**Trends in Bottled Water Consumption**

Here is a data table that shows the consumption of bottled water in the United States in the years 2000 and 2007 in billions of gallons. Let’s assume that during this period consumption was a linear function of time.

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| **U.S. Bottled Water Consumption** |
| **Year** | **Billions of Gallons** |
| 2000 | 4.7 |
| 2007 | 8.8 |

1. Let *x* represent the number of years from 2000 and *y* represent the amount of water consumed in billions of gallons. Make a graph with *x* on the horizontal axis and *y* on the vertical axis by plotting the two points and using a ruler to draw a line between the two points (do not extend the line.)



1. Find the rate of change in water consumption per year using data for the years 2000 and 2007.
2. Use the rate of change from question 2 and the *y*-intercept of your graph to write a linear equation in slope-intercept form.
3. Use your equation from question 3 to determine the consumption of bottled water in 2004.
4. A more accurate figure for the consumption of bottled water in 2007 is 8757.4 million.
5. Write this large number in standard decimal notation.
6. Assume that the average water bottle contains 24 ounces. Estimate the actual number of water bottles sold. Use the fact that one gallon contains 128 ounces.
7. The population of the United States in 2007 was about 300 million. On average how many water bottles were purchased by each person in the country?
8. In 2008, bottled water consumption decreased from about 8.8 billion gallons in 2007 to 8.7 billion in 2008. What are some possible reasons?
9. Here is a table that shows the consumption of bottled water in the United States from 2007 to 2009 in billions of gallons. As you can see, consumption continues to decline. So from 2007 to 2009 we will use a new linear function to model bottled water consumption.

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| **U.S. Bottled Water Consumption** |
| **Year** | **Billions of Gallons** |
| 2007 | 8.80 |
| 2009 | 8.45 |

1. As you did in question 1 above, let *x* represent the number of years from 2000 and *y* represent the amount of water consumed in billions of gallons. Make a graph with *x* on the horizontal axis and *y* on the vertical axis by plotting the two points and using a ruler to draw a line between the two points and extending the line to the right.



1. Find the rate of change in water consumption per year using data for the years 2007 and 2009.

Unlike the equation for the water consumption in question 1, we are not able to find the

*y*-intercept unless we do a little work. So how will we find an equation? Recall that the slope between any two points on a line is the same.

1. If water consumption continues to decline at a steady rate, the slope of the line will continue to be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Use slope to count over to a third point on your line to the left of (7,8.8), and state the coordinates.
3. Then find the slope between the point you picked and the point (7,8.8).

Check with a few classmates to see if you all are getting the same slope you found in question 6b.

1. Now label an arbitrary point on your line (*x,y*). Instead of using numbers in the second point, use the variables *x* and *y*, because there are many different values of *x* and *y* on the line.
2. Use the slope formula to find the slope from this arbitrary point (*x,y*) to the point (7, 8.8) and you should still get the same slope. Why?

Here is the algebra:

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| $\frac{y-8.8 }{x-7}$ = *m* | Do a little algebra to transform the equation. |
| *y* – 8.8 = *m*(*x* – 7) | Multiply both sides of the equation by *x* – 7 to bring the denominator up to the right side. |
| *y* – 8.8 = –0.175(*x* – 7) | Fill in the value for slope and you will have an equation in Point-Slope form. |

Point-slope form simply asserts that the slope between the fixed point (7, 8.8) on the line and any arbitrary point (*x,y*) is the same slope *m*; in this case *m* = –.175.

1. To confirm that this equation contains the point (7, 8.8), substitute *x* = 7 and *y* = 8.8 into the equation *y* – 8.8 = –0.175(*x* – 7). Check to see if the result is a true statement.
2. To confirm that this equation contains the point (9, 8.45), substitute *x* = 9 and *y =* 8.45 into the equation *y* – 8.8 = –0.175(*x* – 7). Check to see if the result is a true statement.
3. Solve for *y* to transform the equation to slope-intercept (*y* = *mx* + *b*) form.