Integrated Review 2: Decimals, Fractions, Percentages, and Graphs

Elementary Statistics Chapter 2: Exploring Data with Tables and Graphs

Objectives:

1. Round decimals.
2. Write a fraction in lowest terms.
3. Convert between decimals, fractions, and percentages.
4. Calculate relative frequencies.
5. Find the percentage of a number.
6. Plot points.
7. Review the skills for graphing.

In this chapter of the Triola text, you will be summarizing data using tables and graphs. In order to create these tables and graphs, you will have to be comfortable with dealing with numbers in several formats: decimals, percentages, and fractions. We will review how to convert from one number format to another in this *Guided Workbook with Integrated Review*. Also, throughout the Triola text, you will be expected to round answers according to various rounding rules. So, we will review the basics of rounding in this workbook. Finally, in the related chapter of the textbook you will learn about several graphs. To help you with this, we will review the basics of plotting points and the basic skills for graphing.

Objective 1: Round decimals.

Throughout the text, you will be asked to round your final answer. You may be asked to round in one of two ways: (1) to a particular place value or (2) to a certain number of significant figures.

Let's begin with a refresher on place value.

The table below indicates the place value for each digit in the number 1234.5678.

1	2	3	4	.	5	6	7	8
Thousands	Hundreds	Tens	Ones	Decimal Point	Tenths	Hundredths	Thousandths	Ten thousandths

You will often be asked to round your final answer to a particular place value. So, we will review the rounding basics in this first example.

Example 1 Round 3456.789 inches to the nearest tenth of an inch.

Step 1: Locate the digit in the desired place value. Let's call this digit R for purposes of our discussion.

The digit 7 is in the tenth place.

We are trying to decide whether the given number is closer to 3456.7 or 3456.8

Step 2: If the digit in the place value immediately to the right of R is a 0, 1, 2, 3, or 4, then keep R as it is and all digits to the right of R are zeros. If the zeros are not placeholders (that is, removing them does not result in other digits losing their place value), then they can be removed. If the digit in the place value immediately to the right of R is a 5, 6, 7, 8, or 9, then increase R by 1 (round up) and all digits to the right of R are zeros. Again, if these zeros are not placeholders, then they can be removed.

Since the digit immediately to the right of 7 is an 8, we must round up to 3,456.800. As the zeros are not placeholders, we can remove them.

Answer 3456.789 inches rounded to the nearest tenth of an inch is 3456.8 inches.

My Turn!

Round 7654.32198 miles to the nearest hundredth of a mile.

Example 2 Round 0.050748 cm to 3 significant digits.

We went over significant digits in the first chapter of this integrated review. Now, we will round numbers to a particular number of significant figures.

First, leading zeros are never significant digits. So, we will begin counting significant figures from left to right, beginning with the 5. The 0 immediately to the right of 5 is also a significant digit, since it is between two nonzero digits. The 7 to the right of the 0 is also significant, since all nonzero digits are always significant. So, by rounding to 3 significant digits, we are trying to decide whether 0.050748 is closer to 0.0507 or 0.0508. Since the digit immediately to the right of 7 is 4, we will keep the third significant digit at 7.

Answer 0.050748 rounded to three significant digits is 0.0507.

My Turn!

Round 0.36409 cm to 3 significant digits.

Objective 2: Write a fraction in lowest terms.

There are times that your result may be a fraction, especially when we work on the chapter on probability. Whenever you give a final result as a fraction, it must be fully reduced. In order for a fraction to be in lowest terms, there should be no common factors in the numerator and denominator.

Example 3 Write $\frac{48}{72}$ in lowest terms.

We may not all arrive at a reduced fraction by taking the same route. What is key is that we all check to make sure that there are no common factors left in the numerator and denominator. If there are any, cancel them out, since $\frac{a}{a} = 1$.

$$\frac{48}{92} = \frac{2 \cdot 24}{2 \cdot 46} = \frac{24}{46} = \frac{2 \cdot 12}{2 \cdot 23} = \frac{12}{23}$$

Note that many calculators (including the TI-83/84) can rewrite fractions in lowest form for you. You may want to become comfortable using this feature, especially for fractions with large numerators and denominators.

My Turn!

Write $\frac{36}{102}$ in lowest terms.

Objective 3: Convert between decimals, fractions, and percentages.

There will be many times in this course that you will want to convert between decimals, fractions, and percentages. We will review how to do this for the most commonly used conversions in statistics.

Example 4 Convert 8% to a decimal.

To convert from a percentage to a decimal, you will remove the percent symbol and move the decimal point two places to the left. (This is because the percent symbol means per hundred; so, you are essentially dividing by 100.)

Currently, the decimal point is to the right of 8. (An invisible decimal point is always to the right of the rightmost digit.) So, we will move it two places to the left. Since there is only one digit to the left, we will have to insert a placeholder of 0. Also, it is good practice to write a 0 to the left of the decimal point, as it results in less confusion to the reader. (Decimal points are pretty tiny for reading.)

$$8\% = 0.08$$

Answer 0.08

My Turn!

Convert 0.3% to a decimal.

Example 5 Convert 0.006 to a percent.

Now, we will do the reverse and convert a decimal to a percent. To do this you will move the decimal point two places to the right and insert the percent symbol.

$$0.006 = 0.6\%$$

Answer 0.6%

My Turn!

Convert 2.3 to a percent.

Example 6 Convert $\frac{7}{8}$ to a percent.

First, we will convert the fraction to a decimal. Then, we will follow the steps from Example 5 to change the decimal to a percentage.

To change a fraction to a decimal, you divide the numerator by the denominator.

$$\frac{7}{8} = 7 \div 8 = 0.875$$

Now, we will convert the decimal 0.875 to a percentage by moving the decimal point two places to the right and inserting the percent symbol.

$$0.875 = 87.5\%$$

Answer 87.5%

My Turn!

Convert $\frac{9}{16}$ to a percent.

Example 7 Convert 0.06 to a fraction.

To convert a decimal to a fraction, you write the number with the decimal point and leading zeros removed as the numerator of a fraction over a denominator that is a power of 10. The exponent on the 10 is the number of digits to the right of the decimal point in the given number. For 0.06, there are 2 digits to the right of the decimal point. So, the denominator will be 10^2, which can be rewritten as 100. Once you have a fraction, be sure to simplify it fully.

$$0.06 = \frac{6}{10^2} = \frac{6}{100} = \frac{3}{50}$$

Answer $\frac{3}{50}$

My Turn!

Convert 0.0028 to a fraction.

Objective 4: Calculate relative frequencies.

As you construct tables and graphs in the text, you will be calculating relative frequencies, which are the ratio of the amount of times an event occurs to the number of times the event could occur. In other words, it is the number of times something happens divided by the total number of times it could happen. Relative frequencies are often represented as percentages.

Example 8 If 30 out of 80 people responded that they skip flossing at least one day a week, calculate the percentage of respondents that skip flossing at least one day a week.

So, the relative frequency for this problem is 30 out of 80, which can be written as $\frac{30}{80}$. We can then turn this fraction into a decimal. Finally, we convert our answer to a percentage by moving the decimal point two places to the right and inserting %.

$$\frac{30}{80} = 30 \div 80 = 0.375 = 37.5\%$$

Answer 37.5% of respondents skip flossing at least one day a week.

My Turn!

If 450 out of 800 people responded that they own more than one computer, calculate the percentage of respondents who own more than one computer.

Objective 5: Find the percentage of a number.

Sometimes, you may need to determine what the percentage of a number is.

What is $p\%$ of x?

To do this, you will multiply the percentage written as a decimal times the number.

That is,

$$p\% \text{ as a decimal} \cdot x$$

Example 9 What is 30% of 150?

Write 30% as a decimal and multiply it by 150.

$$30\% \text{ of } 150 = 0.3 \cdot 150 = 45$$

Answer 30% of 150 is 45.

My Turn!

What is 65% of 600?

Example 10 There were 900 respondents to a survey. If 40% of respondents indicated that they live in an apartment, how many respondents live in an apartment?

This amounts to answering the question, "What is 40% of 900?"

To find the percentage of a number, you multiply the percent written as a decimal times the number.

$$x = 0.4 \cdot 900 = 360$$

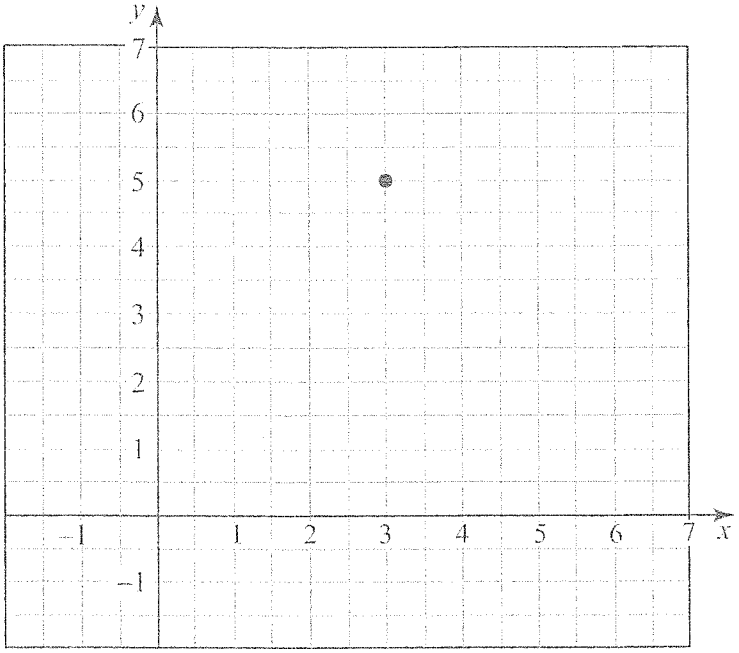
Answer 360 respondents live in an apartment.

My Turn!

There were 80 respondents to a survey. If 30% of respondents indicated that they own a DVD player, how many respondents own a DVD player?

Objective 6: Plot points.

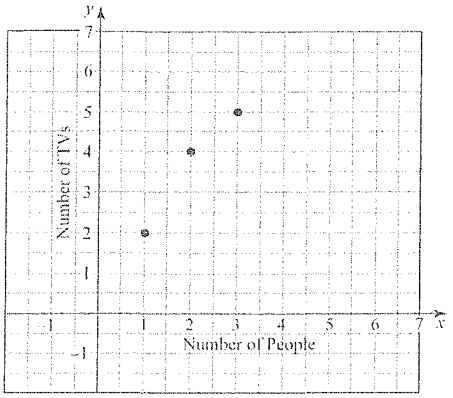
In statistics, we will often study data that come in pairs. It can be helpful to see the paired data on a graph. Each set of paired data can be represented by a point that can be written as (x, y). The points can be plotted on a Cartesian coordinate plane. The origin, or the place where the horizontal (x) and vertical (y) axes intersect, is the starting point The first value in the paired data (the x value) will tell you to move left (negative) or right (positive). The second value (the y value) will place the point up (positive) or down (negative). For example, you can plot the set of paired data (3, 5) by counting three units to the right of the origin and up five units.



Example 11 Plot the following paired data.

Number of People in a Household (x)	Number of TVs in a Household (y)
1	2
2	4
3	5

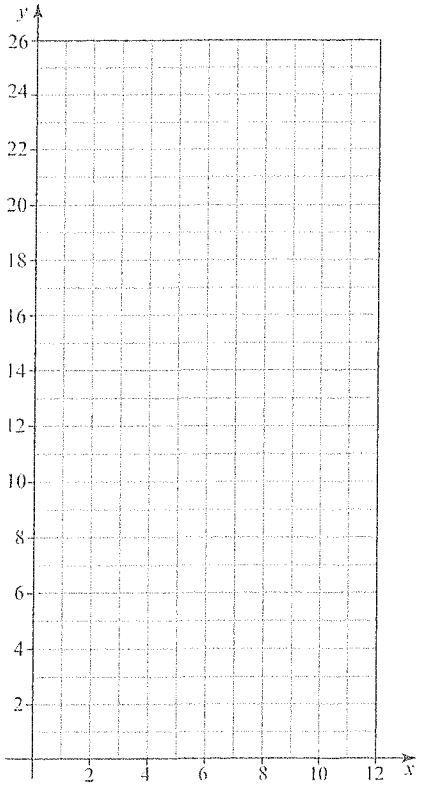
These data can be written as three points (1, 2), (2, 4), and (3, 5). Then, we can plot these three points on the Cartesian plane. As you learn statistics, you will find that most of the data that you will encounter will be positive values. As a result, many times you can limit your Cartesian plane to the first quadrant (the upper right-hand section). Also, there may be times that you will want to change the scale on the axes. Be sure to label your axes with the variables that are being used.



My Turn!

Plot the following paired data.

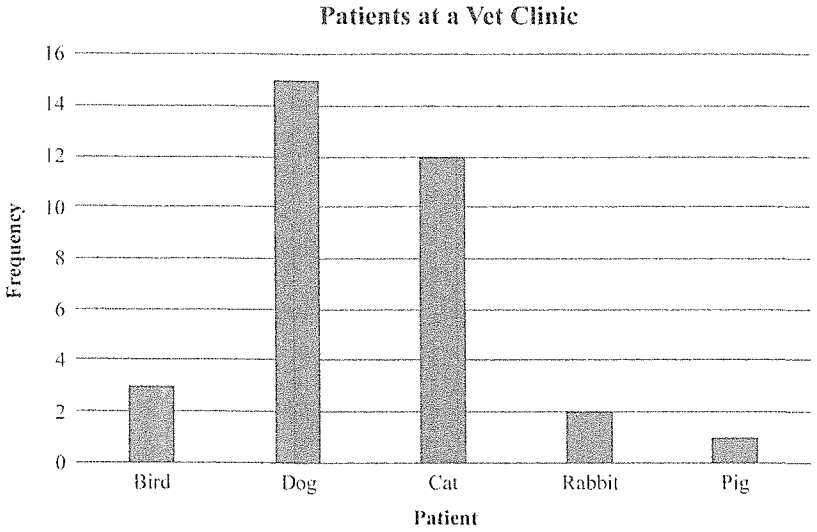
Number of Rooms in a House	Number of Paintings in a House
5	15
7	20
8	26



Objective 7: Review the skills for graphing.

In the corresponding chapter of the text, you will begin interpreting graphs. Some of the graphs will be in the Cartesian plane, as in the last example. Other graphs may include some that you may have seen before in the media, such as bar charts, pie charts, and time series graphs. We will do a sampling of two here. Notice how the graphs that follow are carefully labeled so that the information is clear to the reader. Whenever you create your own graphical representations of data, label everything clearly so that the graph conveys all the necessary information to the reader.

Example 12 The following is called a bar chart. It represents the types of patients that a veterinarian had in one day. What percentage of the vet's patients that day were cats? Round the answer to the nearest percent.



In order to answer this, we need to figure out how many cats were patients that day and how many animals were seen that day at the veterinarian's clinic.

The height of the bar labeled "Cat" will tell us that there were 12 cats seen that day.

To find the total number of animals seen that day, we have to sum up all of the heights (frequencies) of the bars.

Total number of animals seen that day $= 3+15+12+2+1=33.$

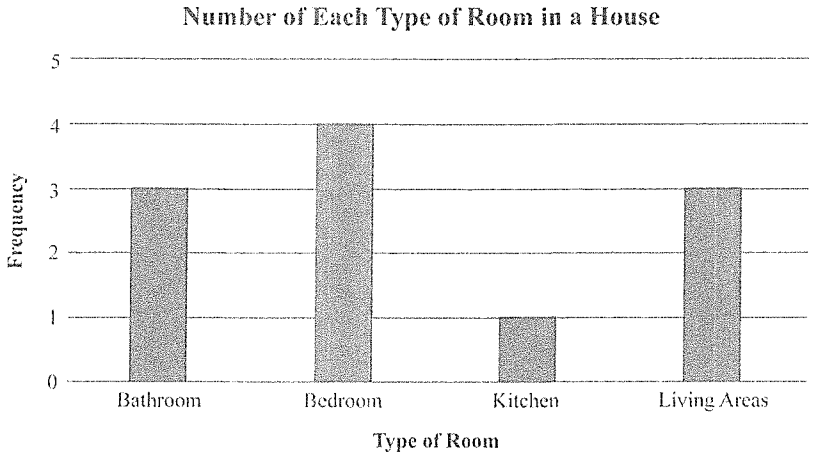
So, to find the relative frequency, we have to divide 12 by 33 to change it to a decimal: $\frac{12}{33} = 0.\overline{36}$. (The 36 has a bar above it since those digits are repeating.) We will now convert this to a percentage and round to the nearest percent.

$$0.\overline{36} = 36.\overline{36}\% \approx 36\%$$

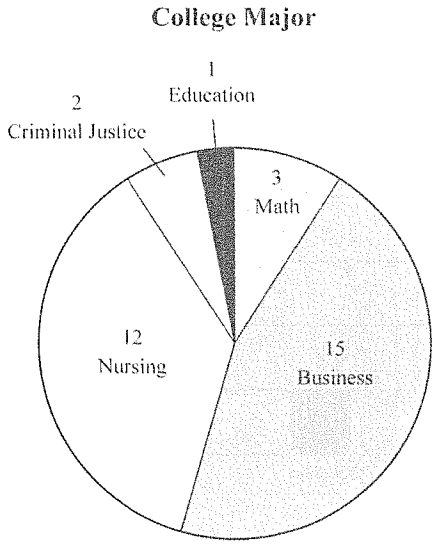
Answer 36% of the patients were cats.

My Turn!

The bar chart represents the frequencies for the types of rooms that are in a home. What percentage of the house's rooms are bathrooms? Round the answer to the nearest percent.



Example 13 The following is called a pie chart. It represents the college majors for a sample of students. What percentage of the college students were math majors? Round the answer to the nearest percent.



First, we need to figure out how many students have math as their college major. There were 3 math majors, as indicated by the number 3 in the appropriate slice of the pie chart. Next, we need to figure out the total number of students who were included in the sample. We can do that by summing up the frequencies for the 5 college majors.

Total number of students sampled $= 3+15+12+2+1 = 33.$

So in order to find the relative frequency, we have to divide 3 by 33 to change it to a decimal:

$\frac{3}{33} = 0.\overline{09}.$

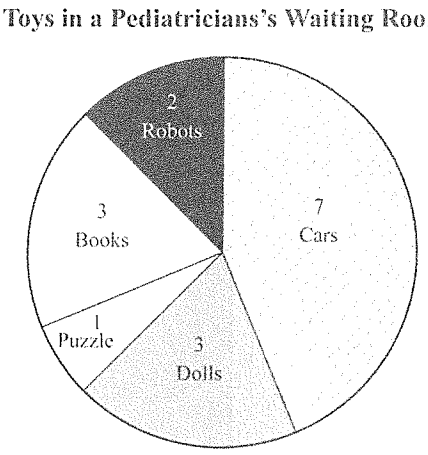
We will now convert this to a percentage and round to the nearest percent.

$$0.\overline{09} = 9.\overline{09}\% \approx 9\%$$

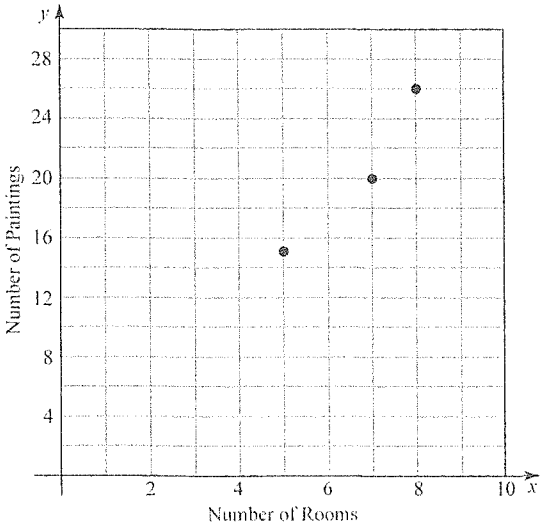
Answer About 9% of college students sampled were math majors.

My Turn!

The pie chart represents the frequencies for various types of toys in a pediatrician's waiting room. What percentage of the toys were dolls? Round the answer to the nearest percent.



Answers to My Turn!

1. 7654.32 miles
2. 0.364 cm
3. $\frac{6}{17}$
4. 0.003
5. 230%
6. 56.25%
7. $\frac{7}{2500}$
8. 56.25%
9. 390
10. 24 respondents
11. 

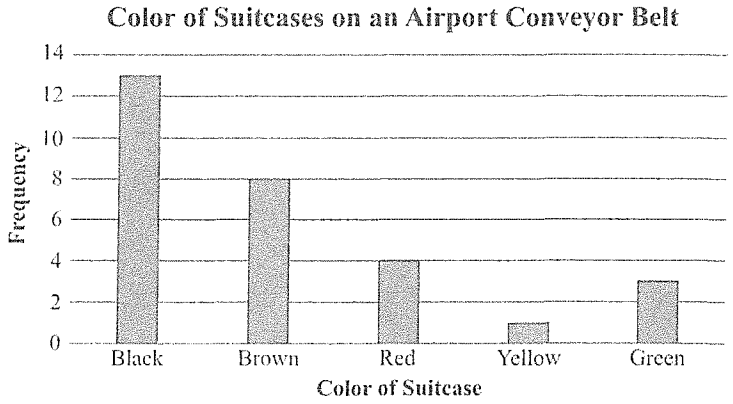
12. 27%
13. 19%

Practice Problems

1. Round 24,967.0784 kilograms to the nearest tenth of a kilogram.
2. Round 1.04708 pounds to 3 significant digits.
3. Write $\frac{84}{196}$ in lowest terms.
4. Convert 2.5% to a decimal.
5. Convert 0.007 to a percent.
6. Convert $\frac{2}{25}$ to a percent.
7. Convert 0.018 to a fraction.
8. If 30 out of 600 people tested positive for a cat allergy, calculate the percentage of participants who tested positive for a cat allergy.
9. What is 32% of 700?
10. A researcher surveyed 300 people. If 22% of those surveyed indicated that they are vegan, how many subjects responded that they are vegan?
11. Plot the following paired data.

Number of Times Exercising in a Week	Number of Meals Eaten in a Week
5	20
2	17
0	15

12. The bar chart represents the frequency of various colored suitcases on an airport baggage claim conveyor belt. What percentage of suitcases were red? Round the answer to the nearest percent.



13. The pie chart represents the frequencies of various state license plates for cars on a Florida highway. What percentage of the license plates were from New York? Round the answer to the nearest percent.