

PROOF OF FORMULA 4.223.3

$$\int_0^{\infty} \ln(1 + 2e^{-x} \cos t + e^{-2x}) dx = \frac{\pi^2}{6} - \frac{t^2}{2}$$

The change of variables $y = e^{-x}$ gives

$$\int_0^{\infty} \ln(1 + 2e^{-x} \cos t + e^{-2x}) dx = \int_0^1 \ln(1 + 2y \cos t + y^2) \frac{dy}{y}.$$

This integral appears as entry **4.296.1** and it gives the result.