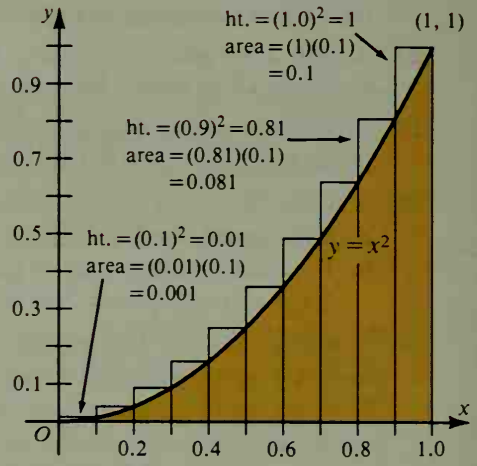
♦ Computer Key-In

The shaded region shown is bounded by the graph of $y = x^2$, by the x-axis, and by the vertical line through the points (1, 0) and (1, 1). You can approximate the area of the shaded region by drawing ten rectangles having base vertices at $x = 0, 0.1, 0.2, 0.3, \ldots, 1.0$, as shown, and computing the sum of the areas of the ten rectangles. The base of each rectangle is 0.1, and the height of each rectangle is given by $y = x^2$.



The following computer program will compute and add the areas of the ten rectangles shown in the diagram. In line 30, Y is the height of each rectangle. In line 40, A gives the current total of all the areas.

```
10  LET X = 0.1
20  FOR N = 1 TO 10
30  LET Y = X ↑ 2
40  LET A = A + Y * 0.1
50  LET X = X + 0.1
60  NEXT N
70  PRINT "AREA IS APPROXIMATELY ";A
80  END
```

If the program is run, the computer will print

```
AREA IS APPROXIMATELY 0.385
```

Exercises

1. A better approximation can be found by using 100 smaller rectangles with base vertices at 0, 0.01, 0.02, 0.03, . . . , 1.00. Change lines 10, 20, 40, and 50 as follows:

```
10  LET X = 0.01
20  FOR N = 1 TO 100
40  LET A = A + Y * 0.01
50  LET X = X + 0.01
```

   RUN the program to approximate the area of the shaded region.

2. Modify the given program so that it will use 1000 rectangles with base vertices at 0, 0.001, 0.002, 0.003, . . . , 1.000 to approximate the area of the shaded region. RUN the program.

3. Is the actual area of the shaded region more or less than the value given by the computer program? Explain.