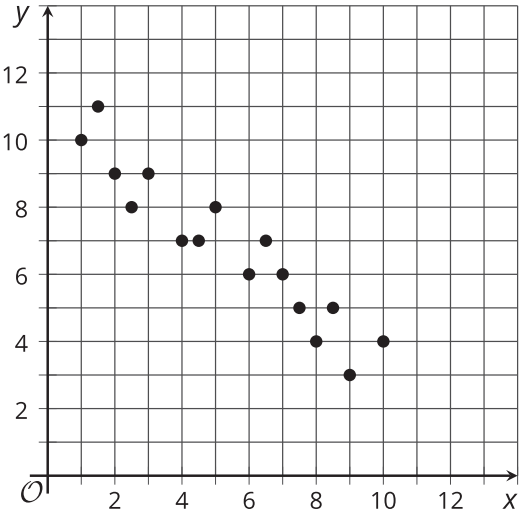
Unit 6, Lesson 21

Skills for Mathematical Modeling

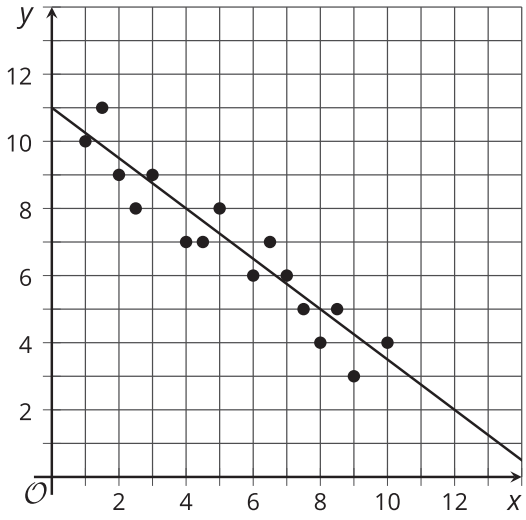
Let's practice our skills for modeling with mathematics.

21.1 Worked Example: What's the Line?

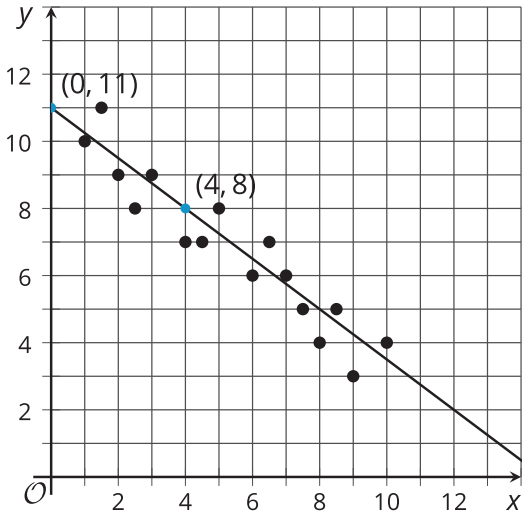
What is an equation that would be a reasonable model for this data?



Step 1:



Step 2:



Step 3: $\frac{8-11}{4-0} = \frac{-3}{4}$

Step 4: $y = -\frac{3}{4}x + 11$

21.2 Holy Agave!

In the spring, an agave plant sends up a flower spike. Here are some data collected from an agave plant in a garden in Tucson, AZ, starting on April 2:



day	height in inches
0	17
1	23
2	29
3	37
4	45
5	52
6	62
7	70
8	80

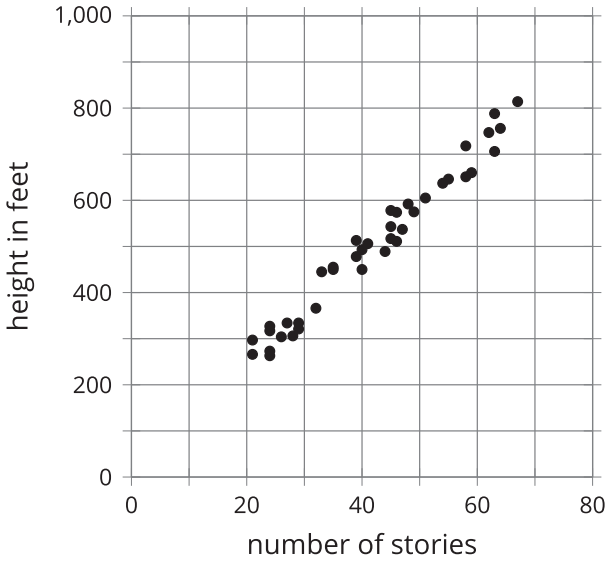
1. Use graphing technology to create a scatter plot with days as the first coordinate and height as the second coordinate.
2. Would a linear or exponential model be a better fit for this data?
3. Create a function that is a good model for the data. If you chose an exponential model, start with the equation $y = a \cdot b^x$ and select values for a and b. If you chose a linear model, start with the equation $y = mx + c$, and select values for m and c.

4. Graph your equation on the same coordinate plane as your scatter plot. Adjust the numbers you used in the equation to improve your model.
5. Explain what each number in your equation means in this situation.

6. Use your model to predict the height of the flower spike on Day 10.
7. Describe any limitations on the domain of the function modeling the data.

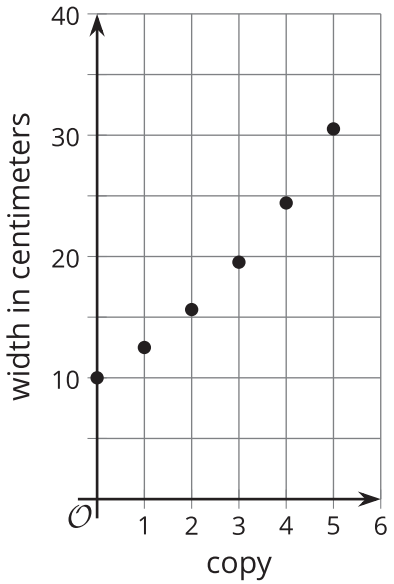
21.3 Let's Model Some Stuff

1. Data Set A shows the height in feet of some buildings and the number of floors in each building. Would a linear or exponential model be a better fit?



2. Which equation, where x represents the number of stories and y represents the height in feet of the building, would be the better model for the data?
   - $y = 11.5x + 21.5$
   - $y = 21.5 \cdot (11.5)^x$
3. What is the meaning of the 11.5 and the 21.5 in this situation?

4. Data Set B shows the results of using the "enlarge by 25%" feature on a copy machine several times on a photo. The width in centimeters of the photo is measured after each copy is made. Would a linear or exponential model be a better fit?



5. Which equation, where x represents the number of the copy and y represents the width in centimeters of the photo, would be the best model for the data?
   - $y = 25x + 10$
   - $y = 10 \cdot (0.25)^x$
   - $y = 10 \cdot (1.25)^x$
6. What is the meaning of the two numbers in the equation for the model?

7. Data Set C shows the height of an agave plant over time. Come up with an equation that would be a good model for this data.

day	0	1	2	3	4	5	6	7	8
height in inches	34	44	52	61	68	74	83	91	97

8. Data Set D shows the results from a person using a computer simulation to roll number cubes and counting how many rolls it takes before all of the cubes come up as sixes. This table shows the results. Come up with an equation that would be a good model for this data.

number of cubes	1	2	3	4	5
number of rolls	5	29	140	794	3,861