

# Can You Graph Me Now?

**Intended for Grade:** Fifth

**Subject:** Math

**Description:** This project explores the concepts of probability and graphing through the use of written and electronic graphs and tables.

**Objective:** The student will be able to collect data by tossing coins, graph the data, and calculate the experimental probabilities for their data.

## **Mississippi Frameworks addressed:**

- Math Framework 3a: Investigate the probability and patterns in tossing coins, number cubes, and spinners.
- Math Framework 3b: Draw and label bar, line, circle graphs, and pictographs.
- Math Framework 3c: Gather, organize, and analyze data to create tables, charts, and graphs.
- Math Framework 3d: Incorporate appropriate technology and manipulatives to explore data collection, organization, and interpretation.

## **National Standard addressed:**

- Math Standard: Data Analysis and Probability

## **Materials:**

- Class set of TI-84 Plus graphing calculators with the application *Probability Simulation*
- Set of 3 coins per pair of students
- Activity sheet “Can You Graph Me Now?” for each student
- [Bar graph](#) sheet for each student
- Colored pencils or crayons (optional)

## **Background:**

### **Simple probability**

When we flip a single fair coin the probability of it landing 'heads' is 0.5. But how is that calculated? The **theoretic probability** of an event occurring is defined as the ratio of successful outcomes to the total number of possible outcomes. Using our coin example:

$$\text{Theoretic Probability of a Heads} = (1 \text{ head}) / (1\text{head}+1\text{tail}) = \frac{1}{2} = 0.5$$

Once the probability of an event is calculated and is expressed in decimal form, we multiply by 100 to express this value as a **percent**.

$$\begin{aligned} \text{For example, from the probability for a single coin,} \\ \text{Theoretic Probability of a head} &= 0.5 \\ 0.5 \times 100 &= 50\% \end{aligned}$$

However, when we perform an experiment, such as the tossing of a coin, we can calculate the **experimental, or empirical, probability** of an event by taking the number of successful outcomes observed (the frequency) and dividing it by the total number of trials. For example, suppose we toss two fair coins 25 times and one head and one tail occur 17 times:

$$\begin{aligned} \text{Experimental probability of one head and one tail} &= (17 \text{ events of} \\ &\text{one head and one tail}) / (25 \text{ total tosses}) = 0.68 \\ \text{Experimental probability expressed as a percent:} &= 0.68 \times 100 = 68\% \end{aligned}$$

### **Bar Graphs**

Figure 1 shows a completed bar graph. A properly constructed bar graph has many useful features which are discussed below.

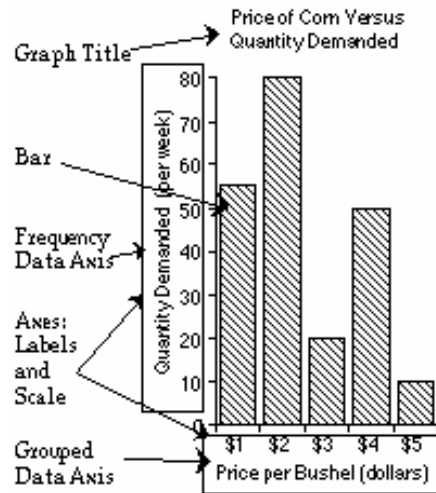


Figure 1. A labeled bar graph.

The **title** of the graph should describe the information that is being displayed. There are two axes per graph. The **grouped data axis** is the x-axis. It shows the independent variable. This axis is always at the base of the bars on the graph. The **frequency data axis** is the y-axis and displays the number of times each particular data group occurs. When the y-axis is setup in this manner it is the dependent variable. The **axes labels** describe what is being displayed on each axis. The **axes scales** contain the range of values that are displayed on each axis. Lastly, the **bars** are the rectangular blocks that represent the y-value that is associated with each x-value.

### ***Probability Simulation on the TI- 84 Plus***

The program *Probability Simulation* is what the students will be using to conduct the electronic portion of their analysis. All TI-84 Plus model calculators have *Probability Simulation* installed on them from the factory. If your calculator does not, however, you need to obtain a copy of the program CD that comes with each calculator, *TI Graphing Program CD, v 1.0*. *Probability Simulation* is on each of these CDs and can be installed directly from the CD following the directions for installing programs in the owner's manual.

To access *Probability Simulation*, turn the calculator on. Then press the purple colored "Apps" button. A list of applications appears. Scroll down the list using the up and down keys on the right hand side of the calculator. Scroll down until you reach the application titled "Prob Sim." With the cursor highlighting "Prob Sim" press "enter". The application appears and asks you to press any key. Once you have pressed a key the main menu appears.

The activity for this project involves tossing coins. From the main menu, select number 1, Toss Coins. Press "enter" to open it. Before you

begin you need to adjust the settings. Press the “zoom” button, which lies below the word “set” on the screen. A new screen appears with “settings” across the top. Scroll down until you have the category “coins” selected and scroll over using the right arrow key until you highlight “3”. Press the “enter” key on the keypad. Then select “ok” by pressing the “graph” key. This should take you back to the screen with the graph on it.

To begin the coin toss, select the “toss” button. Three coins will be tossed and their results graphed on the graph. To complete ten tosses quickly, you can select the “+10” button on screen by pressing the “zoom” button on the calculator.

You can view the frequency of each outcome (0, 1, 2, or 3 heads) by using the right arrow key to scroll the bars on the graph. When you do, the word “Freq” appears. This displays the frequency, and the number after “freq” is the frequency of that result. To view the experimental probability, first press “esc”, located above the “Y=” button on the calculator. Now press the “zoom” key which is below the word “set” on screen. Once on the settings menu, scroll down to the line that says “graph”. Scroll to the right and highlight “Prob”. Then press “enter.” Now press the “graph” button on the calculator, indicating “ok” on the screen. You will now be taken back to the graph screen. To view the percentage, scroll to the right with the arrow keys. The word “simprob” appears. This is informing you that you are looking at the experimental probability of each event. We can multiply the experimental probability by 100 to get the percentage. For example, if the “0 H” bar is highlighted, and the “simprob” is .24, multiply by 100 to get the percentage. In this case it means that 0 Heads occurred on 24% of the tosses.

To view the results of the tosses in tabular form from the graph screen, press the “graph” button, which corresponds to “tabl” on screen. The table now appears and you can scroll through the table and view the outcome of each toss. To return to the graph and the toss screen, press the “graph” button.

To quit the program, press the “Y=” key on the far left side. This corresponds to the “esc” key on the screen. After pushing it once, the calculator prompts you with “This will clear all trials from memory. Are you sure?” Select “yes” if you really want to quit by pressing the “Y=” key. The main menu appears. To quit from there, press the “graph” key which corresponds to “quit”. The prompt “Are you sure you want to quit” appears. Select “yes”. The program is done and a blank screen appears on the calculator.

### **Procedure:**

1. Review the probability definitions covered in the background with the students.
2. Break the class into groups of three.

3. Distribute the activity sheet “Can You Graph Me Now?”
4. Instruct the students how to complete the hand coin-toss experiment by demonstrating with one group of students.
5. Provide each group with a set of coins. Allow the students to complete their 25 coin tosses and record their results.
6. Provide each group of students one graphing calculator.
7. Walk the students through the coin toss experiment on the calculator. Have the students rotate the calculator to other members in their group during the walk through so that all students get the chance to work with the calculator.
8. Discuss with the students how to calculate their resulting probabilities, and allow them to work through both sides of “Can You Graph Me Now?”.
9. Review how to create and draw a bar graph. Distribute copies of the [bar graph](#).
10. Let the students create their bar graphs with the data they collected.

### **Evaluation:**

Successful completion of the probability sheet and the bar graph is one way to evaluate students’ mastery of the material. Calling on students to answer various questions about their findings is another excellent means of evaluation.

### **Extended Activities:**

As an extended activity the students could use the *Probability Simulation* program to simulate the coin toss approximately 300 more times. Doing so on the calculator will cause the experimental probabilities to more closely approach the theoretic probabilities. The theoretic probabilities are:

$$\begin{aligned}0 \text{ heads} &= 1/8 = 0.125 \\1 \text{ head} &= 3/8 = 0.375 \\2 \text{ heads} &= 3/8 = 0.375 \\3 \text{ heads} &= 1/8 = 0.125\end{aligned}$$

### **Sources:**

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# Can You Graph Me Now?

## Part I: Hand Coin-Toss Probability

1. Toss your set of coins 25 times. Record your results.

Result	Frequency
0 Heads (both tails)	
1 Head	
2 Heads	
3 Heads	

2. Are the results what you expected?
  
3. What is the experimental probability of your tosses that came out with 1 head?
  
4. What is the experimental probability of your tosses that came out with 3 heads?

## Part II: Calculator Coin-Toss Probability

1. Set the calculator to toss 3 coins per trial. Toss the set of coins 25 times. This is done by tossing the coins 5 times, then using the “+10” button twice. Record your results below.

Result	Frequency
0 Heads (both tails)	
1 Head	
2 Heads	
3 Heads	

2. Are the results similar to what you got with the hand-toss experiment?

3. What is the experimental probability of the calculator tosses that came out with 1 head?

4. What is the experimental probability of the calculator tosses that came out with 3 heads?

## Part III: Graphing

Make a graph of the frequencies. Include both the results from the calculator simulation and from your hand tosses. You will need to give your graph a title, and create a scale for the frequency axis.