

Question 6

Evaluate the two-tailed integral:

$$\int_{-\infty}^{\infty} e^{-|x|} dx.$$

Question 6 – Solution

Step 1: Use symmetry. Since $e^{-|x|}$ is even,

$$I = 2 \int_0^{\infty} e^{-x} dx.$$

Step 2: Replace infinity with a limit.

$$I = 2 \lim_{b \rightarrow \infty} \int_0^b e^{-x} dx.$$

Step 3: Integrate and evaluate.

$$\begin{aligned} I &= 2 \lim_{b \rightarrow \infty} [-e^{-x}]_0^b \\ &= 2 \lim_{b \rightarrow \infty} (1 - e^{-b}) \\ &= 2(1 - 0) = 2. \end{aligned}$$

$$\boxed{I = 2}$$