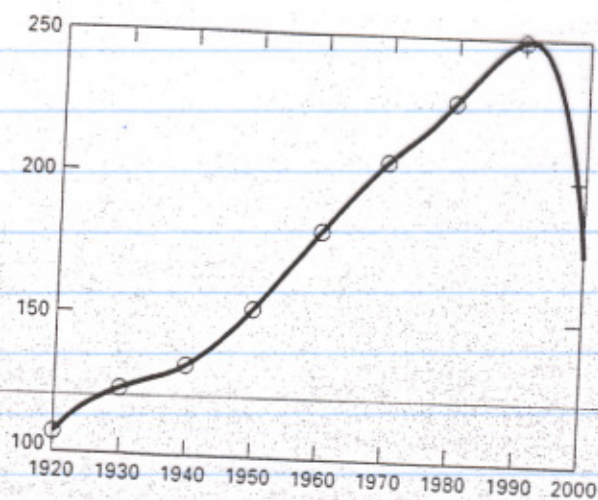
**FIGURE 14.1**

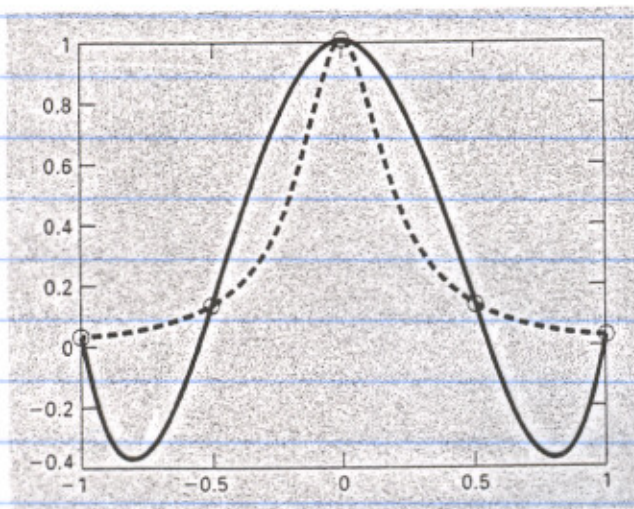
Examples of interpolating polynomials: (a) first-order (linear) connecting two points, (b) second-order (quadratic or parabolic) connecting three points, and (c) third-order (cubic) connecting four points.

**FIGURE 14.11**

Use of a seventh-order polynomial to make a prediction of U.S. population in 2000 based on data from 1920 through 1990.

FIGURE 14.12

Comparison of Runge's function (dashed line) with a fourth-order polynomial fit to 5 points sampled from the function.



Runge's function

$$f(x) = \frac{1}{1+25x^2}$$

(notoriously bad function that cannot be fit well with polynomials.)

Higher order

polynomials usually

to be avoided.

PROBLEMS

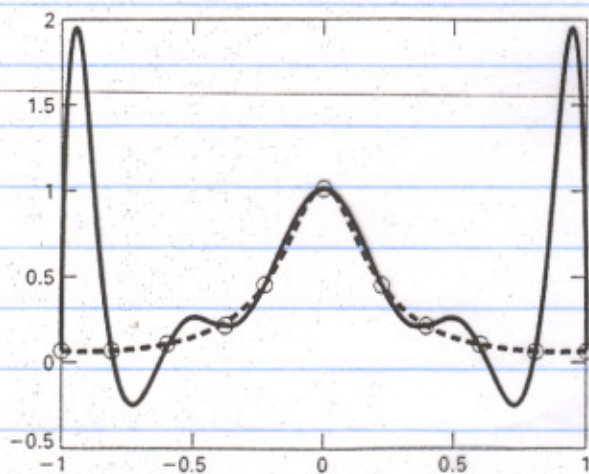


FIGURE 14.13

Comparison of Runge's function (dashed line) with a tenth-order polynomial fit to 11 points sampled from the function.

Figure 3.10

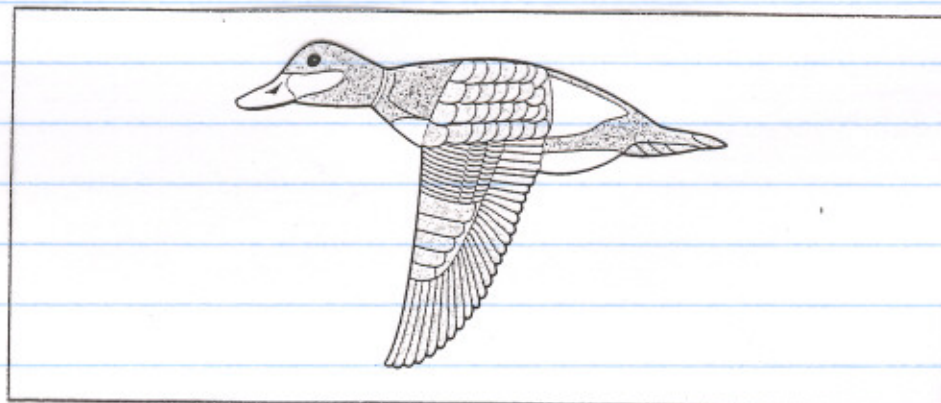


Figure 3.11

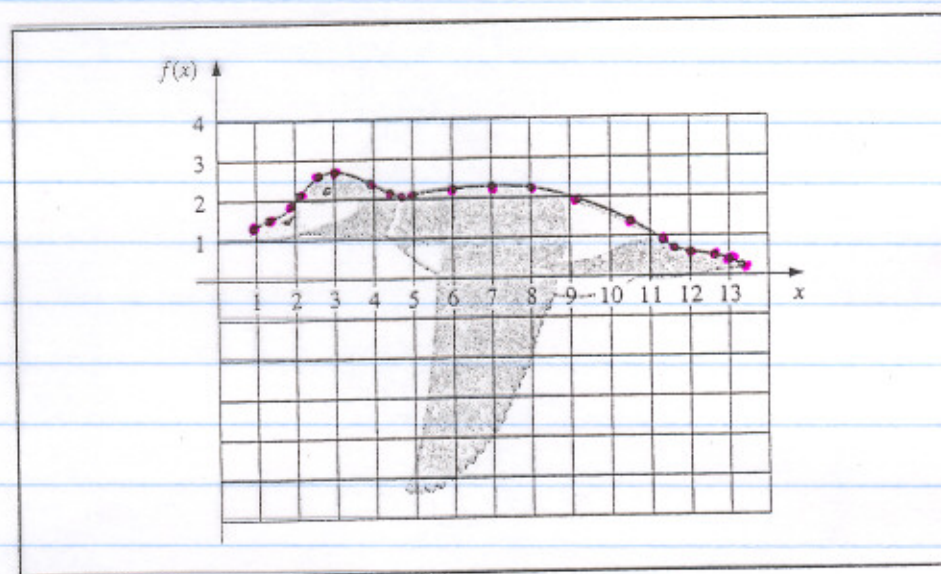
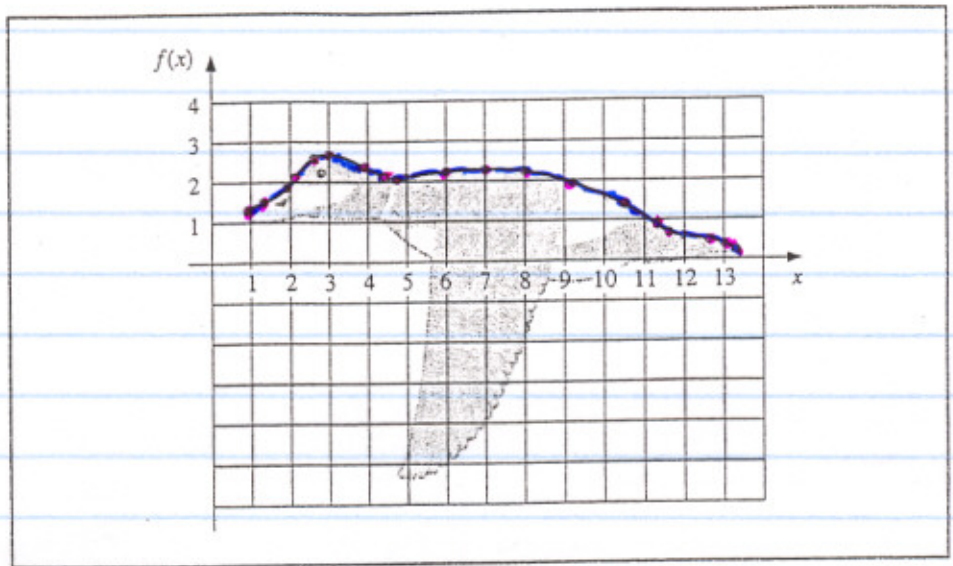
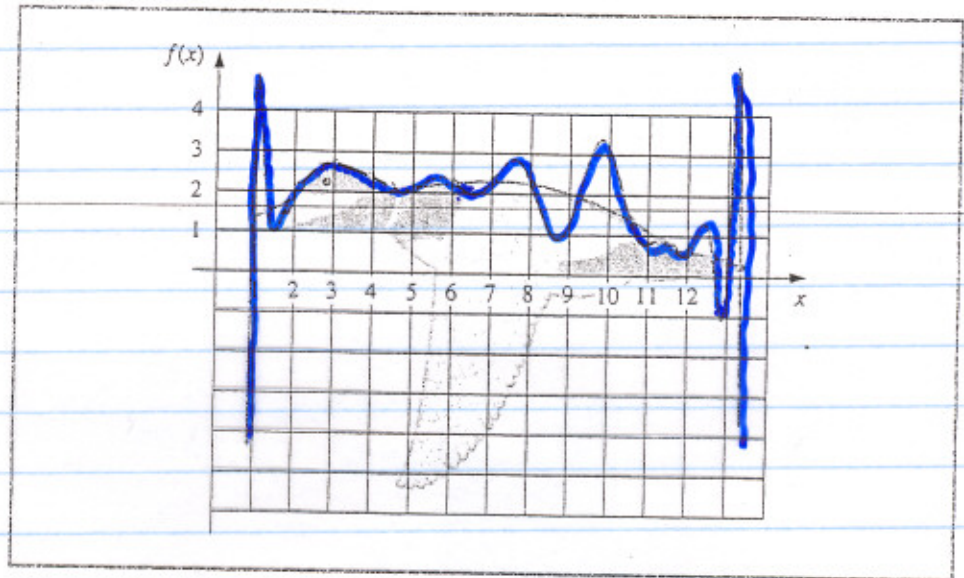


Figure 3.12

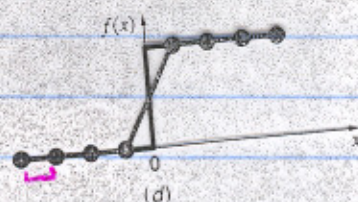
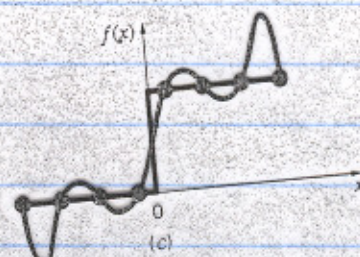
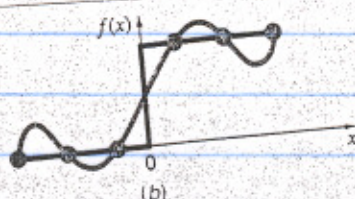
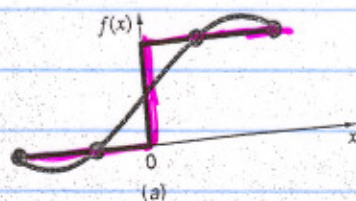


free cubic spline result

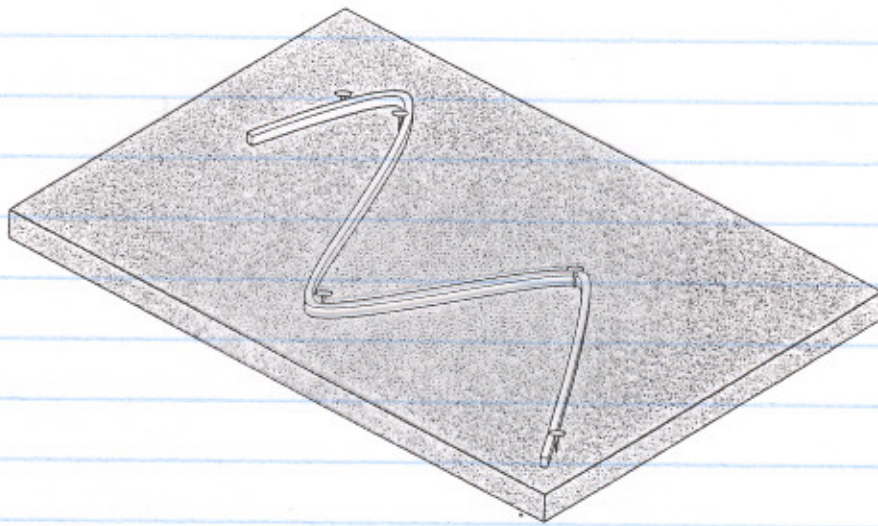
Figure 3.13



- degree 20 polynomial
- Oscillate widely.



The function to be fit undergoes an abrupt increase at $x=0$.

**FIGURE 15.2**

The drafting technique of using a spline to draw smooth curves through a series of points. Notice how, at the end points, the spline straightens out. This is called a "natural" spline.

Natural spline. (curvature = 0)

15.2 LINEAR SPLINES

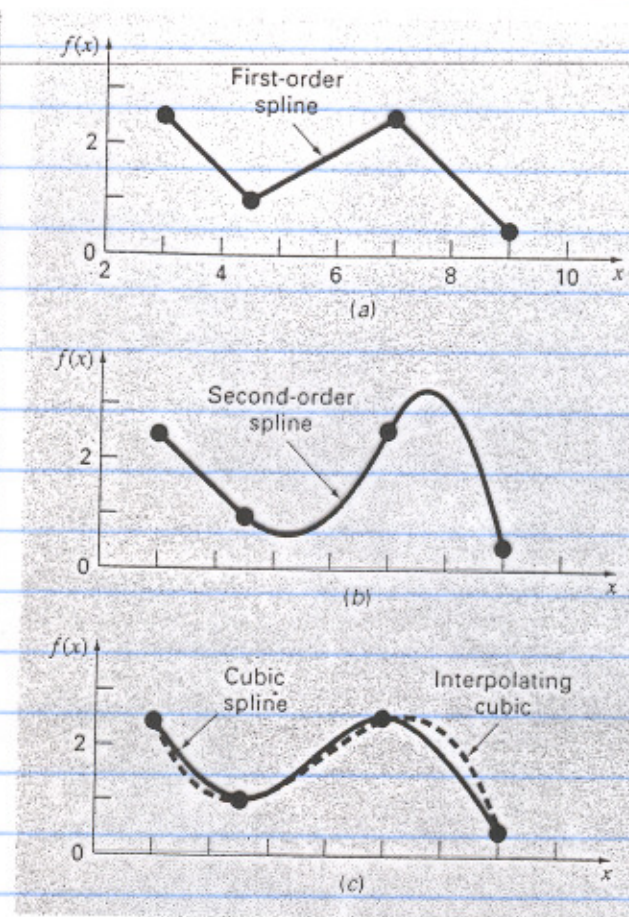


FIGURE 15.4

Spline fits of a set of four points. (a) Linear spline, (b) quadratic spline, and (c) cubic spline, with a cubic interpolating polynomial also plotted.

CURVE FITTING: SPLINES

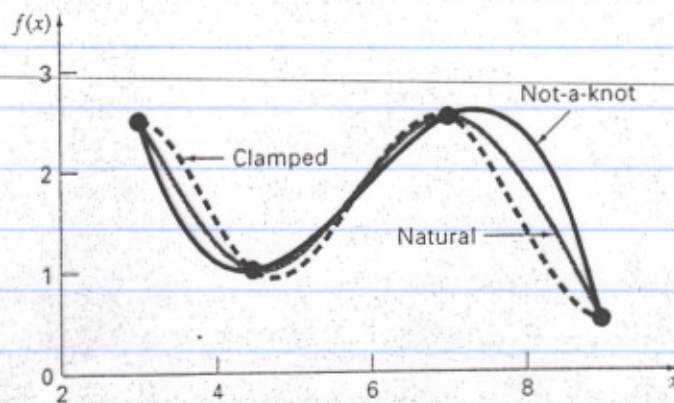


FIGURE 15.5

Comparison of the clamped (with zero first derivatives), not-a-knot, and natural splines for the data from Table 15.1.

Clamped End Condition: At the first

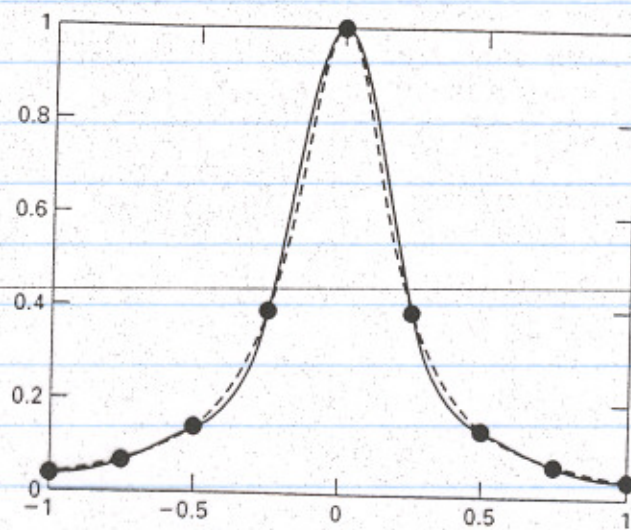
& the last node, the first derivative is zero (i.e. become horizontal at the end.)

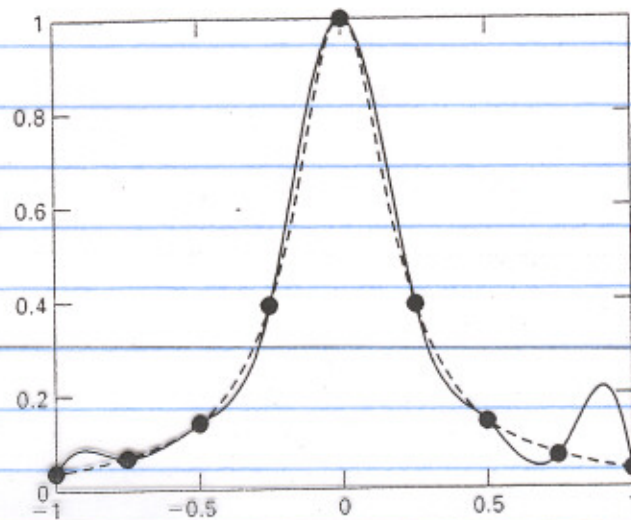
Not-a-knot end condition: force the

3rd derivative to be continuous at the second & the next-to-last knots.

FIGURE 15.6

Comparison of Runge's function (dashed line) with a 9-point not-a-knot spline fit generated with MATLAB (solid line).



**FIGURE 13.7**

Comparison of Runge's function [dashed line] with a 9-point clamped end spline fit generated with MATLAB [solid line]. Note that first derivatives of 1 and -4 are specified at the left and right boundaries, respectively.