

## 2.1 Graph a Giraffe

*Nix and Nox are hanging out at the zoo looking at the giraffes, and talking about the first few weeks of their physics course.*

Nix: *(puzzled)* I was amazed when the physics teacher had everyone in class make a graph of the same lab data and there were so many different kinds of graphs. Weren't you?

Nox: Yea, some were tiny and some only had a line and some didn't have any labels. They were confusing. In science, graphs are a way to show how two variables are related. They need to be uniform so that everyone looking at the graph understands the clear relationship.

Nix: The teacher reviewed how to make good graphs, but she went so fast, I don't think I can remember all the details.

Nox: I remember learning about graphs in chemistry class, so maybe we can work on this together. I'm sure our next quiz is going to test our graphing abilities.

Nix: *(nervously)* Yea, I blew that last quiz. I really need to do better on this one.

Nox: The first thing in graphing is to determine which data column goes on the x axis and which goes on the y axis.

Nix: *(frustrated)* I know the teacher said that the x axis is the independent variable and the y axis is the dependent variable, but I don't know what that means. So that doesn't help me at all.

Nox: *(know it all)* The independent variable (x) is changed by the experimenter. Remember "I control the independent variable." The dependent variable (y) changes as a result of the experimenter's change. "y depends on x"

Nix: That's not so bad. I think I can remember that. Do you have to number both axes the same way? I'm never sure about that.

Nox: No, the two axes don't have to be the same. However, when you number the axis, remember to number each line evenly without any breaks. It's best to number by convenient multiples, like 2, 5, or 10, so it's easy to figure out the value for each point.

Nix: I remember the teacher said to label each axis clearly with the name and unit, like height and (meters).

Nox: When we plot the points on the graph, the teacher said to draw small circles around the points.

Nix: *(irritated)* Why is that? We never did that in math class. Is it just to make the points easier to see?

Nox: No. In science, numbers are measurements. Measurements always have uncertainty. The circles represent the plus and minus uncertainty in the measurement.



- Nix: So in math class, numbers aren't measurements, so they are exact. But in science there is always some uncertainty in measuring.
- Nox: Right. As we get more sophisticated, we'll learn how to graph with error bars to show the specific uncertainty for each measurement. Right now we're just approximating the uncertainty.
- Nix: Don't forget the title of the graph. The teacher made a big issue out of how to write the title. I don't see why it makes a difference about which label comes first.
- Nox: Since graphs always show relationships, it's common to title graphs "The Relationship of "y label" versus "x label." The accepted convention is that the label of the y axis comes first and the x axis comes second.
- Nix: (*catching on*) Is this just another science thing, where we always do it the same way, so everybody understands what we're talking about?
- Nox: Yep. You've got it! Don't forget to think about if the point (0, 0) makes sense on your graph or not. If it does, then plot it.
- Nix: So we're done, right? That makes a perfect graph.
- Nox: Not so fast. We need to draw the best fit line or smooth curve to show the relationship. This lets us figure out the mathematical equation that best represents the relationship.
- Nix: So the best fit line or curve is the average of all the data points. What is some of the points don't land on the line? Is that okay?
- Nox: Sure. Sometimes all the data points fit on the line and it shows a strong relationship. Sometimes the data points are scattered and don't fall on the line at all. This shows a weak or no relationship between the variables.
- Nix: (*with confidence*) Once we get the straight line, I know how to figure out the slope and y intercept. We've done that in math class.
- Nox: That's true, but in math class we usually take two data points and calculate the slope and y intercept. But in science class, it's better to choose two points on the line instead of data points because the line is the best average of all the data measurements.
- Nix: So, should I just look at the graph to see where the line crosses the y axis to determine the y intercept instead of calculating it? That doesn't seem very exact.
- Nox: Remember that you can't be more exact than your original measurements and the average of many measurements is always better than any individual measurement.
- Nix: Okay, I think I get it. Maybe we should practice making a graph. Look here's a big list of heights and weights of all the giraffes in the zoo herd. We can make a graph using that data.
- Nox: Let's each make our own graph and then compare to see if our graphs look the same.
- Nix: I bet my graph will be perfect... more perfecter than yours!

**Giraffe Height (m)**

1.3  
2.2  
3.1  
4.0  
5.5

**Giraffe Weight (kg)**

265  
456  
638  
821  
1136

