Slope – Investigation

Consider the following situation: At her annual physical, Mrs. Smith, the health teacher at Smedley Middle School, found that she was 153 centimeters tall and that she weighed 120 kilograms. After being diagnosed with hypertension (high blood pressure) and high cholesterol, she decided that she would follow a diet planned and supervised by her doctor. On this diet, Mrs. Smith planned to lose 0.5 kg per week.

1. Fill in the table at right to show Mrs. Smith's weight during the first 10 weeks of her diet, if she continues this pattern. Also give her weight for the *n*th week in the process column.

2. Using the variables *n* for week number and *w* for weight, write a function rule to describe Mrs. Smith's weight after n weeks. Be sure to use function notation.

Week	Process Column	Weight
0		120kg
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
n		

3. In a previous lesson, you learned how to find rate of change. Using the ordered pairs $(n, w(n))$, write the ordered pairs that represent her weight for weeks 3 and 4. What is Mrs. Smith's rate of change in kilograms per week between weeks 3 and 4?

In each of the following problems, be sure to justify your answer.

4. What is her rate of change in kilograms per week between weeks 3 and 5?

5. What is her rate of change in kilograms per week between weeks 2 and 8?

6. Stop now and compare your answers with those of your group. What conclusion can you draw about the rate of change in this function?

7. Determine an appropriate viewing window for the graph of this function, and **justify your choice of windows**.

   *x*min

   *x*max

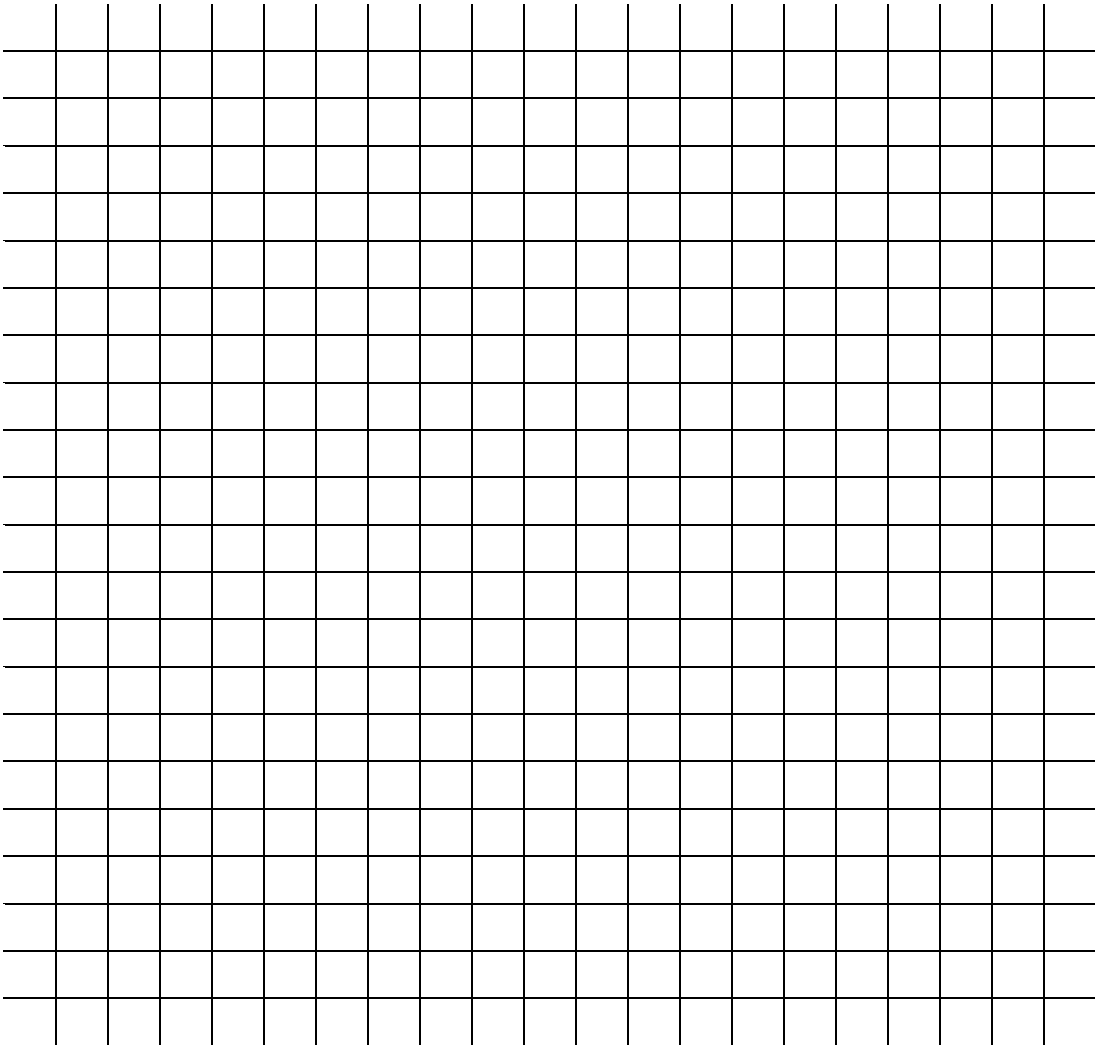
   *x*scale

   *y*min

   *y*max

   *y*scale

8. Graph the function on the grid provided below. Be sure to draw and label your axes, label the tick marks, and label the graph.



9. Discuss with your group the appearance of the points that you graphed above. Write any conclusions that you consider important about that appearance in the space below.

In every situation in which there is a **constant rate of change** between points, the points will always lie on a line. **This constant rate of change is called the slope of the line.**

In mathematics the Greek symbol Δ means "**change**". In problems 3, 4, and 5, you found that the rate of **change** was -0.5 kg per week. You found this by finding the **change** in kilograms and dividing it by the **change** in weeks. This is exactly what slope is. If you have two ordered pairs (x_1, y_1) and (x_2, y_2), then the slope is:

$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

10. Pick any two points on the graph that you made in problem 8. List those two points as ordered pairs and show how to determine the slope between them.

11. Pick two points, different from the ones you chose for problem 10. List those two points as ordered pairs and determine the slope between them.

12. Consider the function that you wrote in problem 2, the rate of change that you found in problems 3 - 5, and the graph that you made in problem 8. Explain how to find the slope from the function, from the rate of change, and visually from the graph.

Slope – Independent Activity

Do this assignment on your own paper. Show each step for each problem. Carefully give each explanation.

1. In the class work, you learned the formula for slope. That formula is $\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$. The practical way to find slope is (difference in y) divided by (difference in x). Use that formula to find the slope between the points (0, 2) and (1, 7).

2. Find the slope between the points (5, 0) and (6, 0). This is a special slope. Graph these two points so that you notice the appearance of the line between them.

3. Find the slope between the points (0, 5) and (0, 6). Again, this is a special case. Graph these two points so that you notice the appearance of the line between them.

4. One way to show that 3 or more points lie on the same line is to **determine that the slope between pairs of points is the same.** Prove that the points (0, 2), (2, 5), and (6, 11) do or do not lie on the same line.

5. Prove that the points (3, 2), (1, 0), and (-2, -5) do or do not lie on the same line.

6. Given the function f(x) = 2x + 3, find two points on the graph, and find the slope between these two points. Remember, you CAN find two points on this line. If x is 0, what is f(x)? That gives you one ordered pair (0, 3). Find another point. Calculate the slope.

7. Given the function g(x) = 3x – 2, find two points on its graph, and find the slope between these two points.

8. Given the function m(n) = $\frac{2}{3}$n + 2, find two points on its graph, and find the slope between these two points.

9. Look carefully at the slopes of the lines in 6, 7, and 8. Do you notice the slope that you determined somewhere in the equation? Explain what you notice.

10. Find the slope of the equation 2x + 3y = 6. **Remember, find two points, then find the slope.** Is this slope as obvious in the equation? Can you find it in the equation? Where?