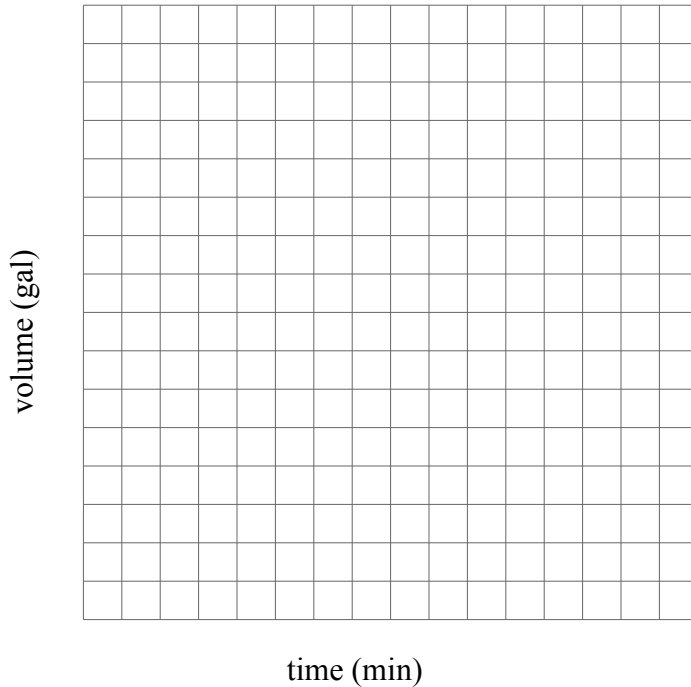


Playing with Linear Models, Part 2

Filling the big tank

You have a side job driving a tanker truck to gas stations and refilling their large underground gas tanks. The tank you're filling has a capacity of 8000 gallons. A couple minutes after you start pumping, you wonder how fast your truck's pump works, so you start check the volume of gasoline in the tank every few minutes. Your measurements are shown on the right.

1. Make a scatter plot of the measurements, including scales on the axes and a best-fit line.



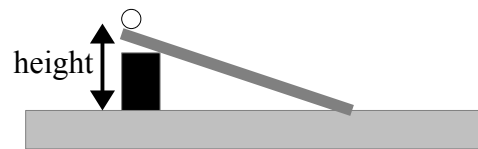
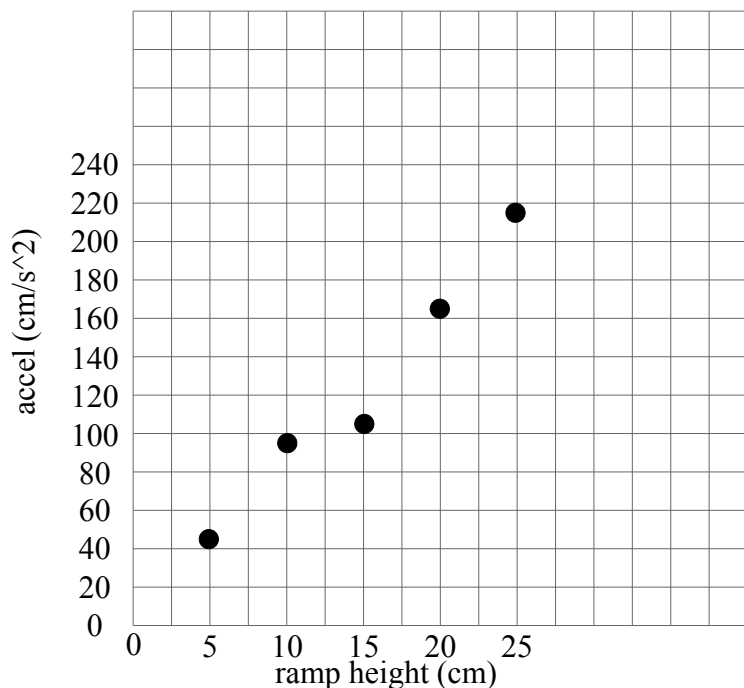
Time (min)	Volume (gal)
2	2000
5	2700
8	3100
12	3900
15	4800
20	5500
27	7100

2. Find the slope of your best-fit line, including its units. What does this slope tell you?
3. What's the y -intercept of your best-fit line? What does it tell you about the state of the tank when you started pumping?
4. Use your best-fit line or your equation to estimate how much gasoline would've been in the tank at the 10 minute mark.
5. Use your best-fit line or your equation to estimate when the tank would've reached its max of 8000 gallons.

Marble on a ramp

Mr. Stonebraker did an experiment with a ramp and a marble, as shown in the picture. He propped up the ramp to a few different heights, then timed the marble as it rolled down. Using the magic of physics, he figured out the marble's acceleration for each ramp height.

He made a scatter plot of the results, but isn't sure what to do next... maybe you can help?

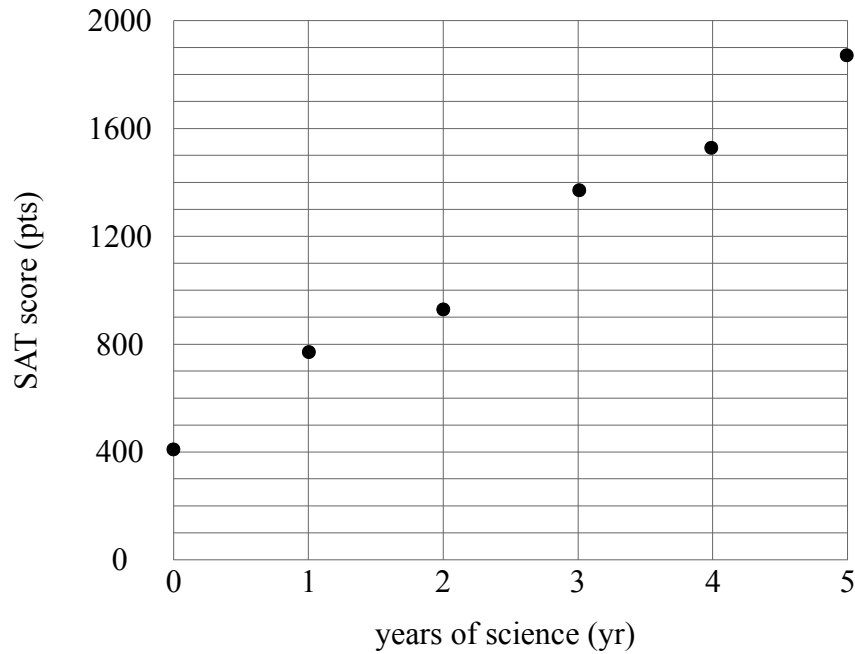


Ramp height (cm)	Acceleration (cm/s ²)
5	43.45
10	94.53
15	102.04
20	165.29
25	215.38

- Would a best-fit line for this experiment need to go through the origin, or is it okay to have a y -intercept? (Hint: Think about what the ball would do if the ramp height were 0 cm.)
- Draw a best-fit line and find the equation for that line.
- What acceleration would you expect the ball to have if the ramp height was 35 cm?
- If you were going to tell Mr. Stonebraker to re-measure one of these data points, which one would you pick? Explain why.

SAT scores

A guidance counselor kept track of students' SAT scores and how many science classes they took in middle and high school:



10. Draw a best-fit line and find the equation for that line.
11. This line has a y -intercept that isn't zero. Based on what you know about people and college-entrance exams, explain why this is OK.
12. Use your equation to predict the score of a student who took 6 years of science. (They could do this by doubling up or taking summer classes.)
13. Suppose this school offered many, many different science classes. Use your equation to predict the score of a student who managed to take 11 years of science. There should be something "wrong" with your answer. What's the problem?