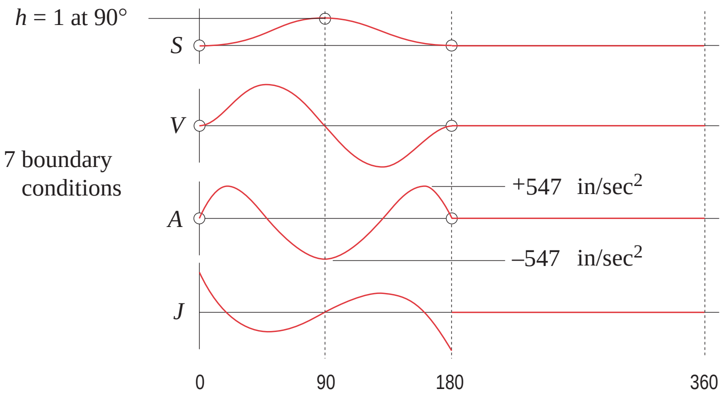

FIGURE 4-4

3-4-5-6 polynomial function for a two-segment symmetrical rise-fall, single-dwell cam

Effect of Asymmetry on the Rise-Fall Polynomial Solution

The examples so far presented in this chapter all had equal time for rise and fall, referred to as a symmetrical rise-fall curve. What will happen if we need an asymmetric program and attempt to use a single polynomial as was done in the previous example?

EXAMPLE 4-4

Designing a Polynomial for an Asymmetrical Rise-Fall Single-Dwell Case

Problem: Redefine the CEP specification from Example 4-3 as:

rise-fall	rise 1 in (25.4 mm) in 45° and fall 1 in (25.4 mm) in 135° for 180°
dwell	at zero displacement for 180° (low dwell).
cam ω	15 rad/sec (143.24 rpm)

Solution:

1 Figure 4-5 shows the minimum set of seven BCs for this problem that will give a sixth-degree polynomial. The dwell on either side of the combined rise-fall segment has zero values for *S, V, A,* and *J*. The fundamental law of cam design requires that we match these zero values, through the acceleration function, at each end of the rise-fall segment.

2 The endpoints account for six BCs; $S = V = A = 0$ at each end of the rise-fall segment.

3 We also must specify a value of displacement at the 1-in peak of the rise that occurs at $\theta = 45°$. This is the seventh BC.

4 Simultaneous solution of this equation set gives a 3-4-5-6 polynomial whose equation is:

$$s = h\left[151.704\left(\frac{\theta}{\beta}\right)^3 - 455.111\left(\frac{\theta}{\beta}\right)^4 + 455.111\left(\frac{\theta}{\beta}\right)^5 - 151.704\left(\frac{\theta}{\beta}\right)^6\right] \tag{4.3}$$