48. (a) The nodes are located from vanishing of the spatial factor $\sin 5\pi x = 0$ for which the solutions are

$$5\pi x = 0, \pi, 2\pi, 3\pi, \ldots \quad \Longrightarrow \quad x = 0, \frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \ldots$$

so that the values of x lying in the allowed range are $x = 0$, $x = 0.20$ m, and $x = 0.40$ m.

(b) Every point (except at a node) is in simple harmonic motion of frequency $f = \omega/2\pi = 40\pi/2\pi = 20$ Hz. Therefore, the period of oscillation is $T = 1/f = 0.050$ s.

(c) Comparing the given function with Eq. 17-45 through Eq. 17-47, we obtain

$$y_1 = 0.020 \sin(5\pi x - 40\pi t) \quad \text{and} \quad y_2 = 0.020 \sin(5\pi x + 40\pi t)$$

for the two traveling waves. Thus, we infer from these that the speed is $v = \omega/k = 40\pi/5\pi = 8.0$ m/s.

(d) And we see the amplitude is $y_m = 0.020$ m.

(e) The derivative of the given function with respect to time is

$$u = \frac{\partial y}{\partial t} = -\,(0.040)\,(40\pi)\sin(5\pi x)\sin(40\pi t)$$

which vanishes (for all x) at times such $\sin(40\pi t) = 0$. Thus,

$$40\pi t = 0, \pi, 2\pi, 3\pi, \ldots \quad \Longrightarrow \quad t = 0, \frac{1}{40}, \frac{2}{40}, \frac{3}{40}, \ldots$$

so that the values of t lying in the allowed range are $t = 0$, $t = 0.025$ s, and $t = 0.050$ s.