

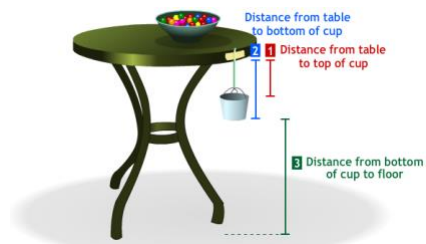
Creating linear models for data

Student Activity Sheet 3; Exploring “Rate of change”

1. What is Hooke’s Law?

2. What item in the science experiment is being used to simulate a spring?

3. Fill in the table (for number of marbles = {0, 5, 10, 15}) with the data collected during the science experiment.



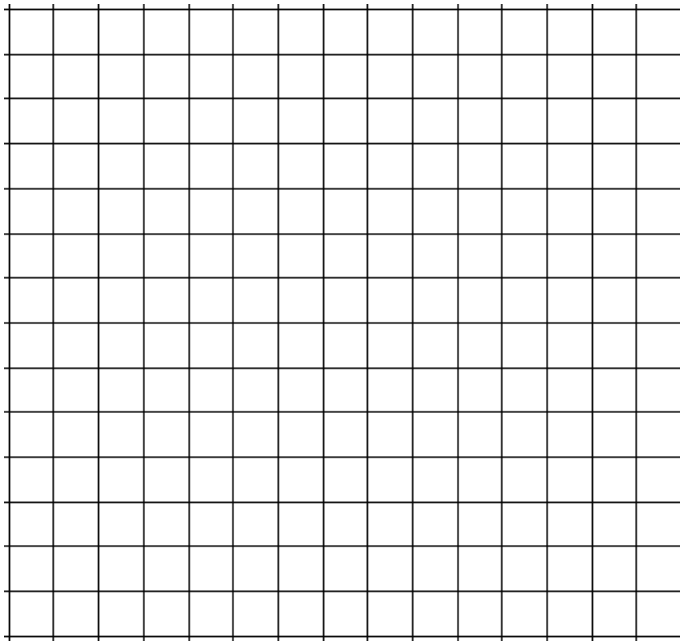
Number of marbles	[1] Distance (cm) from table to top of cup	[2] Distance (cm) from table to bottom of cup	[3] Distance (cm) from bottom of cup to floor
0			
5			
10			
15			
20			
25			
30			

4. Fill in the table in question 3 (for number of marbles = {20, 25, 30}) with the rest of the data from the experiment.

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5. Make a scatterplot to show the data for the number of marbles and the distance from the table to the top of the cup (Distance [1]). Does your scatterplot indicate a positive, negative, or no correlation between the number of marbles and distance from the table? Explain.



6. Find the change in the distance (cm) from the table to the top of the cup, (Distance 1), each time 5 marbles are added.

Stretch-It Experiment

Number of marbles	Distance 1: from table to top of cup in centimeters
0	16.0
5	16.5
10	16.9
15	17.2
20	17.5
25	17.8
30	18.2

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7. Based on your analysis of the data, is a linear model appropriate? Why or why not?

8. What might be an appropriate y -intercept for the graph of a trend line that models these data? Why?

9. What number could approximate the slope of a trend line for these data?

10. Use the information in questions 8 and 9 to write a function rule for a trend line for these data.

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This table displays information about the number of marbles and the distance from the table to the bottom of the cup (Distance 2). Use the table to complete statements 11-14. Use the answer choices provided.

Number of marbles	0	5	10	15	20	25	30
Distance 2: from table to bottom of cup in centimeters	26.1	26.4	27.0	27.3	27.6	27.8	28.2

27.3	0	0.35	26.1	0.07
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11. The mean of the differences in the distances is _____ cm.
12. A good approximation for the rate of change is _____ cm/marble. Write a sentence that illustrates what this represents in the problem.
13. The first observation, (0,26.1), indicates the distance from the table to the bottom of the cup is _____ cm when there are _____ marbles in the cup.
14. An equation for a trend line modeling these data could be $y = \underline{\hspace{2cm}}x + \underline{\hspace{2cm}}$.

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This table displays information about the number of marbles and the distance from the bottom of the cup to the floor (Distance 3). Use the table to complete statements 15-19. Use the answer choices provided.

Number of marbles	0	5	10	15	20	25	30
Distance 3: from bottom of cup to floor in centimeters	51.6	51.2	50.8	50.5	50.2	49.8	49.4

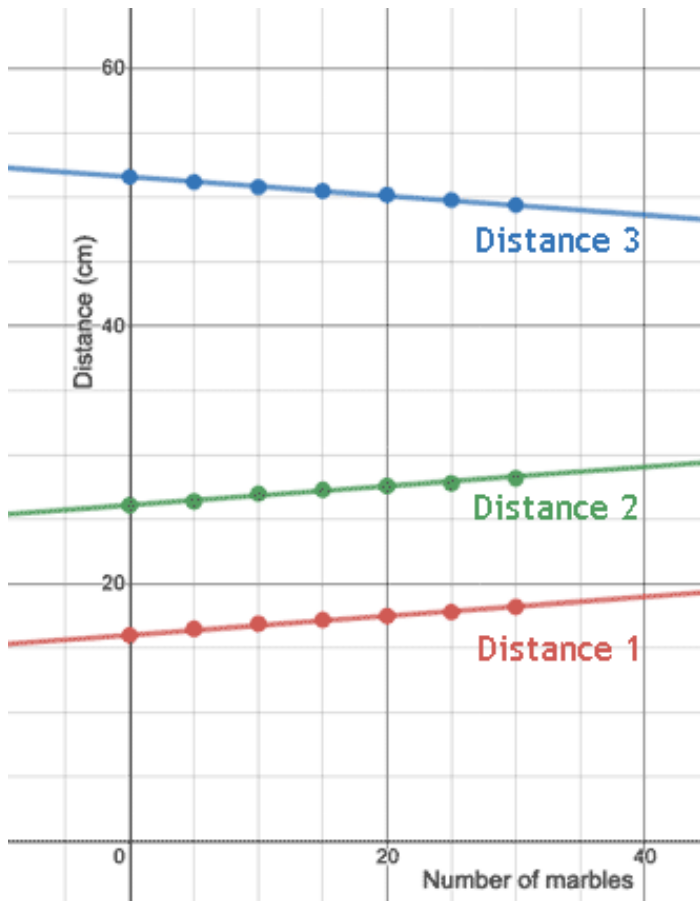
0	0.074	-0.074	50.5	5	-0.37	51.6	0.37	a negative	a positive
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15. A scatterplot of these data indicates _____ correlation.
16. The mean of the differences in the distances is _____ cm.
17. A good approximation for the rate of change is _____ cm/marble. Write a sentence that illustrates what this represents in the problem.
18. The first observation, (0,51.6), indicates the distance from the bottom of the cup to the floor is _____ cm when there are _____ marbles in the cup.
19. An equation for a trend line modeling these data could be
 $y = \underline{\hspace{2cm}}x + \underline{\hspace{2cm}}.$

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This graph displays the trend lines for Distance 1, Distance 2, and Distance 3. Use the graph to complete statements 20 and 21. Use the answer choices provided.



negative	increasing
decreasing	rubber band
positive	cup
table	

20. The slopes for the bottom two trend lines are _____, because these distances are _____ as the number of marbles increases. The slope for the third trend line is _____, because this distance is _____ as the number of marbles increases.

21. The difference between the *y*-intercepts of the trend lines for Distances 1 and 2 represents the length of the _____ in the experiment.

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Use your trend lines or the patterns in the data in the following table to complete statements 22-24. Use the answer choices provided.

Stretch-It Experiment

Number of marbles	Distance 1: from table to top of cup in centimeters	Distance 2: from table to bottom of cup in centimeters	Distance 3: from bottom of cup to floor in centimeters
0	16.0	26.1	51.6
5	16.5	26.4	51.2
10	16.9	27.0	50.8
15	17.2	27.3	50.5
20	17.5	27.6	50.2
25	17.8	27.8	49.8
30	18.2	28.2	49.4
x	$y = 16 + 0.074x$	$y = 26.1 + 0.074x$	$y = 51.6 - 0.074x$

19.108	48.64	cups	22.136	35	marble	centimeters
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22. With 42 marbles, the top of the cup would be _____ cm from the table.

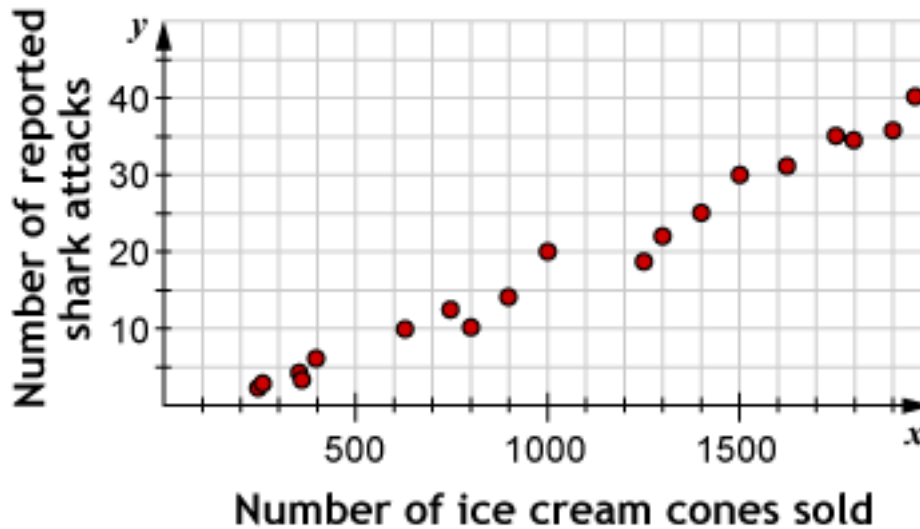
23. When the cup’s bottom is 49.01 cm from the floor, the cup will have _____ marbles. With at least 40 marbles, the cup’s bottom is at most _____ cm from the floor.

24. The units for the slope in the trend lines are _____ per _____.

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25. The plot shows a positive correlation between the number of ice cream cones sold and the number of shark attacks.



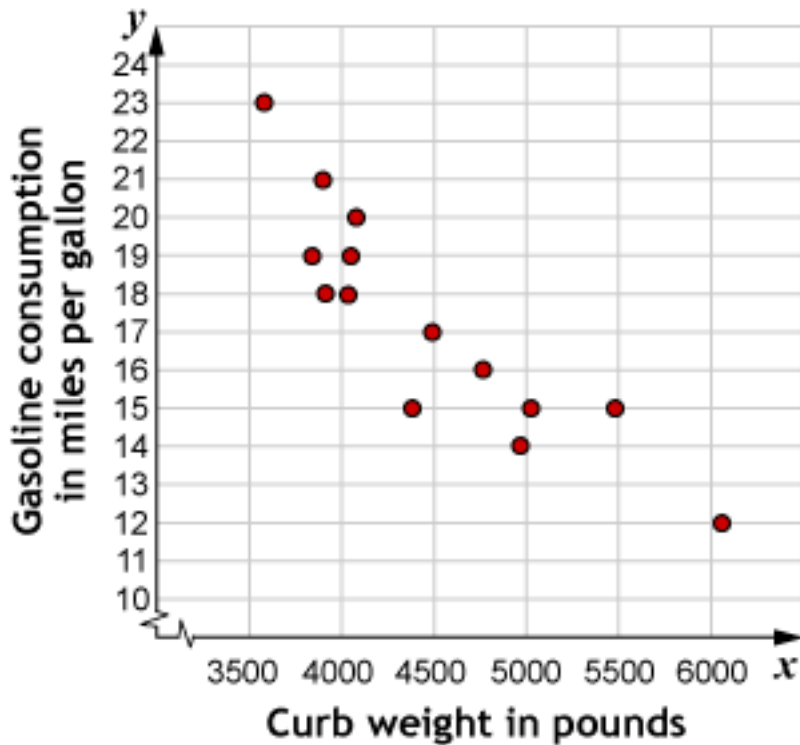
- a. Based on this scatterplot, could you make a reasonable prediction of the number of shark attacks if you knew the number of ice cream cones sold?

- b. Does this mean that eating ice cream causes sharks to attack?

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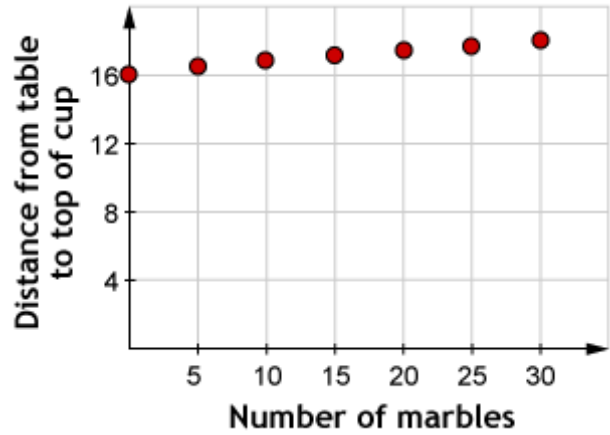
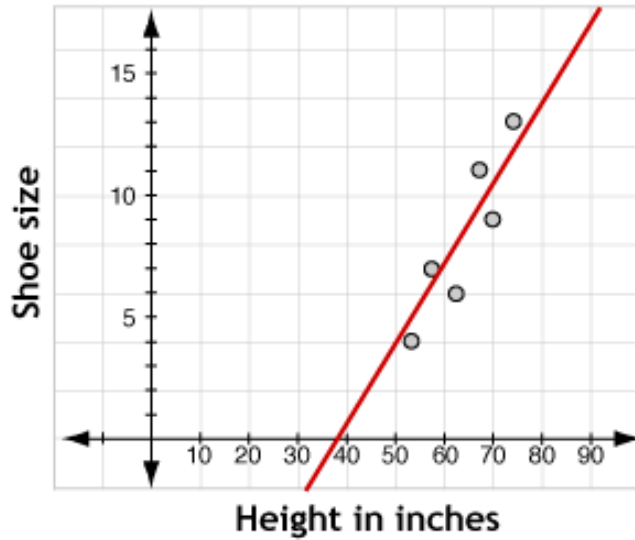
26. These data show gasoline consumption and curb weight (the weight of the car with no cargo or occupants) for a sample of different car models. What conclusions might you draw from these data? Is there a causal relationship between weight and fuel economy?



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Consider these two situations. In both cases, there is a statistical relationship between the variables.



27. Is there a causal relationship in either of these situations?

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28. **REINFORCE** Four cars started from the same city at the same time. The following data were collected on the performance of the four cars, based on miles driven in terms of hours. Use these tables to answer parts a-f below.

Car A		Car B		Car C		Car D	
Hours	Miles	Hours	Miles	Hours	Miles	Hours	Miles
0	0	0	0	0	0	0	0
2	120	1	75	5	200	1	65
3	180	2	150	10	400	2	85
5	300	3	225	15	600	3	105
6	360	4	300	20	800	4	125

a. Which car was traveling the fastest? How do you know?

b. Which car was traveling the slowest? How do you know?

c. Compare and contrast the tables.

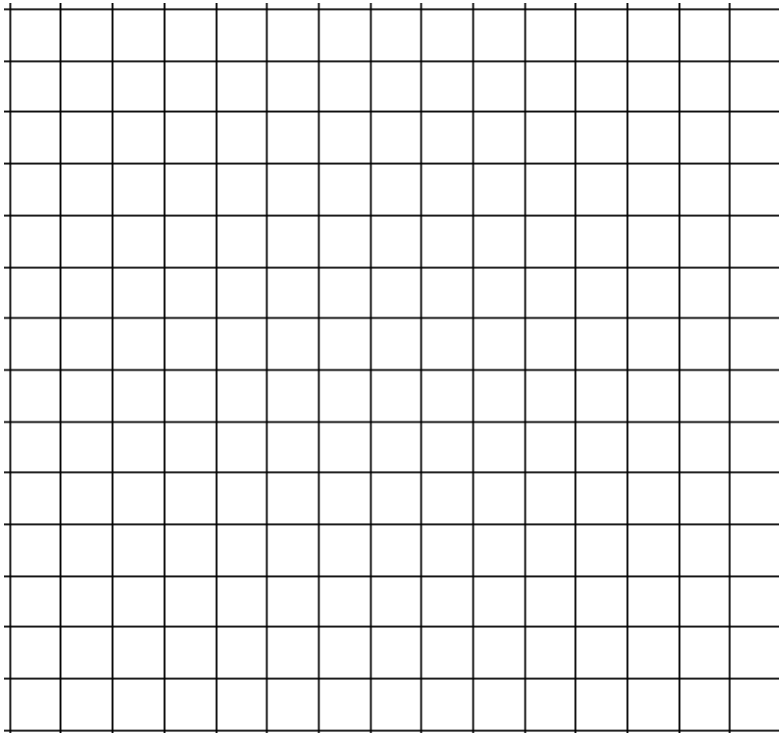
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d. Write a function rule to model each car’s travel.

Car A	Car B	Car C	Car D

e. On a single graph, create a scatterplot for each table. Compare and contrast the graphs.



f. Do any of the tables represent a direct variation? Explain how you know.

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29. **REINFORCE** Natalie read the following statement in the newspaper:

“In a random sample of 250 students at an elementary school, researchers found a strong correlation between the students’ vocabulary level and their shoe sizes.”

Natalie concluded that shoe size causes vocabulary to increase. Do you agree or disagree with Natalie’s conclusion? Explain your answer.