

Problem 1.6 The height of an ocean wave is described by the function

$$y(x, t) = 1.5 \sin(0.5t - 0.6x) \quad (\text{m}).$$

Determine the phase velocity and the wavelength, and then sketch $y(x, t)$ at $t = 2$ s over the range from $x = 0$ to $x = 2\lambda$.

Solution: The given wave may be rewritten as a cosine function:

$$y(x, t) = 1.5 \cos(0.5t - 0.6x - \pi/2).$$

By comparison of this wave with Eq. (1.32),

$$y(x, t) = A \cos(\omega t - \beta x + \phi_0),$$

we deduce that

$$\begin{aligned} \omega &= 2\pi f = 0.5 \text{ rad/s}, & \beta &= \frac{2\pi}{\lambda} = 0.6 \text{ rad/m}, \\ u_p &= \frac{\omega}{\beta} = \frac{0.5}{0.6} = 0.83 \text{ m/s}, & \lambda &= \frac{2\pi}{\beta} = \frac{2\pi}{0.6} = 10.47 \text{ m}. \end{aligned}$$

At $t = 2$ s, $y(x, 2) = 1.5 \sin(1 - 0.6x)$ (m), with the argument of the cosine function given in radians. Plot is shown in Fig. .

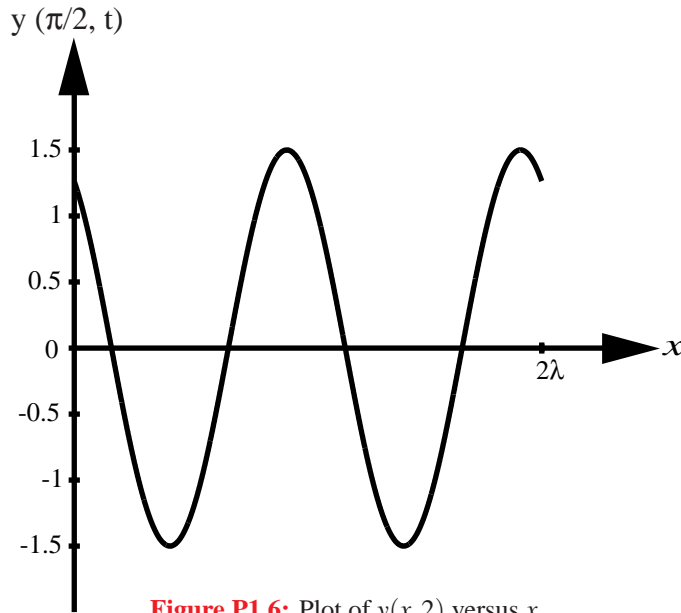


Figure P1.6: Plot of $y(x, 2)$ versus x .