

TASK 2.4.3: BOXES OF CUPS — SOLVING EQUATIONS BASED ON THE HEIGHT FUNCTION**Solutions**

Suppose the cups of Figure 1 are sold in a box that holds one stack of cups and is 27 cm high (inside dimension). How many cups are in a box?

1. Answer this question using the graph of the height function, $h = 1.5n + 7.5$.

Count up on the y-axis to a height of 27 cm and go over to the graph of the function, then go down to find the number of cups.

2. a. Answer the question again, this time using your function rule, $h = 1.5n + 7.5$.

$$\begin{array}{l} 9.0 + 1.5(n - 1) = 27 \\ 9.0 + (1.5)n - 1.5 = 27 \\ 7.5 + (1.5)n = 27 \\ (1.5)n = 19.5 \\ n = 13 \end{array} \qquad \text{or} \qquad \begin{array}{l} 7.5 + (1.5)n = 27 \\ (1.5)n = 19.5 \\ n = 13 \end{array}$$

b. Interpret the steps you took to solve the equation in terms of the situation.

The number of Type I cups can be found by subtracting 7.5 cm from the height and dividing the result by 1.5 cm.

3. How can you find the solution using the table in a graphing calculator?

Look at the y values in the table. Find 27 cm. What is the value of n for the height of 27 cm? Look for the corresponding x value. The number of cups is 13.

4. a. What if the box is 30.25 cm high (inside dimension)?

$$\begin{array}{l} 9.0 + 1.5(n - 1) = 30.25 \\ 9.0 + (1.5)n - 1.5 = 30.25 \\ 7.5 + (1.5)n = 30.25 \\ (1.5)n = 22.75 \\ n = 15 \text{ with } 0.25 \text{ cm space at the} \\ \text{top of the box} \end{array} \qquad \text{or} \qquad \begin{array}{l} 7.5 + (1.5)n = 30.25 \\ (1.5)n = 22.75 \\ n = 15 \text{ with } 0.25 \text{ cm space at the} \\ \text{top of the box} \end{array}$$

b. How can you find the solution using the table feature of the graphing calculator?

Look at the y-values in the table. "Zoom" in on the x-values in your table to find the whole number value of x for $y \leq 30.25$. The number of cups is 15, with 0.25 cm space left over.

c. Describe another way that you could find the solution.

Use the graph of the function rule with the trace feature.

TASK 2.4.3: BOXES OF CUPS — SOLVING EQUATIONS BASED ON THE HEIGHT FUNCTION

In the stacks of cups problem, we are interested in the relationship between two variables h and n :

h = the height of the stack in cm

n = the number of cups in the stack

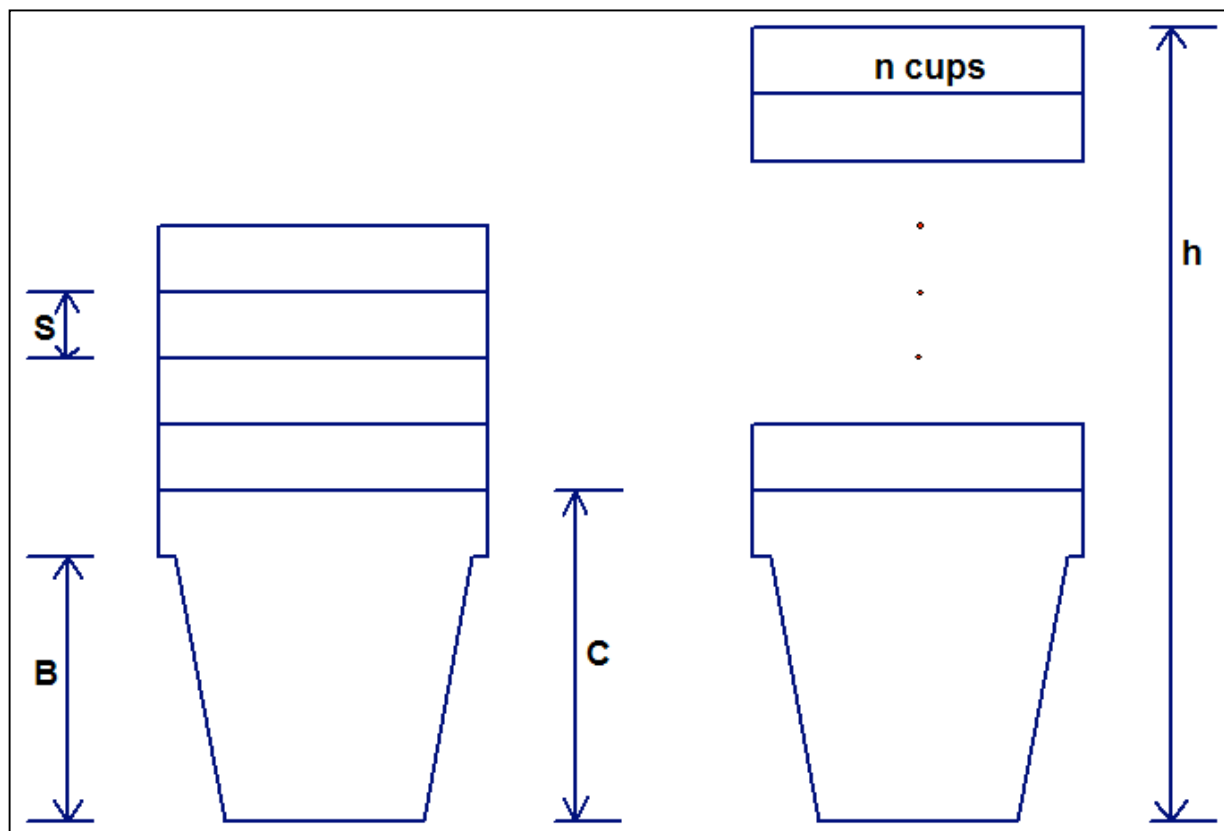
The dimensions of one particular type of cup have been labeled:

$C = 9.0$ cm = the individual cup height

$S = 1.5$ cm = the “stick up” height of the cup (see diagram for clarification)

$B = 7.5$ cm = the height of the individual cup without the stick up part

Figure I



Suppose the cups of Figure 1 are sold in a box that holds one stack of cups that is 27 cm high (inside dimension). How many cups are in a box?

1. Answer this question using the graph of the height function, $h = 1.5n + 7.5$.

2. a. Answer the question again, this time using your function rule, $h = 1.5n + 7.5$.

b. Interpret the steps you took to solve the equation in terms of the situation.

3. How can you find the solution using the table in a graphing calculator?

4. a. What if the box is 30.25 cm high (inside dimension)?

b. How can you find the solution using the table feature of the graphing calculator?

c. Describe another way that you could find the solution.