

Slope Investigation

At her annual physical, Mrs. Smith, the health teacher at Smedley Middle School, finds that she is 153 centimeters tall and that she weighs 120 kilograms. After being diagnosed with hypertension (high blood pressure) and high cholesterol, she decides that she will follow a diet planned and supervised by her doctor. On this diet, Mrs. Smith plans to lose 0.5 kg per week.

1. Complete the table at right to show Mrs. Smith's weight during the first 10 weeks of her diet, if she is able to lose 0.5 kg per week.
2. Using the variables n for week number and w for weight, write a rule to describe Mrs. Smith's weight after n weeks.
3. Is there information provided for mid-week values? Can Mrs. Smith's weight fluctuate during the week as long as her cumulative weight loss for the week is 0.5 kg? How do these answers affect the domain of the data?

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

4. 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 between weeks 3 and 4? Include units in the answer.
5. What is her rate of change in kilograms per week between weeks 3 and 5? Show the points and the method used to calculate the answers.
6. What is her rate of change in kilograms per week between weeks 2 and 8? Show the points and the method used to calculate the answers.
7. What conclusion can you draw about the rate of change for this data?

8. Determine an appropriate window for the data then graph the data on the grid provided. Label both axes and the graph.

x -minimum

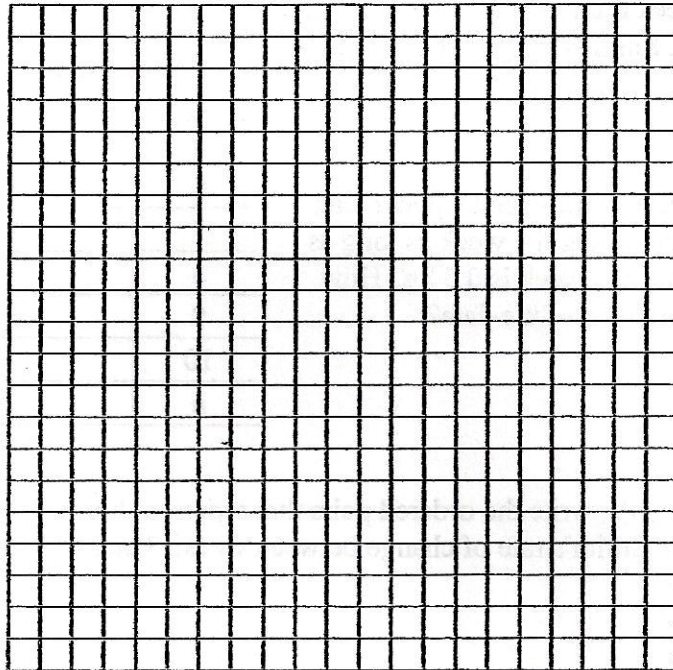
x -maximum

x -scale

y -minimum

y -maximum

y -scale



9. Explain why the data cannot be connected with a line segment.

When there is a constant rate of change between points, the points will follow a linear pattern. This constant rate of change is called the slope.

In mathematics, the Greek symbol Δ means "change." In questions 4, 5, and 6, the rate of change was calculated by determining the change in kilograms and dividing it by the change in weeks. For any two ordered pairs, (x_1, y_1) and (x_2, y_2) , the slope is $\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$.

10. Select any two points on the graph that you made in question 8. List those two points as ordered pairs and show how to determine the slope algebraically.

11. Select two additional points and calculate the slope algebraically.

12. Explain how to calculate the slope, or average rate of change, from the table, from the graph, and from two coordinate points.

13. At the end of week 20, how many pounds will Mrs. Smith expect to weigh if she has lost 0.5 kg per week? (1 kg \approx 2.205 lbs). Show the work that leads to your answer.

14. If she loses 0.5 kg per week, Mrs. Smith wants to know when she will weigh 205.065 pounds. Show the work that leads to your answer.

15. Complete the following:

a. Using the slope formula $\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$, calculate the slope of the line containing the points (0, 2)

and (1, 7). Sketch a graph of these two points and draw a line that contains them.

b. Calculate the slope of the line containing the points (5, 3) and (6, 3). Sketch a graph of these two points and draw a line that contains them, labeling the line *a*. Repeat with the points (3, 5) and (3, 6), labeling the line *b*.

c. Write a statement about the slopes and graphs in part (b).

d. One method that can be used to show that three or more points lie on the same line is to determine that the slope between pairs of points are the same. Show whether the points (0, 2), (2, 5) and (6, 11) do or do not lie on the same line.

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

- f. For the function $f(x) = 2x + 3$, determine two points on the graph and calculate the slope between the two points. Show your work.
- g. For the function $g(x) = -3x - 2$, determine two points on the graph and calculate the slope between the two points. Show your work.
- h. For the function $h(x) = \frac{2}{3}x + 2$, determine two points on the graph and calculate the slope between the two points. Show your work.
- i. How is the slope of a function represented in the function rule?
- j. Consider the equations $2x + 3y = 6$ and $y = -\frac{3}{4}(x - 2) + 7$. Explain how you can determine the slope for each equation.