## The Right Stuff: Appropriate Mathematics for All Students

*Promoting the use of materials that engage students in meaningful activities that promote the effective use of technology to support mathematics, further equip students with stronger problem solving and critical thinking skills, and enhance numeracy.*

**AMATYC**
**The Right Stuff**
*Appropriate Mathematics for All Students*

### Overview
Students will apply the concepts of
- Interpreting graphs
- Calculating sums, differences, and quotients from a graph

### Supplies and Materials
- 13.1 Student Worksheet

### Prerequisite Knowledge
Students must be able read graphs and do basic arithmetic.

### Pedagogical Suggestions
1. Print out each graph from its original source on a full sheet of paper (one graph per page). Break the class into groups of four and give each group a full-size graph. Have each group answer the questions given in the activity for the graph. Then have the students report their findings to the entire class.
2. Have students search the Internet to find one or more graphs of personal interest. For each graph, have the student make up two or more questions that can be answered by the graph. Then have the students find answers to the questions they asked. Then have a second person work through the activity to verify the accuracy of the solutions.

### Assessment Ideas
1. In a testing environment, present the student with a previously unseen graph and a series of questions that can be answered by the graph. Measure the student's accuracy in interpreting the graph correctly.

**Introduction**

Technology allows us to produce graphics easily.  However, many people are not skilled at interpreting graphics.  In this activity, students will answer questions based on the graphics provided.

**Frequency Table**

We often take surveys and record the answers to surveys in frequency tables such as the one shown in Figure 1.

A frequency table is often a first step in analyzing data.  They often lead to histograms that will be shared with others.

1. How many people took part in the Candy Bar Challenge survey?
   60 people

2. What percent of people surveyed preferred Butterfinger?  Round to the nearest tenth of a percent.

   17/60 = 28.3%

# Candy Bar Challenge

| SURVEY SHEET | | |
|---|---|---|
| **Chocolate Bar** | **Talley** | **Frequency** |
| Butterfinger | ┼┼┼┼ ┼┼┼┼ ┼┼┼┼ \| \| | 17 |
| 5th Avenue | \| \| \| | 3 |
| Baby Ruth | ┼┼┼┼ | 5 |
| Snickers | ┼┼┼┼ ┼┼┼┼ ┼┼┼┼ | 15 |
| Nestle | ┼┼┼┼ | 5 |
| Hershey | ┼┼┼┼ \| \| \| | 8 |
| Dove | ┼┼┼┼ \| \| | 7 |
| source:  Take Our Surveys | | |

Figure 1

Figure 2 shows the **number of drugs in development by therapeutic area**. During the next few years, a number of blockbuster drugs for cancer, diabetes, immunological diseases, cardiovascular disorders, and pain are anticipated. Note: this list includes drugs that are in Phase II, Phase III, or awaiting FDA approval.
Source:  www.swivel.com

3.  How many drugs are in development for cancer?
    630

4.  Rounded to two decimal places, the number of drugs being developed for infections is how many times greater than the number of drugs in development for blood disorders?

    212/88 = 2.41 times more
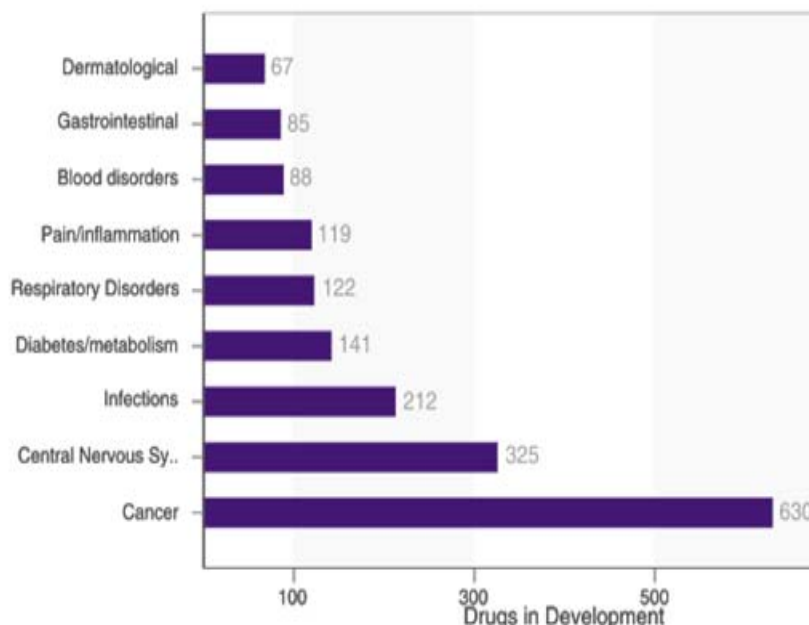


Figure 2

Figure 3 shows the number of Grateful Dead concerts between 1965 and 1983.
Source: www.swivel.com

5. Estimate the number of concerts in 1980.
   Approximately 87 concerts

6. In what year(s) were there 100 concerts?

   1966 and 1971

The **cumulative moving average** is also frequently called a *running average* or a *long running average*. The cumulative moving average is the average of all of the data up and including the current data point. A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles.

7. Compute and then graph the *cumulative moving average* for the number of concerts per year?

See the Excel file for the results.
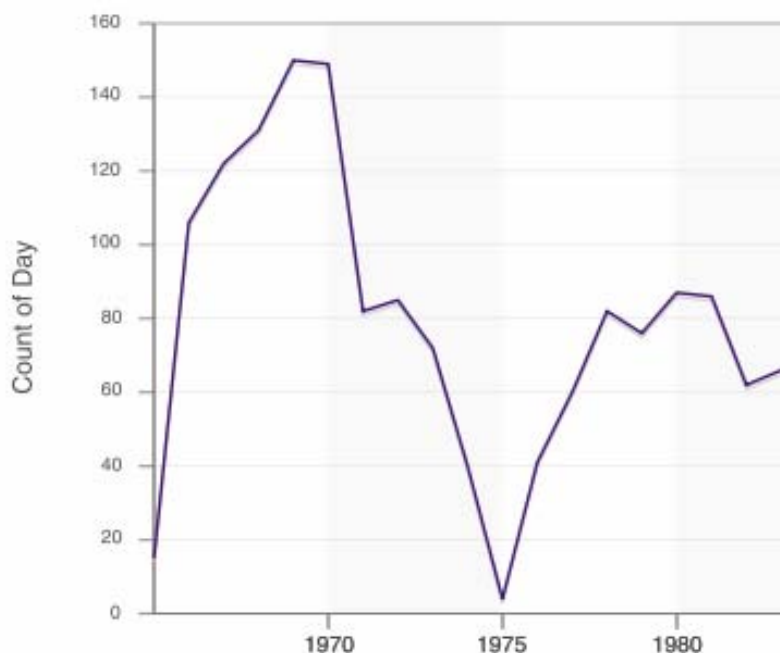


Figure 3    Yearly Grateful Dead Concerts

Figure 4 shows the retirement age and average age at death of a group of Boeing Aerospace retirees.

8. As the age at retirement increases, what happens to the average age at death?
   It decreases.

9. Over what age range does the average age at death seem to decrease the fastest from one age to the next?
   From age 60 to 62

10. Do you think that this graph accurately represents the relationship between retirement age and average age at death for the entire US population?
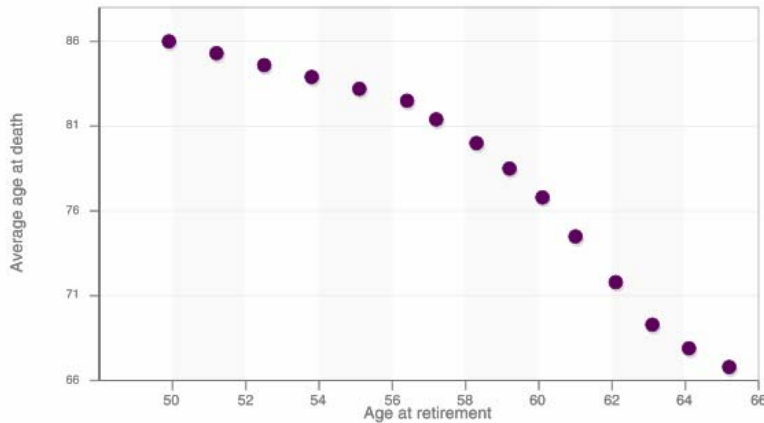


Figure 4 **Average age at death by Age at retirement**

9. No. The size of the sample (one group of people who worked at the same company) is too small to be representative of the entire US population.

Figure 5 shows the frequency of use of letters in the English language.

11. What is the most used letter in the English language, and how frequently is it used?
    e is used most frequently (12.7%)

12. As an example look at the sentence in question 11. Which letter is the most common, and how often does that letter occur?
    There are 69 letters in the question. Of those letters, 10 of them are e's. This is 14.5% of the letters in the sentence.
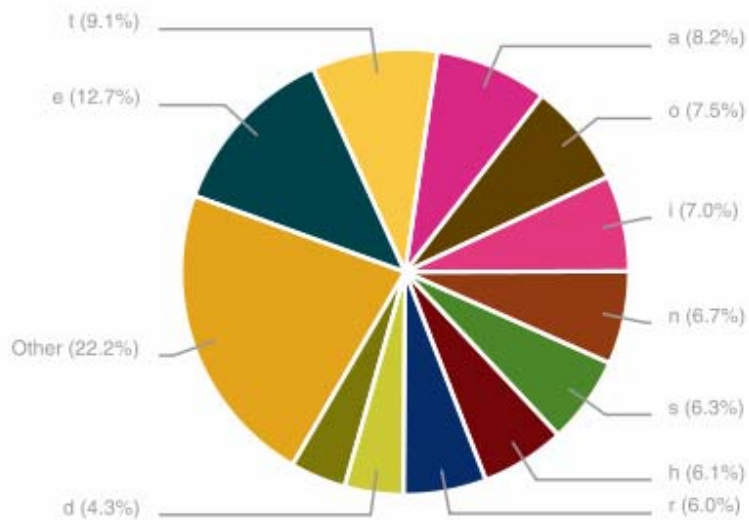


Figure 5 English Letter Frequency

Figure 6 shows annual motor vehicle deaths in the United States by gender.

13. What was the approximate difference in motor vehicle deaths between males and females in 1975?
33,000 – 11,000 = 22,000

14. What was the total number of motor vehicle deaths in 2007?
29,000 + 11,000 = 40,000

15. Does this graph indicate that males are more likely to have an accident? Consider the ratio accidents per mile driven.
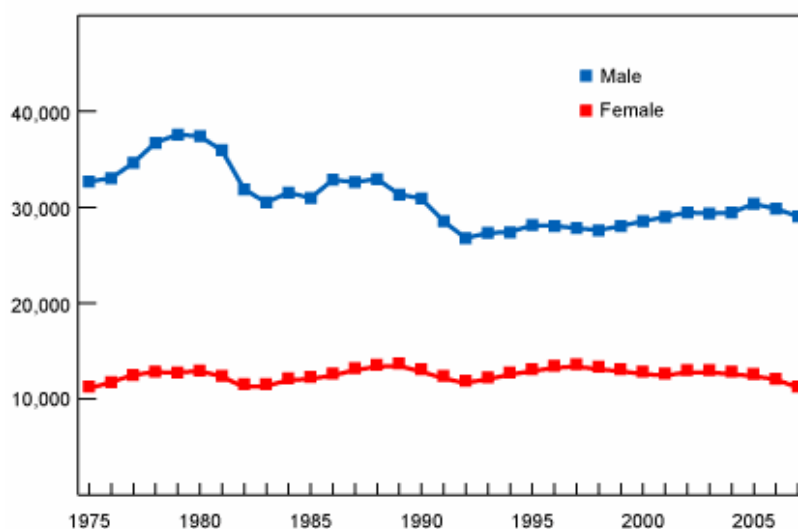


Figure 6 Motor Vehicle Deaths by Gender and Year

15. One cannot draw any conclusions regarding this question just based on the data in this graph. Additional information, the number of miles driven by each sex, would be necessary.

Figure 7 shows the natural gas usage and average monthly temperature over twenty-one months in Raleigh, NC.
The average daily temperature for each month is measured in degrees Fahrenheit and shown on the left axis. The per day use of natural gas, in therms, is shown on the right axis.
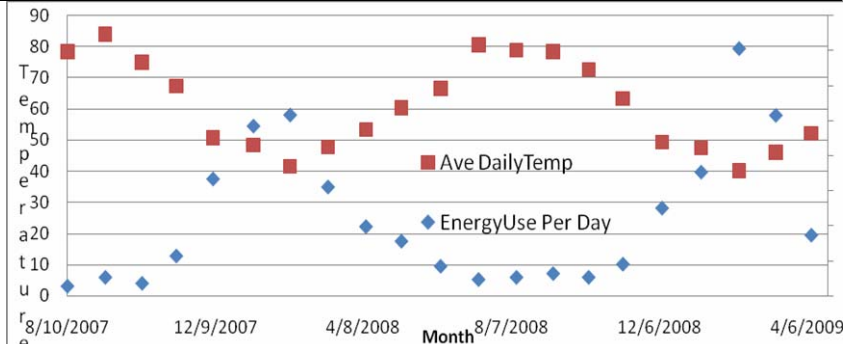
16. In what month was the Ave. Daily Temp. the greatest? Least?
17. In which month was the per day use of natural gas the least? Most?
18. Explain why the peaks and valleys of each graph are related, and how.



Figure 7 Author's Data

16. In September of 2007, the Ave Daily Temp was 84.1. It was 40.0 in February of 2009.
17. Least: August Most: February
18. Natural gas is typically used to heat houses and in water heaters. So when it is hot outside, furnaces are not used. Conversely, when outside temperatures are cold, furnaces use a lot of natural gas.
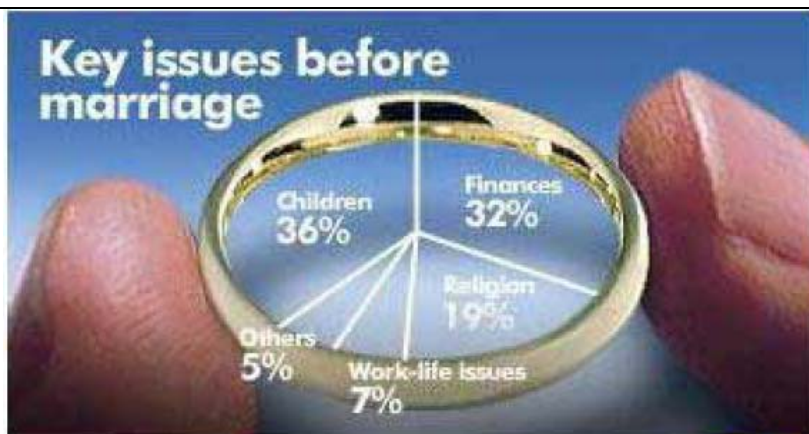
Picture-graphs are prevalent in many newspapers and magazines. While eye-catching, they may be difficult to read and are often misleading.

19. What is the most common issue before marriage, according to Figure 8?
**Children**
20. What questions might the reader have concerning Figure 8?
**Why do the percentages only sum to 99%?**



By David Stuckey and Gia Kereselidze, USA TODAY
Source: Findlaw.com

Figure 8

The picture-graph in Figure 9 uses brooms rather than bars.

21. In which month do most people clean house?
**April**
22. Which statement below do you believe is illustrated by this graph? Explain your reasoning.

a. Nine percent of adults (11% of the 77%) of adults who do spring cleaning start in May.
b. Eleven percent of all adults start spring cleaning in May.

Without the knowing the original data either interpretation is possible. Possible reasoning could include the following:
a. Seventy-seven percent of the adults do spring cleaning and 11% begin in May so 9 percent start in Mary.
b. Some people start spring cleaning in months other than March, April, and May. Therefore, 11% start in May.



Mary Cadden and Keith Carter, USA TODAY
Source: Levolor Window Fashions

Figure 9

Figure 10 shows four "top" destinations for vacationers.

23. Which of these questions is more likely the question asked in order to get the response shown?
a. What would be your favorite destination on your next vacation?

b. What are your favorite vacation destinations?
**B is more likely to be the question asked; however, it could be based on business surveys of room bookings.**
24. Why do the percentages sum to move than 100%?
Answers will vary.



By April Umminger and Jerry Mosemak, USA TODAY
Source: YPB&R Yankelovich

Figure 10

Some graphs may be accurate but still misleading.

25. Which statement(s) do you believe is correct, based on Figure 11?

a. Twenty-nine percent of 21-25 year-olds have had a DUI.

b. Twenty-nine percent of DUIs went to 21-25 year-olds.

c. Eight percent of those 35 or older have had DUIs.
b,
26. The caption was "*Twenty-somethings are more likely than other adults to say they drove while intoxicated.*" Does this caption change your response?
Answers will vary.



By Cristina Abello and Chad Palmer, USA TODAY
Source: U.S. Dept. of Health & Human Services

Figure 11

27. Which statement(s) do you believe is correct, based on Figure 12?

a. 13.3% of people who chat and drive live in the west.

b. 13.3% of those who live in the west chat and drive.

c. 13.3% of the 48% of people who chat and drive live in the west.

**A**

Nearly half (48%) of adults who drive and have a cellphone say they talk at least sometimes while driving; they are more likely to live in the West.

People who chat and drive

West 13.3%
Midwest 12.7%
Northeast 11.3%
South 11.0%

By Rebecca F. Johnson and Gia Kereselidze, USA TODAY
Source: Synovate for Plantronics

Figure 12