# Linear Equations: Using Symbols
## Extend Your Learning
## Answers and Explanations

Write an algebraic equation to represent each situation and then solve the equation.

1. Jake is working at the Happy Hollow Apple Orchard picking apples. He is paid $2 for each 5-pound container of apples that he picks. So far today, he has picked 7 containers of apples. His goal for the day is to pick 125 pounds of apples. How many more containers must he pick to reach his goal?
   The $2 in the problem is additional information that will not be used to find out the number of containers. It will be helpful to relate the number of containers to the number of pounds of apples. Each container holds 5 pounds of apples. If x represents the number of containers, then 5x represents the number of pounds of apples. Since he has already picked 7 containers, he has 35 pounds of apples (7 x 5 = 35).

   **Equation**
   $5x + 35 = 125$ where $x$ is the number of containers

   **Solve the equation**

   | | |
   |---|---|
   | $5x + 35 = 125$ | original equation |
   | $-35 \quad -35$ | subtract 35 from both sides of the equation |
   | $5x = 90$ | |
   | $\frac{5x}{5} = \frac{90}{5}$ | divide by 5 on both sides of the equation |
   | $x = 18$ | solution |

   Jake should pick 18 more containers of apples.

   **Check** 18 containers is equivalent to 90 pounds of apples (18x5=90). He already picked 7 containers (or 35 pounds). 90+35=125 pounds, which was his goal.

2. Denise has a summer job that pays her $6 per hour. It costs her $10 per week for round-trip transportation to her job. She wants to save half of what she has left (after transportation) with her goal being to save $55 each week. How many hours must she work each week to do this?

   To build the equation for this problem, multiply $6 times h where h is the number hours worked. Then subtract $10 (her transportation cost) from this expression and divide by 2 (since she wants to save half of her remaining income). The result will be $55.

   **Equation**
   $\frac{6h - 10}{2} = 55$ where $h$ is the number of hours Denise works.

**Solve the equation**

| | |
|---|---|
| $\frac{6h-10}{2}=55$ | original equation |
| $2\left(\frac{6h-10}{2}\right)=2(55)$ | multiply both sides of the equation by 2 |
| $6h-10=110$ | |
| $\underline{+10 \quad +10}$ | add 10 to both sides of the equation |
| $6h \quad =120$ | |
| $\frac{6h}{6}=\frac{120}{6}$ | divide by 6 on both sides of the equation |
| $h=20$ | solution |

Denise should work 20 hours per week.

**Check** 20 hours per week times \$6 is \$120 per week. Subtract transportation costs \$120 - \$10 is \$110. Save half \$110 ÷ 2 is \$55.

3. Theresa earns \$10 per hour. If she works on Thanksgiving, she earns twice as much per hour. She earned \$470 for the week including Thanksgiving. How many hours did Theresa work on Thanksgiving if she worked 35 hours during the rest of the week?

Since Theresa typically earns \$10 per hour, she would earn twice that amount, \$20 per hour, on Thanksgiving. To build the equation for this problem take \$20 times h where h is the number hours worked on Thanksgiving Day. In addition, she has already earned \$350 from the first 35 hours of work at a rate of \$10 per hour. She earns a total of \$470.

**Equation**
20h + 350 = 470 where *h* is the number of hours worked on Thanksgiving

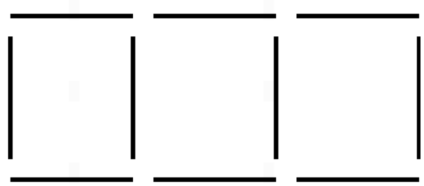
**Solve the equation**

| | |
|---|---|
| $20h+350=470$ | original equation |
| $\underline{-350 = -350}$ | subtract 350 from both sides of the equation |
| $20h \quad =120$ | |
| $\frac{20h}{20}=\frac{120}{20}$ | divide both sides of the equation by 20 |
| $h=6$ | solution |

Theresa worked 6 hours on Thanksgiving Day.

**Check** $20 times 6 hours is $120 for Thanksgiving pay. $10 times 35 hours is $350 for regular pay. $120 + $350 is $470 for total earned during Thanksgiving week.

4. You can build three connected squares with 10 toothpicks. How many connected squares can you build with 103 toothpicks?



To build the equation, notice that it takes three additional toothpicks each time to complete one more square. This means the starting value (no squares) would be 1.

This might be easier to visualize in the table.

| # of squares | # of toothpicks |
|---|---|
| 1 | 4 |
| 2 | 7 |
| 3 | 10 |

Another way to think about the pattern is to look at the figure. Notice that when there are 3 squares, there are 3 horizontal toothpicks on the top of the squares and 3 horizontal toothpicks on the bottom of the squares. There are 4 vertical toothpicks (or one more than the # of squares). This pattern holds for any number of squares. So the number of horizontal toothpicks (top and bottom) is 2x and the number of vertical toothpicks is x + 1. The equation could be written 2x + (x + 1)=103. This can be simplified 3x + 1=103.

**Equation** 3x + 1=103 where *x* is the number of connected squares formed by the toothpicks

| | |
|---|---|
| $3x + 1 = 103$ | original equation |
| $-1 \quad -1$ | subtract 1 from both sides of the equation |
| $3x \quad = 102$ | |
| $\frac{3x}{3} = \frac{102}{3}$ | divide each side of the equation by 3 |
| $x = 34$ | solution |

34 connected squares can be formed by using 103 toothpicks.

**Check** There are 34 toothpicks on top. There are 34 toothpicks on bottom. There are 35 vertical toothpicks. The total is 34 + 34 + 35 = 103 toothpicks.