express $f(x)$ in terms of the Heaviside unit step functions and obtain the Laplace transform of it.