Isothermal Compressibility of Water and Sound Speed

Compressibility, 10^{-9} Pa^{-1}

Water

Isothermal, κ

Adiabatic, κ_S

Temperature, °C
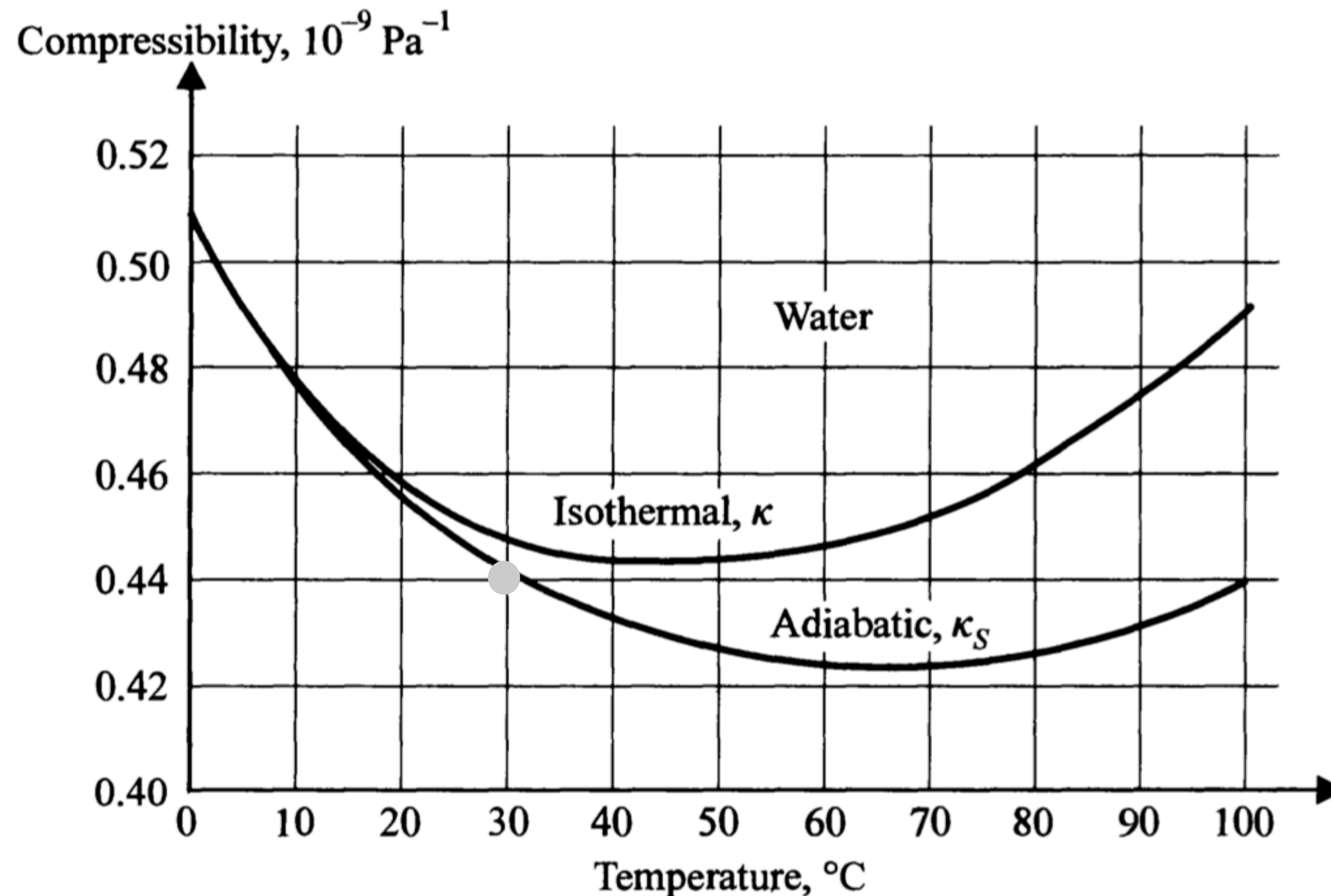
The speed of sound is related to these curves

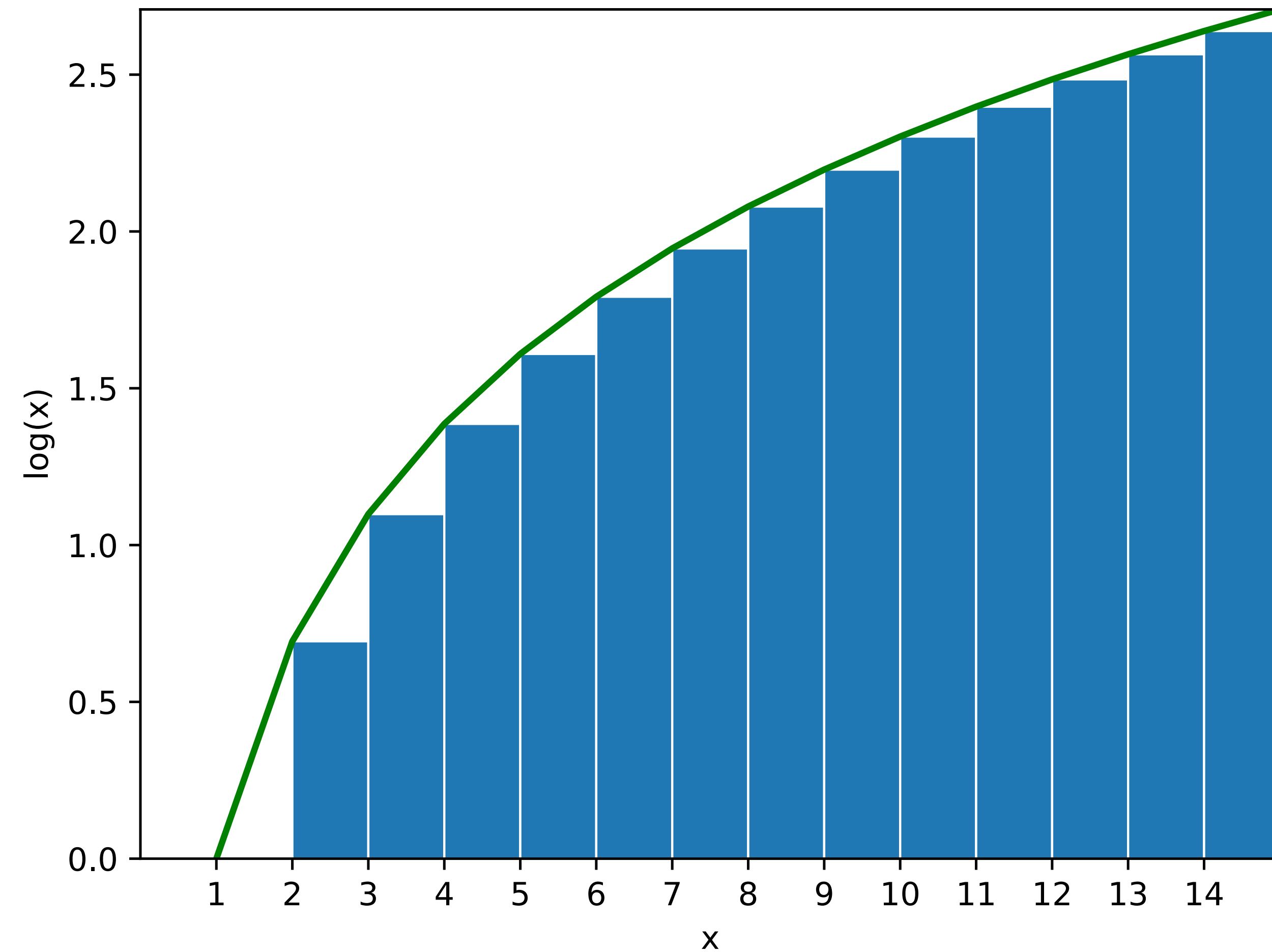$$c_s = \sqrt{\frac{B_s}{\rho}} = \sqrt{\frac{1}{\rho \kappa_S}}$$

For water $\rho = 1 \, \text{g/cm}^3$ and

$$c_s \simeq 1500 \, \text{m/s}$$

at 30 degrees celsius

Deriving the Stirling approximation:

Replace the sum with integral