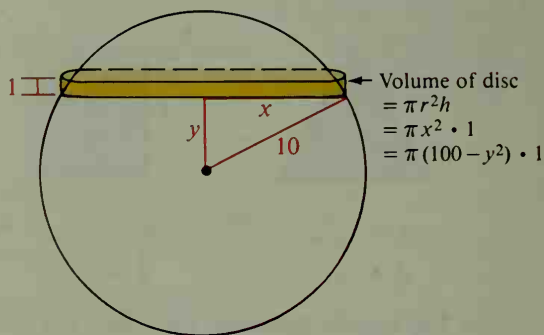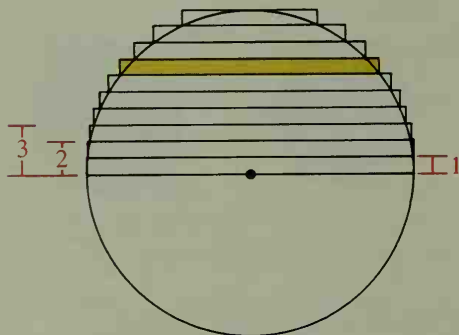## ♦ **Computer Key-In**

The volume of a sphere with radius 10 can be approximated by cylindrical discs with equal heights, as discussed on page 498. It is convenient to work with the upper half of the sphere, then double the result.

Suppose you use ten discs to approximate the upper hemisphere, as shown at the left below.

The diagram at the right above shows that the volume of a disc y units from the center of the sphere is $V = \pi(100 - y^2)$. You can substitute $y = 0, 1, 2, \ldots, 9$ to compute the volumes of the ten discs.

Now suppose you use n discs to approximate the upper hemisphere. Then the height of each disc equals $\dfrac{10}{n}$, and the volume of a disc y units from the center of the sphere is $V = \pi(100 - y^2) \cdot \dfrac{10}{n}$. The following computer program adds the volumes of the n discs, then doubles the result. Note that line 80 calculates the volume of the sphere using the formula $V = \frac{4}{3}\pi r^3$.

```
10  LET Y = 0
15  LET V = 0
20  PRINT "HOW MANY DISCS";
25  INPUT N
30  FOR I = 1 TO N
40  LET Y = (I - 1) * 10/N
50  LET V = V + 3.14159 * (100 - Y↑2) * (10/N)
60  NEXT I
70  PRINT "VOLUME OF DISCS IS ";2 * V
80  PRINT "VOLUME OF SPHERE IS ";4/3 * 3.14159 * 10↑3
90  END
```

Exercises

1. Use 10 for N and RUN the program. By about what percent does the disc method overapproximate the volume of the sphere?

2. RUN the program to find the total volume of n discs for each value of n.
   a. 20   **b.** 50   **c.** 100   **d.** 1000
   As n increases, does the approximate volume approach the actual volume?