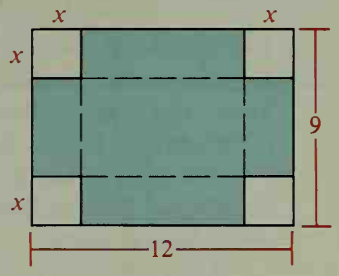
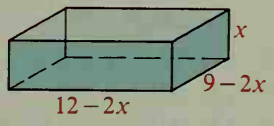
♦ Computer Key-In

A manufacturing company produces metal boxes of different sizes by cutting out square corners from rectangular pieces of metal that measure 9 in. by 12 in. The metal is then folded along the dashed lines to form a box without a top. If a customer requests the box with the greatest possible volume, what dimensions should be used?



The volume, V, of the box can be expressed in terms of x.

$$V = \text{length} \cdot \text{width} \cdot \text{height}$$
$$= (12 - 2x) \cdot (9 - 2x) \cdot x$$



To form a box, the possible values for x are $0 < x < \frac{9}{2}$.

The following computer program finds the volumes of the boxes produced for ten values of x from 0 to 4.5.

```
10  PRINT "X", "VOLUME"
15  PRINT
20  FOR X = 0 TO 4.5 STEP 0.5
30  LET V = (12 - 2 * X) * (9 - 2 * X) * X
40  PRINT X, V
50  NEXT X
60  END
```

```
X             VOLUME

0                  0
.5                44
1                 70
1.5               81
2                 80
2.5               70
3                 54
3.5               35
4                 16
4.5                0
```

The print-out at the right shows that the maximum volume of the box probably occurs when the value of x is between 1 and 2. Also, the print-out shows that the maximum volume is about 81 in.^{3}

Exercises

1. To find a more accurate value for x, change line 20 to:

   ```
   FOR X = 1 TO 2 STEP 0.1
   ```

   Between what values of x does the maximum volume occur?

2. Modify line 20 to find the maximum volume, correct to the nearest tenth of a cubic inch. What are the length, width, and height, correct to the nearest tenth of an inch, of the box with maximum volume?

3. Suppose the manufacturing company cuts square corners out of pieces of metal that measure 8 in. by 15 in.
   a. Express the volume in terms of x.
   b. Find the maximum volume, correct to the nearest tenth of a cubic inch.
   c. What are the length, width, and height of the box with maximum volume? Give each correct to the nearest tenth of an inch.