## Lesson 10: Combining Functions

* Let’s make some new functions using other functions.

### 10.1: Notice and Wonder: Are Book Sales Improving?

What do you notice? What do you wonder?

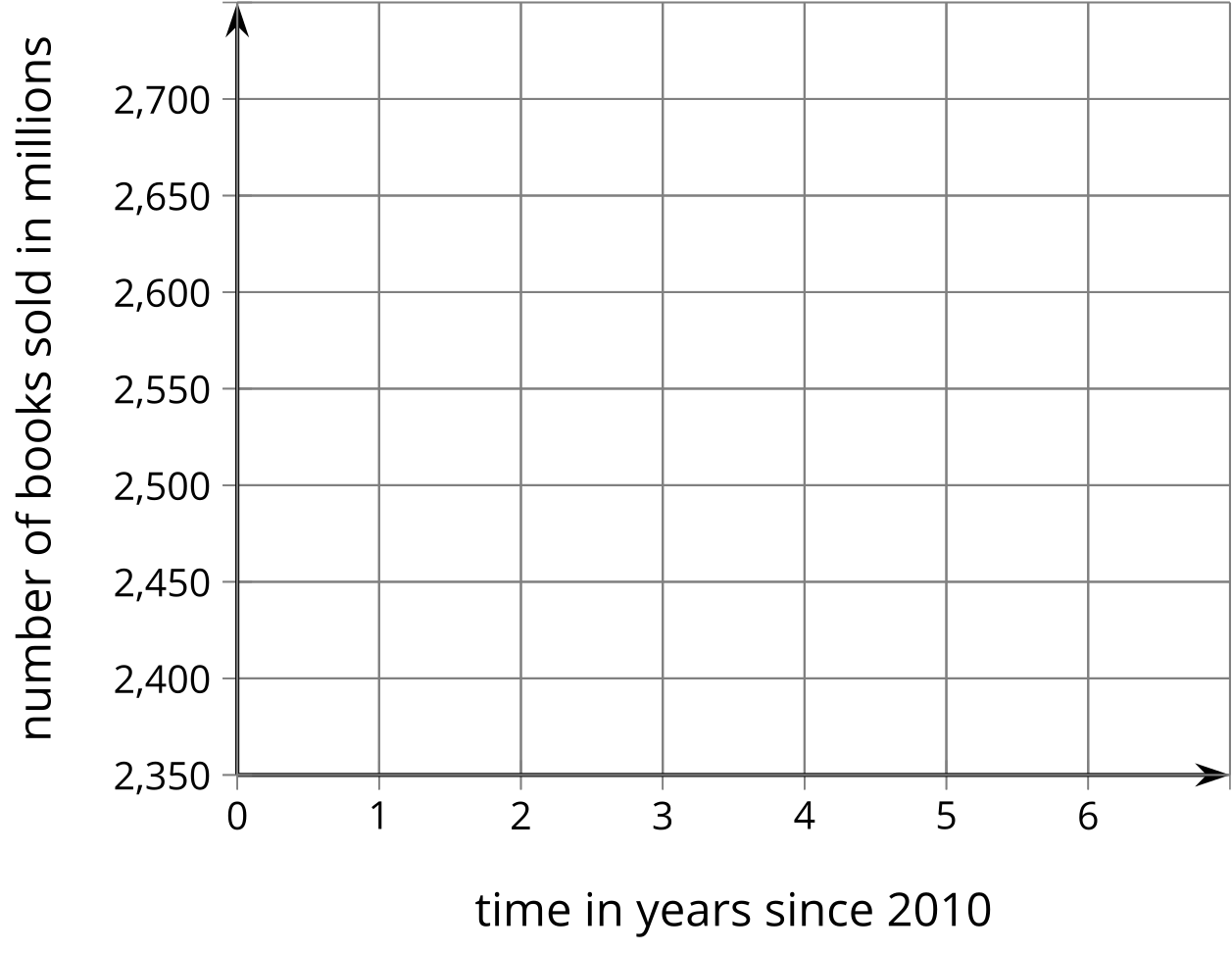
| (years since 2010) | number of books sold in the US (millions) | population of the US (millions) |
| --- | --- | --- |
| 0 | 2,530 | 309.35 |
| 1 | 2,400 | 311.64 |
| 2 | 2,730 | 313.99 |
| 3 | 2,720 | 316.23 |
| 4 | 2,700 | 318.62 |
| 5 | 2,710 | 321.04 |
| 6 | 2,700 | 323.41 |

### 10.2: How Many Books Can One Person Have?

The table shows the values of two functions, and , where is the population of the US, in millions, years after 2010, and is the number of books sold per year, in millions, years after 2010.

| (years since 2010) | (millions) | (millions) |  |
| --- | --- | --- | --- |
| 0 | 2,530 | 309.35 |  |
| 1 | 2,400 | 311.64 |  |
| 2 | 2,730 | 313.99 |  |
| 3 | 2,720 | 316.23 |  |
| 4 | 2,700 | 318.62 |  |
| 5 | 2,710 | 321.04 |  |
| 6 | 2,700 | 323.41 |  |

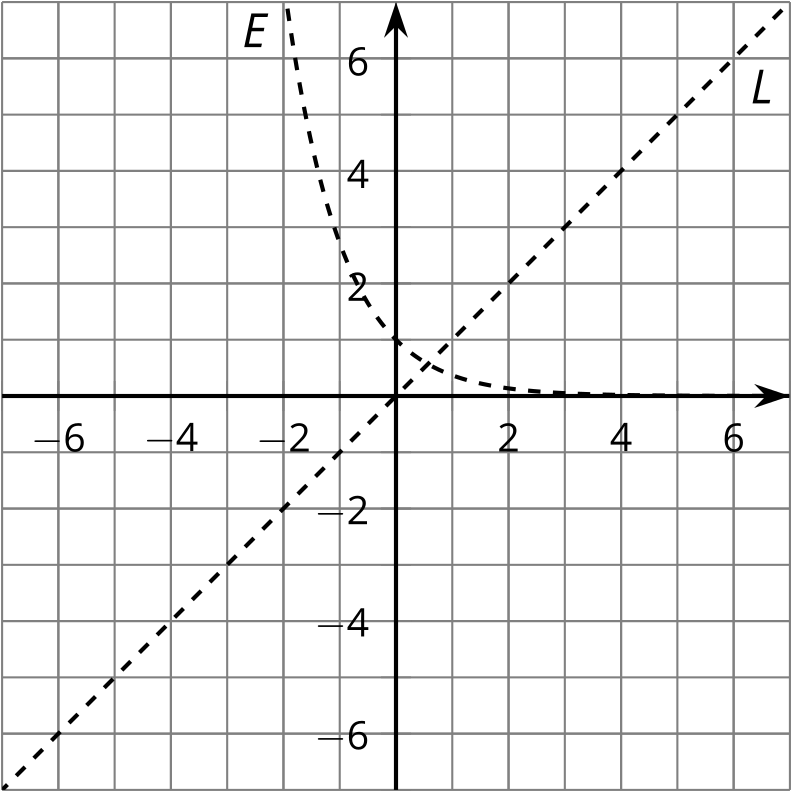
1. Plot the values of as a function of . What does the plot tell you about book sales?

* 

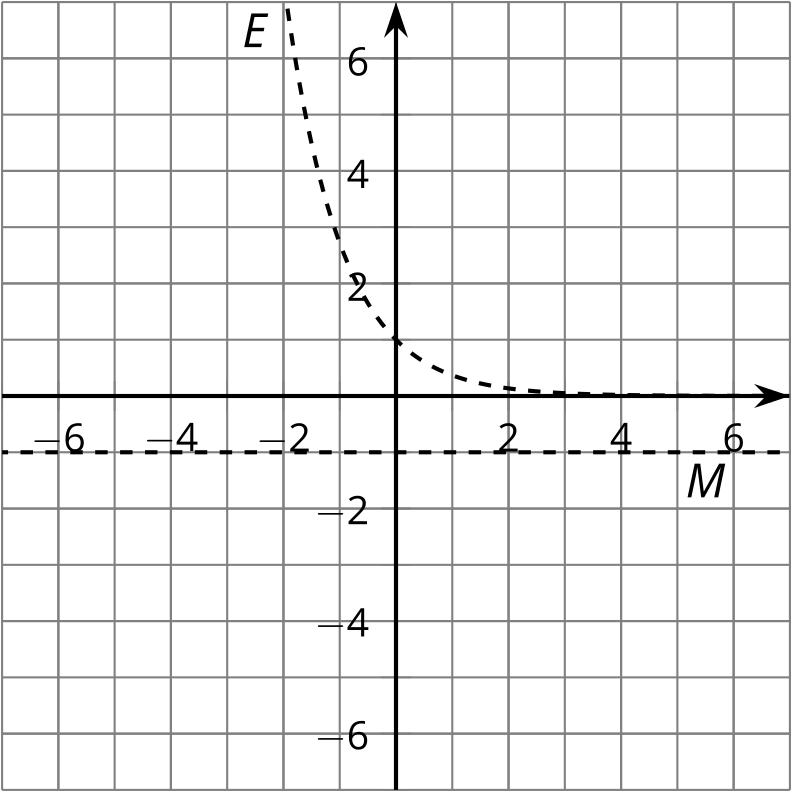
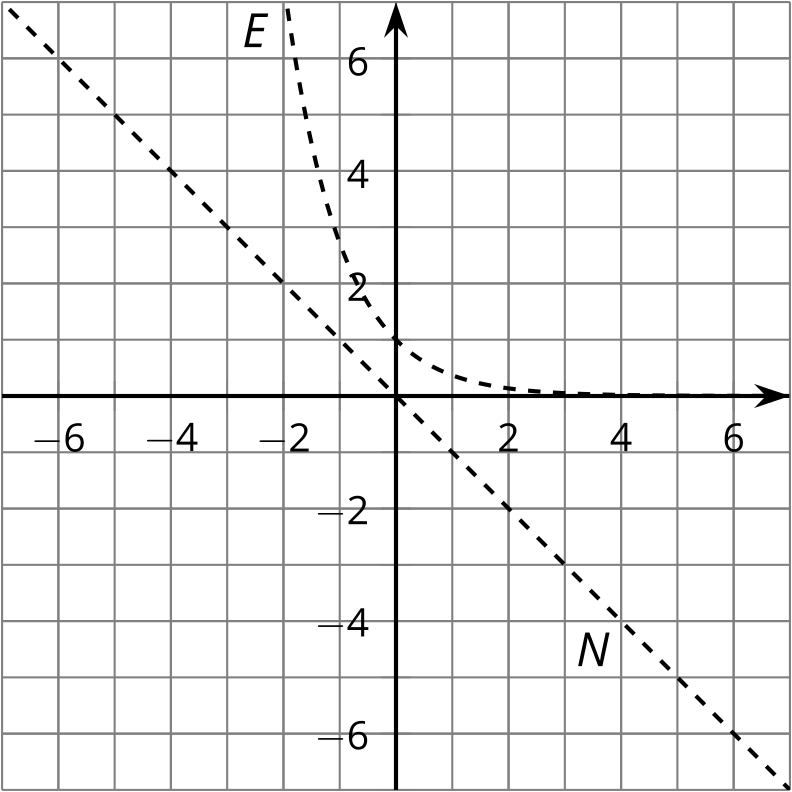
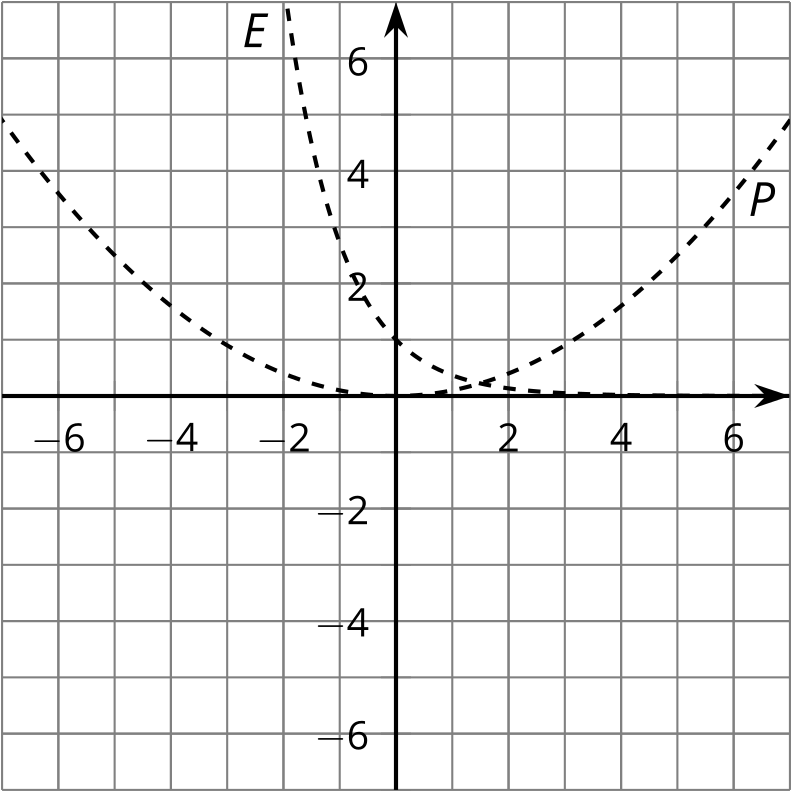
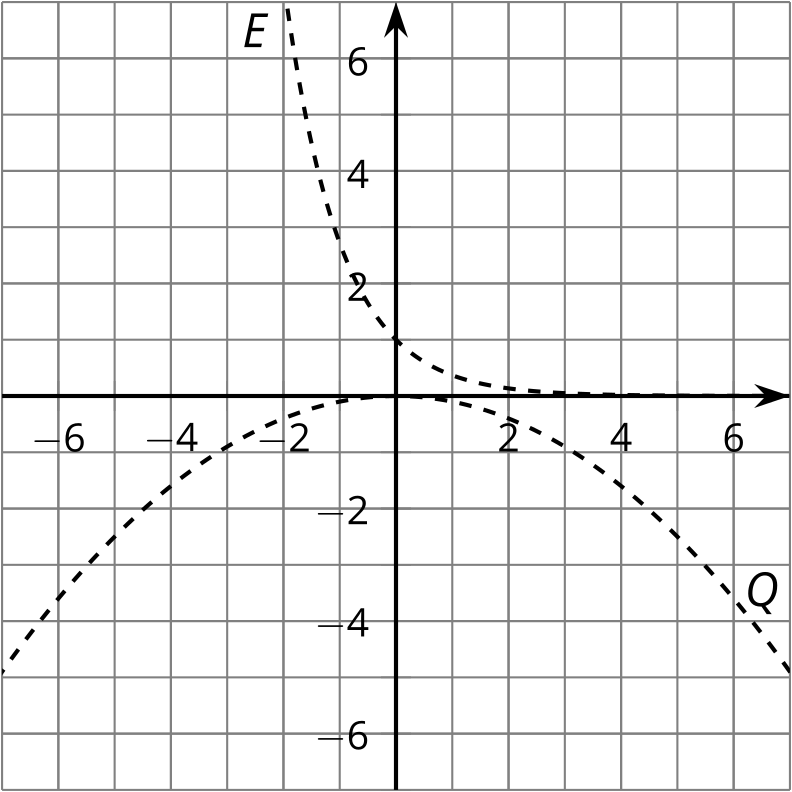
1. How many books were sold per person in 2010 and 2016? What do these values tell you about book sales?
2. Define a new function by . Complete the table and then graph the values of . What do the values of tell you?

### 10.3: Adding Functions

1. Here are the graphs of two functions, and . Define a new function by adding and , so . On the same axes, sketch what you think the graph of looks like.

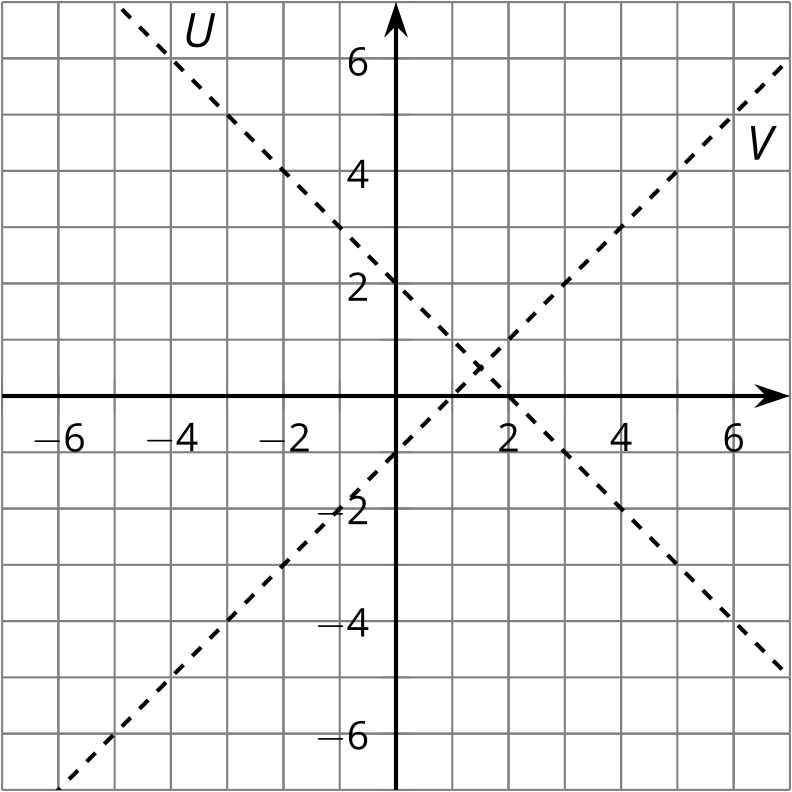
* 

1. Sketch the graph of the sum of and each of the following functions.

* 
* 
* 
* 

#### Are you ready for more?

Here are the graphs of two functions, and . Define a new function by multiplying and , so . On the same axes, sketch what you think the graph of looks like.

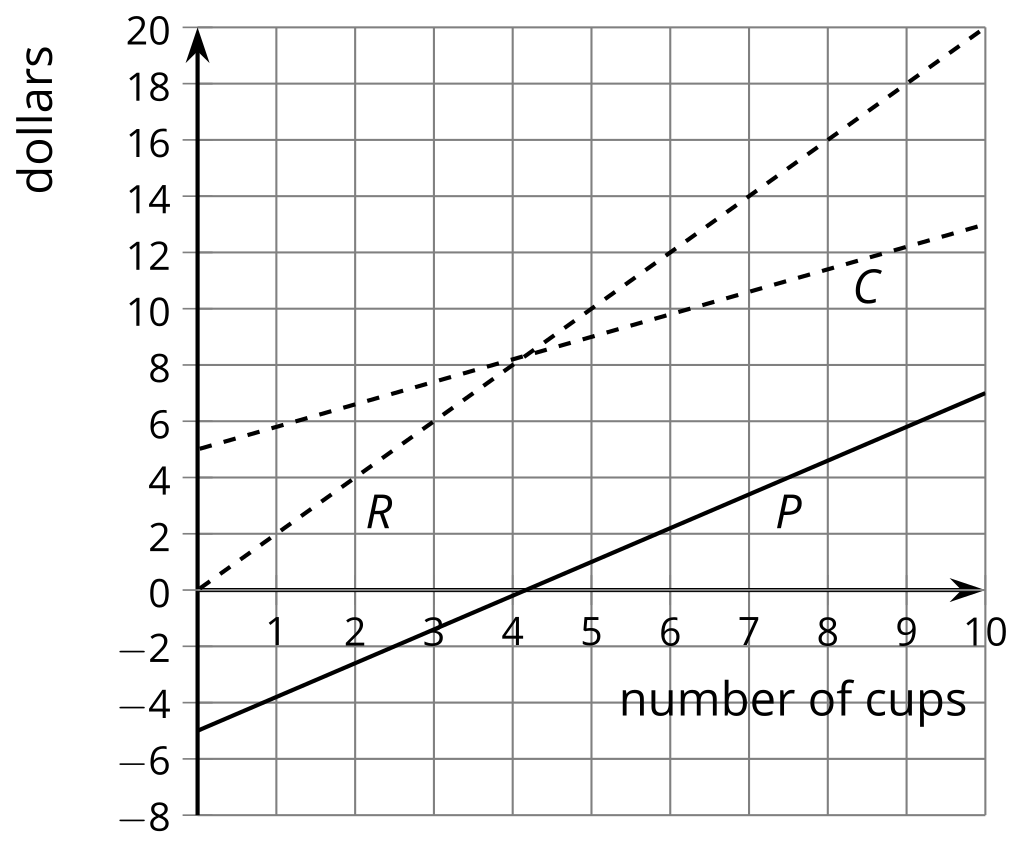


### Lesson 10 Summary

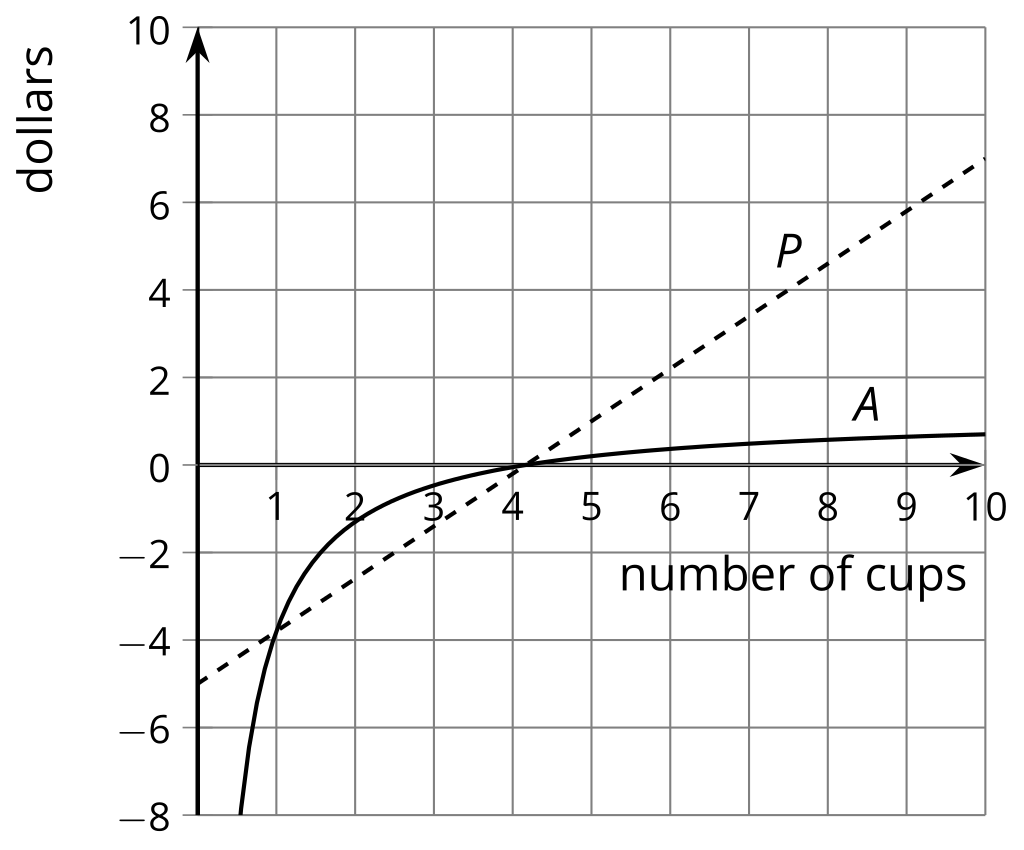
We can add, subtract, multiply, and divide functions to get new functions. For example, the cost in dollars of producing cups of lemonade at a lemonade stand is . The revenue (amount of money collected) from selling cups is dollars. The profit from selling cups is the revenue minus the cost, so

Here are the graphs of , , and . Can you see how each value on is the result of the difference between the corresponding points on and ?

The average profit per cup, , from selling cups, is the quotient of the profit and the number of cups, so



Here are the graphs of and . Can you see how the value of is the result of the quotient of and ? Why does it make sense that both functions are negative when and positive when ?



Since can only be positive, and always have the same sign for a given value. Notice that for the average profit to be positive, the seller has to sell at least 5 cups (since is not in the domain, we must round up). It is also true that for a large number of cups, the average profit is close to $1.20 per cup.



© CC BY 2019 by Illustrative Mathematics®