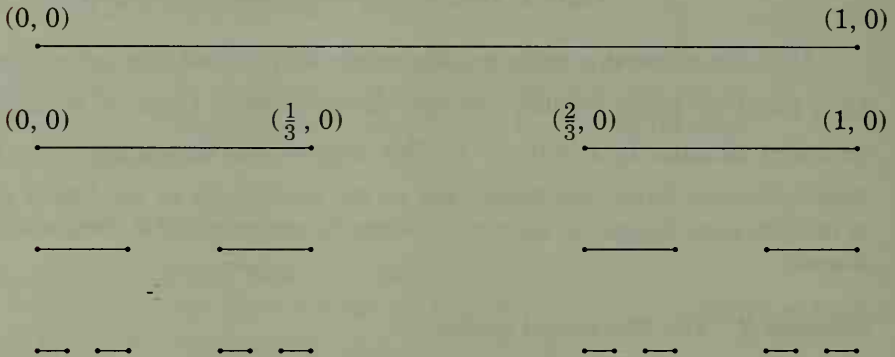


Example 3 The Cantor Set

Use a segment for an initiator and replace it with 2 copies of itself, each $\frac{1}{3}$ as long. This creates a set of disjointed segments that get shorter and shorter with each new level. This fractal is called the *Cantor set* in honor of its creator, Georg Cantor (1845–1918). It is one of the most important sets in mathematics. The data in Table 4 suggests that this fractal has an infinite number of points, yet its length is zero.



| Level Number | Edge Length | Number of edges | Sum of lengths |
|--------------|----------------|-----------------|----------------------------|
| 0 | 1 | 1 | 1 |
| 1 | $\frac{1}{3}$ | 2 | $\frac{2}{3} = 0.\bar{6}$ |
| 2 | $\frac{1}{9}$ | 4 | $\frac{4}{9} = 0.\bar{4}$ |
| 3 | $\frac{1}{27}$ | 8 | $\frac{8}{27} \approx 0.3$ |

Table 4. Data for the Cantor set pre-fractals

Exercises

In Exercises 1–5, level 1 pre-fractals are shown. Assume that the level 0 pre-fractal for each is a segment of length 1. For each exercise, (a) draw the level 2 pre-fractal, (b) draw the level 3 pre-fractal (or a portion of it), and (c) construct a table showing edge length, number of edges, and total length for pre-fractals 0 through 3.

