## Unit 4 Lesson 17: Writing Inverse Functions to Solve Problems

### 1 Water in a Tank

#### Student Task Statement

A tank contained some water. The function $w$ represents the relationship between $t$, time in minutes, and the amount of water in the tank in liters. The equation $w\left(t\right)=80−2.5t$ defines this function.

1. Discuss with a partner:
	1. How is the water in the tank changing? Be as specific as possible.
	2. What does $w\left(t\right)$ represent? Is $w\left(t\right)$ the input or the output of this function?
2. Sketch a graph of the function. Be sure to label the axes.



### 2 Another Look at the Tank

#### Student Task Statement

A tank contained 80 liters of water. The function $w$ represents the relationship between $t$, time in minutes, and the amount of water in the tank in liters. The equation $w\left(t\right)=80−2.5t$ defines this function.

1. How much water will be in the tank after 13 minutes?
2. How many minutes will it take until the tank has 5 liters of water?
3. In this situation, what information can we gain from the inverse of function $w$?
4. Find the inverse of function $w$. Be prepared to explain or show your reasoning.
5. How would the graph of the inverse function of $w$ compare to the graph of $w$? Describe or sketch your prediction.

#### Activity Synthesis





### 3 Phones in Homes

#### Student Task Statement

In 2004, less than 5% of the homes in the U.S. relied only on a cell phone. Since then, the percentage of homes that used only cell phones have increased.

Here are the percentages of homes with only cell phones from 2004 to 2009.

| years since 2004 | percentages |
| --- | --- |
| 0 | 4.4 |
| 1 | 6.7 |
| 2 | 9.6 |
| 3 | 13.6 |
| 4 | 17.5 |
| 5 | 22.7 |



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1. Suppose a linear function, $P$, gives us the percentage of homes with only cell phones as a function of years since 2004, $t$.
* Fit a line on the scatter plot to represent this function and write an equation that could define the function. Use function notation.
1. Use your equation to find the value of $P\left(6\right)$. Then, explain what it means in this situation.
2. Use your equation to solve $P\left(t\right)=30$ for $t$. What does the solution represent?
3. Suppose we want to know when the percentage of homes with only cell phones would reach 50%, 75%, or 100% (assuming that the trend continues and the function stays valid). What equation could be written to help us find the years that correspond to those percentages? Show your reasoning.



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