except for small values of \( t \) or \( \alpha^2 \). Therefore accurate results can usually be obtained by using only a few terms of the series.

In order to display quantitative results let us measure \( t \) in seconds; then \( \alpha^2 \) has the units of \( \text{cm}^2/\text{sec} \). If we choose \( \alpha^2 = 1 \) for convenience, this corresponds to a rod of a material whose thermal properties are somewhere between copper and aluminum. The behavior of the solution can be seen from the graphs in Figures 10.5.3 through 10.5.5. In Figure 10.5.3 we show the temperature distribution in the bar at several different times. Observe that the temperature diminishes steadily as heat in the bar is lost through the endpoints. The way in which the temperature decays at a given point in the bar is indicated in Figure 10.5.4, where temperature is plotted against time for a few selected points in the bar. Finally, Figure 10.5.5 is a three-dimensional plot of \( u \) versus both \( x \) and \( t \). Observe that the graphs in Figures 10.5.3 and 10.5.4 are obtained by intersecting the surface in Figure 10.5.5 by planes on which either \( t \) or \( x \) is constant. The slight waviness in Figure 10.5.5 at \( t = 0 \) results from using only a finite number of terms in the series for \( u(x, t) \) and from the slow convergence of the series for \( t = 0 \).

**FIGURE 10.5.3** Temperature distributions at several times for the heat conduction problem of Example 1.

**FIGURE 10.5.4** Dependence of temperature on time at several locations for the heat conduction problem of Example 1.