

Height and Weight

You will need:

graph paper



Dr. Terwit, a pediatrician, kept records of her son Joshua's height and weight from birth to age four years. We will use these numbers to learn about *rate of change*.

Age	Height (cm)	Weight (kg)
birth	51	3.4
3 mo	60	5.7
6 mo	66	7.6
9 mo	71	9.1
12 mo	75	10.1
15 mo	79	10.8
18 mo	82	11.4
2 yr	88	12.6
2.5 yr	92	13.6
3 yr	96	14.6
4 yr	103	16.5

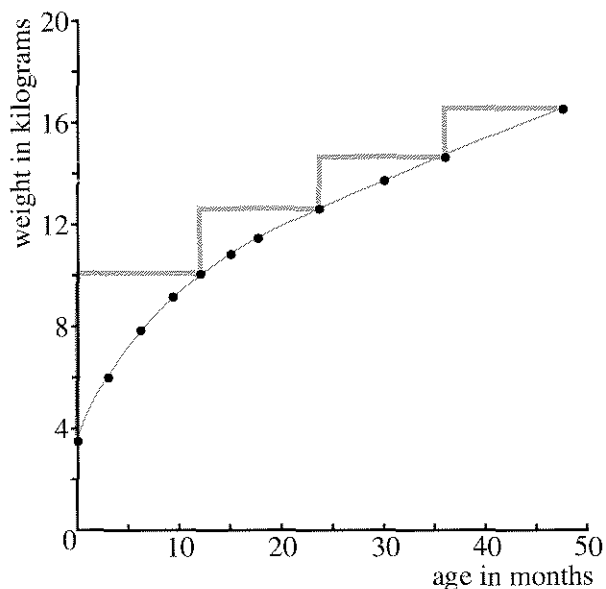
HEIGHT AS A FUNCTION OF AGE

- Make a graph to represent height as a function of age. (Note that the ages given are not evenly spaced.)
- What is the increase in height between:
 - birth and three months?
 - 15 months and 18 months?
 - birth and one year?
 - three years and four years?
- Did Joshua's height grow faster or more slowly as he grew older? Explain your answer by referring to:
 - the answers to problem 2;
 - the shape of the graph.
- If Joshua had grown the same number of centimeters every month, what would his average rate of growth be, in *centimeters per month*, between:
 - birth and three months?
 - 15 months and 18 months?
 - birth and one year?
 - three years and four years?
- What was Joshua's *average rate of growth* in centimeters per month during his first four years? Compare this average with the averages you found in problem 4.
- Summary** Write a short paragraph summarizing the relationship between Joshua's age, his height, and the rate of his growth. In particular, explain the idea of average rate of growth and how it changed with his age.

7. **Project** Find out how many sizes there are for babies' and children's clothes in the age range studied here. Is what you find consistent with the information in the table?

WEIGHT AS A FUNCTION OF AGE

This is a graph of weight as a function of age. The straight lines form four *steps* connecting some data points.



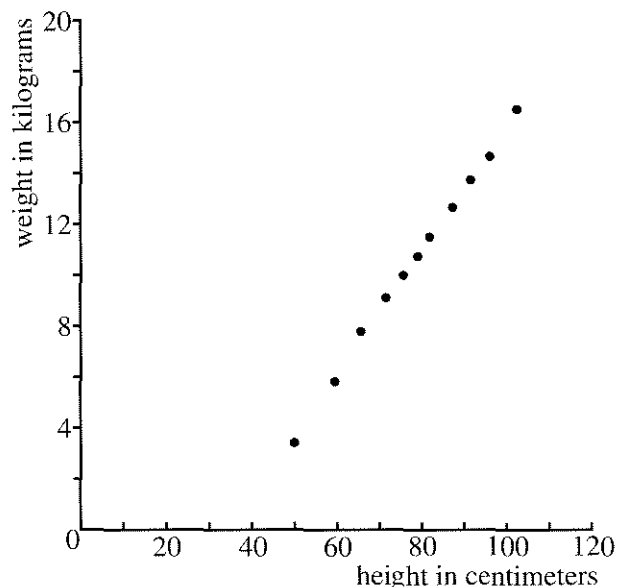
8. Use the data to answer these questions about the graph.
- How high is each step? (Give your answer in kilograms.)
 - How wide is each step? (Give your answer in months.)
 - Explain the meaning of your answers to (a) and (b) in terms of the *yearly* change in Joshua's weight.
9. Find the average *monthly* weight gain between ages
- two and two-and-a-half;
 - two-and-a-half and three;
 - two and three.

10. **Key** Joshua's weight grew at a fairly constant monthly rate between ages one and four. Explain how this can be seen
- on the graph;
 - numerically.


11. **Key** However, his weight grew much more slowly between ages one and four than during his first year. Explain how this can be seen
- on the graph;
 - numerically.

WEIGHT AS A FUNCTION OF HEIGHT

This is a graph of weight as a function of height.



12. How much weight did Joshua gain for each centimeter he gained in height? Answer this question for the following periods:
- birth and three months;
 - ages three and four;
 - on the average, over the four years.

13. Study the preceding graph and table and make calculations to find the time in Joshua's first four years when he gained
- the least weight per centimeter;
 - the most weight per centimeter.
14.  Compare the two graphs of weight (as a function of age and as a function of height). How are they alike? How are they different? Discuss the shape of the graphs, the units, and the rate of change.

Because the rate of change of weight as a function of height does not vary much, the data points fall close to a line. You could say that this data is nearly linear. In cases like this, it is a common statistical technique to approximate the data with a line. You will learn more about this in future lessons, but first you need to know more about lines and linear functions.

BOYS AND GIRLS

The following table shows the average height in inches of boys and girls, ages 9 through 18.

Age	Height (in.)	
	Girls	Boys
9	52.3	53.3
10	54.6	55.2
11	57.0	56.8
12	59.8	58.9
13	61.8	61.0
14	62.8	64.0
15	63.4	66.1
16	63.9	67.8
17	64.0	68.4
18	64.0	68.7

15. **Report** Write a report comparing the height and the rate of growth of boys and girls. Include a graph showing the heights of both boys and girls as a function of age, on the same axes. (Since the graphs are close to each other, you may want to distinguish them by using color.) Your report should include, but not be limited to, answers to these questions.
- How many inches do boys and girls gain per year, on the average?
 - At what ages do they grow fastest?
 - How many inches do they gain per year during those growth spurts?