

1

How Should the Tip Be Divided?

Maria is catering director at Cool Springs Panera Bread Company. When a large order is delivered, the recipient often adds a gratuity to the credit card bill. Maria must decide how the money should be assigned to the paychecks of those who worked to prepare the order.

Last week, Maria enlisted Marissa, Brian, and Rosanna to work on a lunch delivery for which the tip was \$330.

- 1) What is your first thought about how to designate the amount of the tip for each of the four workers?

Maria clocked in at 4:00 am and stayed on the job until she made the delivery at 1:00 pm. Marissa worked with her from 4:30 am until 12:30 pm when the car was loaded. Brian packed boxes from 9:00 am until noon, and Rosanne bagged cookies for two hours.

- 2) Does this additional information change your response to the first question?
- 3) Decide on the fair way to allocate the \$330 tip among the four workers based on the hours that each contributed to the total work-hours to prepare the order. Explain your plan and show all work. Include a final statement telling how much money each worker should find on their paycheck for this job.

3 Sara and Sheila are twins, alike in many ways. At age 20 they began working at identical jobs with identical starting salaries. At the beginning of each year, starting at age 30, they received identical bonuses of \$2500.

In one way, however, Sara and Sheila were not identical. Sara was fiscally conservative. She invested the \$2500 bonus in a savings program earning 8% interest compounded annually. Each year she added that year's \$2500 bonus to this savings program. Then at 40 she decided to use the bonus each year for a vacation. But she let the money already invested keep earning interest. This continued until she was 65. How much money was in her savings program at that time?

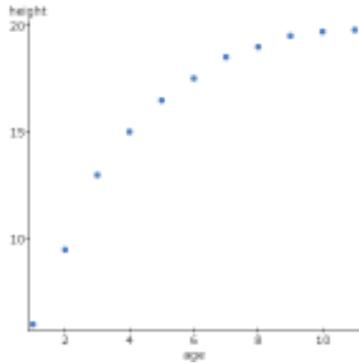
In contrast, Sheila spent her bonus each year. Then at age 40 she decided she should save the money. She used the same savings program that Sara had found 10 years earlier, earning 8% interest compounded annually. Each year she added the \$2500 bonus to her savings program, continuing until she was 65. How much money was in Sheila's savings program at age 65?

Compare the amount of money saved by Sheila and Sara when they reached 65. Discuss the advantages for Sheila's plan and for Sara's plan. Which plan would you choose to follow?

5 Math 152 – Section 7.6

Objective: To identify the most appropriate mathematical model (linear, quadratic, exponential, or logarithmic) given a graph of collected data

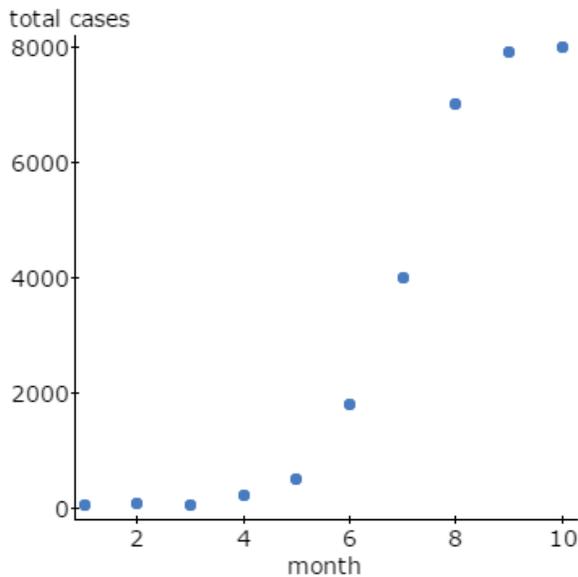
1. Twelve new one-year-old cherry trees were planted 10 years ago in Washington, DC. They were all 6 feet tall at the time of planting. The graph below shows the average height y of the 12 trees at x years.



a) What kind of model is most appropriate to describe the growth of these trees?

b) Assume you are in the horticulture business. Write a brief description of what a customer should expect to happen to the height of one of these trees planted at his home.

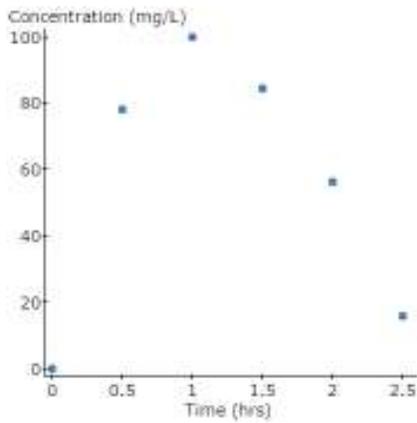
2. Using data from the World Health Organization, the following graph shows the total number of reported ebola cases in Liberia beginning in April 2014 (month 1) and continuing through January 2015 (month 10).



a) What type of model would seem appropriate for the spread of this disease?

b) What significance would you give to the data reported for months 9 and 10 (December and January)? Why might they deviate from the pattern shown by the rest of the data?

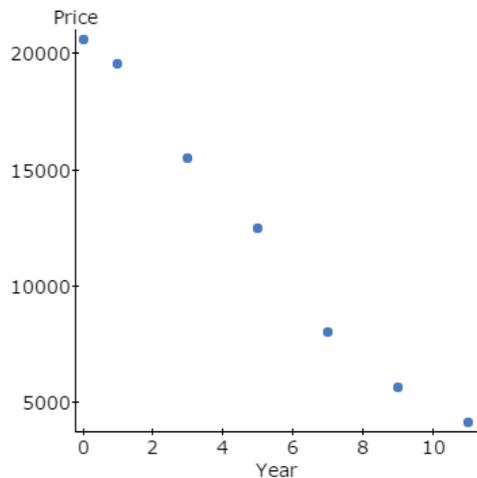
3. The graph shows the concentration y of a medicine (mg/L) in a patient's blood stream x hours after the medicine is administered.



a) What type of function would be most appropriate to model this situation?

b) Assume you are the physician treating this patient. If you wanted to keep at least 20 mg/L of the drug in your patient's blood stream, how often would you administer the medicine to be given to this patient, assuming you prescribe the dose use to collect this data?

4. The graph shows the relationship between the age of a Hyundai Sonata 4-door Sedan (x years before 2015) and the fair market value shown by the Kelly Blue Book.



a) Based on this car, how would you describe the relationship between age and price?

b) Explain what $x = 0$ means in this situation.

c) If your friend wanted to purchase a 2010 Sonata (year 6). Based on this model, what would you suggest that your friend pay for the car?

d) Suppose you own an original Sonata from 1985. Do you think this model would be able to help you predict the price of that car? Explain.

6 Math 157 Project 4 Correlation and Regression

After you complete this course in December, you might think about a vacation to fly away to relax and enjoy yourself by skiing up north or out west or soaking up the warm Caribbean sun. When researching airfares, you wonder if it really costs more to fly further away and less to stay closer to home. In other words, does a relationship exist between cost of a plane ticket and the distance to your destination?

I started you out with 9 cities, the airfare and their distance from Norfolk.

Q1a. First, add two more places that you might enjoy seeing. I found my airfares at www.orbitz.com, just choosing the lowest one offered, leaving December 15 and returning December 21, To find the distance by air between Norfolk and your cities, use this site: http://www.worldatlas.com/travelaids/flight_distance.htm

When your table is complete, copy and paste it into your Word document for this assignment.

1b. From the numbers in the table, can you see any relationship between miles and ticket price? Do you think that the cost of the ticket should be related to how far you are going to fly? What kind of trend do you expect to find?

City	Cost (dollars)	Distance (miles)
Orlando (either for a cruise or Disney World, of course)	225	628
Denver	344	1580
Los Angeles (not warm, but should be sunny)	473	2360
Portland, ME	281	580
Salt Lake City	451	1945
Montego Bay	684	1248
Fairbanks	734	3463
San Juan	448	1391
San Jose, Costa Rica	714	1929

Q2a. Now we will investigate whether our data provide support for the conjecture from Question 1. Open StatCrunch through MyStatLab > StatCrunch > open data sets. When the spreadsheet opens, copy and paste (Ctrl + V) the table information into it. Make sure the Var line shows the names of your three variables. Look at the picture of your data. Use Graph > Scatterplot and choose the variables. If our goal is to see if the price of the ticket is based on the miles traveled, which variable should be x and which should be y? Copy and paste the plot. Do you see a trend and shape? Is a linear model appropriate?

2b. Check the linear strength of the relationship between cost and distance by finding the correlation coefficient. Stat > Summary > Correlation. What is r? How strong is the relationship?

2c. Look again at the graph. Could there be an outlier in the set? Remove it from the data set and create a second scatterplot with the remaining cities and find r again. Paste the second graph, comment on its trend and shape, and interpret any difference in this second r value.

Q3a. Now obtain the regression equation: Stat > Regression > Linear. Use the revised data set without the outlier. Again, pay attention to your choice for the x- and y-variables if your goal is to use the miles flown to predict the cost of the ticket.

Copy and paste the computer output.

3b. Then write the regression equation for yourself, using either $\text{Cost} = m \cdot \text{miles} + b$ or just $y = mx + b$.

3c. Based on this model, how much should it cost to fly 1600 miles?

3d. Use the right arrow at the bottom of the dialogue box to see the regression line drawn on the scatterplot. Copy and paste. Note that Denver is almost 1600 (1580) miles away from Norfolk. Find the point for Denver data. How does the observed cost of that ticket compare to the prediction from your equation? Explain why there is a difference.

Q4a. Give the y-intercept and slope of the regression equation. Interpret each in context.

4b. If two cities are about 200 miles apart, based on the regression equation, by approximately how much should their airfare costs differ?

4c. You want to try skiing at Niseko resort in Japan. Explain whether it would be appropriate to use your model to predict the airfare for a flight to Sapporo, Japan, 6486 miles away from Norfolk.

7

APPLIANCE COSTS

Name _____

YOU WILL NEED TO STAPLE A SHEET OF GRAPH PAPER WITH YOUR GRAPHS TO THIS PAPER.

Brand	Size	Initial Cost	Estimated Annual Cost (at 6 cents/kwh)
Amana	21 cubic feet	\$875	\$34
Whirlpool	21cubic feet	\$800	\$39
Tappan	21 cubic feet	\$650	\$57
Kitchen Aid	21 cubic feet	\$950	\$31

- 1) For each brand, write an equation that describes the relationship between expected life in years and total cost. Let x be the number of years and y be the total cost (initial cost plus total annual cost). Each equation must include an x and a y variable.

Amana _____

Whirlpool _____

Tappan _____

Kitchen Aid _____

- 2) Complete the table below:

Number of Years x	Total Cost y Amana	Total Cost y Whirlpool	Total Cost y Tappan	Total Cost y Kitchen Aid
0				
5				
10				
15				
20				
25				

- 3) On a sheet of graph paper graph each of the above equations on the same set of axes by plotting the points from the table. Mark off the x -axis from 0 to 25 with a scale of 1. Select an appropriate min, max, and scale for the y -axis based on the values in the table. Do not use the graphing calculator. Use different colors or types of lines to distinguish the four lines. Be sure to label each axis and line.

- 4) Write an equation in one variable (x) that could be used to determine when the costs of Tappan and Whirlpool are equal. Solve this equation to determine when the costs are equal.
- 5) Write an inequality in one variable (x) that could be used to determine when the cost of Kitchen Aid is less than the cost of Amana. Solve this inequality to determine when the cost of Kitchen Aid is cheaper.
- 6) The Costanzas want to buy a refrigerator that is the **best value as related to the number of years of expected life**. However, they have not yet decided how long they will expect the refrigerator to last. In a few sentences give some detailed advice to the Costanzas to help them make their decision. Be sure to state which brands are cheapest for certain life expectancies such as: For 6 to 7 years brand x is the cheapest at a total cost of \$1000.

6

EXPLORATION GARBAGE

(Multiple Representations of Linear Equations – Wrap Up)

Name _____

Date Due _____

YOU WILL NEED TO STAPLE A SHEET OF GRAPH PAPER WITH YOUR GRAPH TO THIS PAPER.

The table below gives the number of millions of tons of municipal solid wastes in the United States from 1960 to 2010. Complete all blanks in the table.

Year	1960	1970	1980	1990		2000	2004	2005		2007	
TIME since 1960	0	10			34		44		46		50
WASTE (million tons)	88	121	152	197	209	239	250	253	254	255	250

<http://www.epa.gov/osw/nonhaz/municipal/pubs/msw07-rpt.pdf>

http://www.epa.gov/wastes/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf accessed 06/13/12

<http://www.eia.doe.gov/cneaf/solar.renewables/renewable.energy.annual/chap03.html>, accessed 09/11/09

- Carefully draw a scatterplot of points (TIME, WASTE) on a sheet of graph paper and attach it to this document.
Remember that TIME represents the number of years since 1960, not the year itself.
Use x-scale = 2 and y-scale = 10 million.
Be sure to label each axis and put a title on your graph.
- Fit a line to the data by eye and draw a straight line with a ruler. (Hint: Transparent rulers help here.) **The line may or may not pass through ANY of the data points plotted from the table.**
- Give the coordinates of any two points that lie on the line you drew. **Warning!** A point that is in the table but **not** on your line cannot be used.
(_____ , _____) (_____ , _____)
- Use these two points to find an equation for your line. Show your work.
- What is the slope? In a sentence explain what the slope means about the amount of municipal waste.
- What is the y-intercept? In a sentence explain what the y-intercept means about the amount of municipal waste.

The following questions should be answered on another sheet of paper and attached to this document.

- 7) a) Use your equation to predict the approximate amount of municipal solid waste that should have occurred in the year 2010. Explain your answer in a sentence. Show your work.
- b) Is your prediction accurate? Why or why not?
- c) If your prediction is not accurate, what events might explain the discrepancy between your prediction and the actual amount?
- 8) Use your equation to predict the approximate amount of municipal solid waste that will occur in the year 2050. Explain your answer in a sentence. Show your work.
- 9) Use your equation to predict in what year the approximate amount of municipal solid waste will reach 350 million tons. Explain your answer in a sentence. Show your work.
- 10) A graphing calculator, computing the actual *line of best fit*, gives the equation as approximately

$$y = 3.59x + 86.80$$

- a) What is the slope and what does it mean in terms of the production of solid waste?
- b) What is the y-intercept and what does it mean in terms of the production of solid waste?
- c) What does this equation predict for the amount of municipal waste in 2050?
- d) Does your prediction in #8 overestimate or underestimate the prediction using the line of best fit (#10c)? By what percent? Why would this discrepancy in the two predictions occur?

Figure 7. Chief Components of Municipal Solid Waste Management

