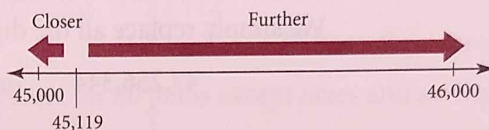
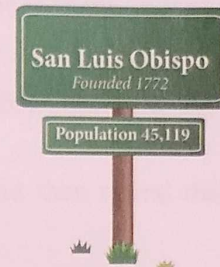


Rounding Numbers, Estimating Answers, and Displaying Information

R.3

Many times when we talk about numbers, it is helpful to use numbers that have been *rounded off*, rather than exact numbers. For example, the city where I live has a population of 45,119. But when I tell people how large the city is, I usually say, "The population is about 45,000." The number 45,000 is the original number rounded to the nearest thousand. The number 45,119 is closer to 45,000 than it is to 46,000, so it is rounded to 45,000. We can visualize this situation on the number line.



Rounding

The steps used in rounding numbers are given below.

Note After you have used the steps listed here to work a few problems, you will find that the procedure becomes almost automatic.

Steps for Rounding Whole Numbers

1. Locate the digit just to the right of the place you are to round to.
2. If that digit is less than 5, replace it and all digits to its right with zeros.
3. If that digit is 5 or more, replace it and all digits to its right with zeros, and add 1 to the digit to its left.

You can see from these steps that in order to round a number you must be told what column (or place value) to round to.

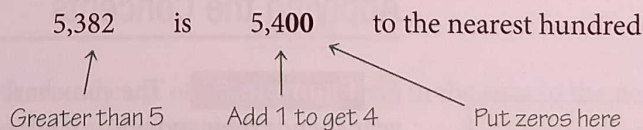
VIDEO EXAMPLES



SECTION R.3

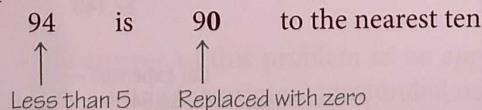
Example 1 Round 5,382 to the nearest hundred.

Solution The 3 is in the hundreds column. We look at the digit just to its right, which is 8. Because 8 is greater than 5, we add 1 to the 3, and we replace the 8 and 2 with zeros.



Example 2 Round 94 to the nearest ten.

Solution The 9 is in the tens column. To its right is 4. Because 4 is less than 5, we simply replace it with 0.



Example 3 Round 973 to the nearest hundred.

Solution We have a 9 in the hundreds column. To its right is 7, which is greater than 5. We add 1 to 9 to get 10, and then replace the 7 and 3 with zeros:

973 is 1,000 to the nearest hundred

Greater than 5 Add 1 to get 10 Put zeros here

Example 4 Round 47,256,344 to the nearest million.

Solution We have 7 in the millions column. To its right is 2, which is less than 5. We simply replace all the digits to the right of 7 with zeros to get:

47,256,344 is 47,000,000 to the nearest million

Less than 5 Leave as is Replaced with zeros

Table 1 gives more examples of rounding.

Original Number	Rounded to the Nearest		
	Ten	Hundred	Thousand
6,914	6,910	6,900	7,000
8,485	8,490	8,500	8,000
5,555	5,560	5,600	6,000
1,234	1,230	1,200	1,000

Table 1

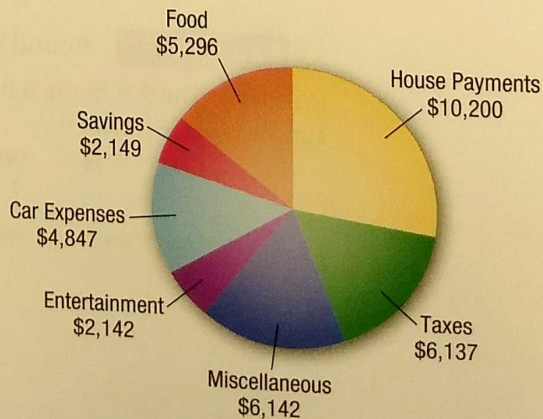
Rule: Calculating and Rounding

If we are doing calculations and are asked to round our answer, we do all our arithmetic first and then round the result. That is, the last step is to round the answer; we don't round the numbers first and then do the arithmetic.

Applying the Concepts

Example 5

The pie chart below shows how a family earning \$36,913 a year spends their money.



Note Pie charts are one of the visual representations of data we will be using in this book. They are especially useful when we want to show parts of a whole and the relationships between those parts. Without doing any math, we can see from the pie chart here that the amount spent on the house payment is about twice the amount spent on food.



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- a. To the nearest hundred dollars, what is the total amount spent on food and entertainment?
- b. To the nearest thousand dollars, how much of their income is spent on items other than taxes and savings?

Solution In each case we add the numbers in question and then round the sum to the indicated place.

- a. We add the amounts spent on food and entertainment and then round that result to the nearest hundred dollars.

$$\begin{array}{r} \text{Food} \qquad \qquad \qquad \$5,296 \\ \text{Entertainment} \quad + \$2,142 \\ \hline \text{Total} \qquad \qquad \qquad \$7,438 = \$7,400 \text{ to the nearest hundred dollars} \end{array}$$

- b. We add the numbers for all items except taxes and savings.

$$\begin{array}{r} \text{House payments} \quad \$10,200 \\ \text{Food} \qquad \qquad \qquad \$5,296 \\ \text{Car expenses} \qquad \quad \$4,847 \\ \text{Entertainment} \qquad \quad \$2,142 \\ \text{Miscellaneous} \quad + \$6,142 \\ \hline \text{Total} \qquad \qquad \qquad \$28,627 = \$29,000 \text{ to the nearest thousand dollars} \end{array}$$

Estimating

When we *estimate* the answer to a problem, we simplify the problem so that an approximate answer can be found quickly. There are a number of ways of doing this. One common method is to use rounded numbers to simplify the arithmetic necessary to arrive at an approximate answer, as our next example shows.

Example 6 Estimate the answer to the following problem by rounding each number to the nearest thousand.

$$\begin{array}{r} 4,872 \\ 1,691 \\ 777 \\ + 6,124 \\ \hline \end{array}$$

Solution We round each of the four numbers in the sum to the nearest thousand. Then we add the rounded numbers.

$$\begin{array}{r} 4,872 \quad \text{rounds to} \quad 5,000 \\ 1,691 \quad \text{rounds to} \quad 2,000 \\ 777 \quad \text{rounds to} \quad 1,000 \\ + 6,124 \quad \text{rounds to} \quad + 6,000 \\ \hline 14,000 \end{array}$$

We estimate the answer to this problem to be approximately 14,000. The actual answer, found by adding the original unrounded numbers, is 13,464.

Note The method used in Example 6 does not conflict with the rule we stated before Example 5. In Example 6 we are asked to estimate an answer, so it is okay to round the numbers in the problem before adding them. In Example 5 we are asked for a rounded answer, meaning that we are to find the exact answer to the problem and then round to the indicated place. In this case we must not round the numbers in the problem before adding. Look over the instructions, solutions, and answers to Examples 5 and 6 until you understand the difference between the problems shown there.



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Descriptive Statistics Bar Charts

In the introduction to this chapter, we gave two representations for the amount of caffeine in five different drinks, one numeric and the other visual. Those two representations are shown below in Table 2 and Figure 1.

Beverage (6-Ounce Cup)	Caffeine (in Milligrams)
Brewed Coffee	100
Instant Coffee	70
Tea	50
Cocoa	5
Decaffeinated Coffee	4

Table 2

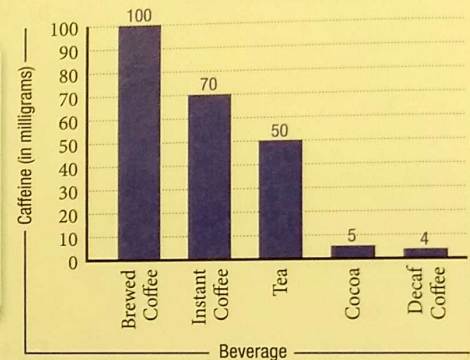


Figure 1

The diagram in Figure 1 is called a *bar chart*. Bar charts are especially useful for showing how something changes over time or for comparing items (such as the different drinks above). The horizontal line below which the drinks are listed is called the *horizontal axis*, while the vertical line that is labeled from 0 to 100 is called the *vertical axis*. Notice how we have labeled the horizontal axis with “Beverage” and the vertical axis with “Caffeine (in milligrams).” It is important to label the axes and to tell what the units are on the vertical axis. Finally, choose the numbers on the vertical axis so that it will be convenient for your data. Here, we went from 0 to 100 by 10’s. Can you see why that was a good choice?

When I put together the manuscript for this book, I used a spreadsheet program to draw the initial versions of the bar charts, pie charts, and some of the other diagrams you will see as you progress through the book. The Using Technology box on the next page shows an example of such a program.

Using Technology Spreadsheet Programs

Figure 2 shows how the screen on my computer looked when I was preparing the bar chart for Figure 1 in this section. Notice that I also used the computer to create a pie chart from the same data.

If you have a computer with a spreadsheet program, you may want to use it to create some of the charts you will be asked to create in the problem sets throughout the book.

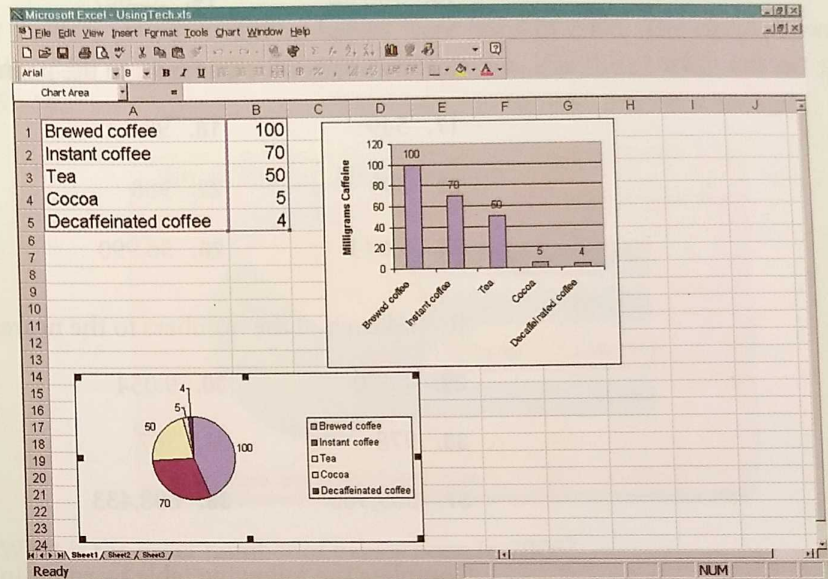


Figure 2

Getting Ready for Class

After reading through the preceding section, respond in your own words and in complete sentences.

- Describe the process you would use to round the number 5,382 to the nearest thousand.
- Describe the process you would use to round the number 47,256,344 to the nearest ten thousand.
- Find a number not containing the digit 7 that will round to 700 when rounded to the nearest hundred.
- When I ask a class of students to round the number 7,499 to the nearest thousand, a few students will give the answer as 8,000. In what way are these students using the rule for rounding numbers incorrectly?

Problem Set R.3

Round each of the numbers to the nearest ten.

- | | | | |
|------------|------------|-----------|-----------|
| 1. 42 | 2. 44 | 3. 46 | 4. 48 |
| 5. 45 | 6. 73 | 7. 77 | 8. 75 |
| 9. 458 | 10. 455 | 11. 471 | 12. 680 |
| 13. 56,782 | 14. 32,807 | 15. 4,504 | 16. 3,897 |

Round each of the numbers to the nearest hundred.

- | | | | |
|-----------|------------|------------|------------|
| 17. 549 | 18. 954 | 19. 833 | 20. 604 |
| 21. 899 | 22. 988 | 23. 1,090 | 24. 6,778 |
| 25. 5,044 | 26. 56,990 | 27. 39,603 | 28. 31,999 |

Round each of the numbers to the nearest thousand.

- | | | | |
|-------------|-------------|---------------|---------------|
| 29. 4,670 | 30. 9,054 | 31. 9,760 | 32. 4,444 |
| 33. 978 | 34. 567 | 35. 657,892 | 36. 688,909 |
| 37. 509,905 | 38. 608,433 | 39. 3,789,345 | 40. 5,744,500 |

Complete the following table by rounding the numbers on the left as indicated by the headings in the table.

Original Number	Rounded to the Nearest		
	Ten	Hundred	Thousand
41. 7,821			
42. 5,945			
43. 5,999			
44. 4,353			
45. 10,985			
46. 11,108			
47. 99,999			
48. 95,505			

Applying the Concepts



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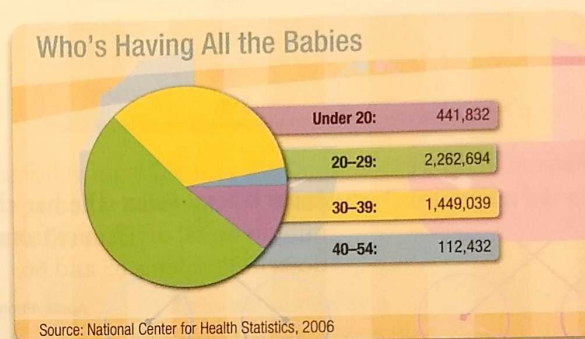
49. **Average Salary** Based on salary studies by *The Associated Press*, major league baseball's average player salary for the 2012 season was \$3,440,000, representing an increase of 4.1% over the previous season's average. Round the 2012 average player salary to the nearest hundred thousand.

50. **Tallest Mountain** The world's tallest mountain is Mount Everest. On May 5, 1999, it was found to be 7 feet taller than it was previously thought to be. Before this date, Everest was thought to be 29,028 feet high. That height was determined by B. L. Gulatee in 1954. The first measurement of Everest was in 1852. At that time the height was given as 29,002 feet. Round the current height, the 1954 height, and the 1852 height of Mount Everest to the nearest thousand.



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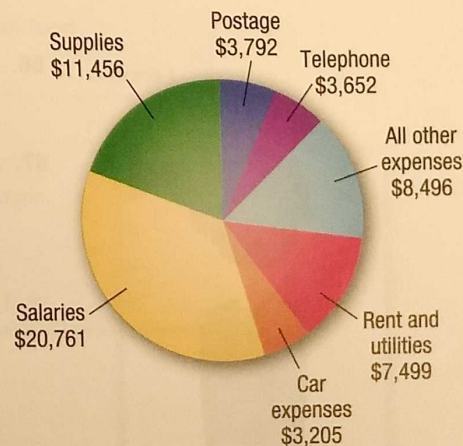
- Age of Mothers** About 4 million babies were born in 2006. The chart shows the breakdown by mother's age and number of babies. Use the chart to answer problems 51–54.



51. What is the exact number of babies born in 2006?
52. Using your answer from Problem 51, is the statement “About 4 million babies were born in 2006” correct?
53. To the nearest hundred thousand, how many babies were born to mothers aged 20 to 29 in 2006?
54. To the nearest thousand, how many babies were born to mothers 40 years old or older?

Business Expenses The pie chart shows one year's worth of expenses for a small business. Use the chart to answer Problems 55–58.

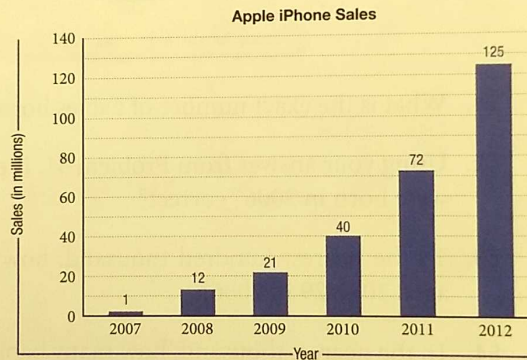
55. To the nearest hundred dollars, how much was spent on postage and supplies?
56. Find the total amount spent, to the nearest hundred dollars, on rent, utilities and car expenses.
57. To the nearest thousand dollars, how much was spent on items other than salaries, rent and utilities?
58. To the nearest thousand dollars, how much was spent on items other than postage, supplies, and car expenses?



Estimating Estimate the answer to each of the following problems by rounding each number to the indicated place value and then adding.

- | | | |
|--|---|---|
| <p>59. hundred</p> $\begin{array}{r} 750 \\ 275 \\ + 120 \\ \hline \end{array}$ | <p>60. thousand</p> $\begin{array}{r} 1,891 \\ 765 \\ + 3,223 \\ \hline \end{array}$ | <p>61. hundred</p> $\begin{array}{r} 472 \\ 422 \\ 536 \\ + 511 \\ \hline \end{array}$ |
| <p>62. hundred</p> $\begin{array}{r} 399 \\ 601 \\ 744 \\ + 298 \\ \hline \end{array}$ | <p>63. thousand</p> $\begin{array}{r} 25,399 \\ 7,601 \\ 18,744 \\ + 6,298 \\ \hline \end{array}$ | <p>64. thousand</p> $\begin{array}{r} 9,999 \\ 8,888 \\ 7,777 \\ + 6,666 \\ \hline \end{array}$ |

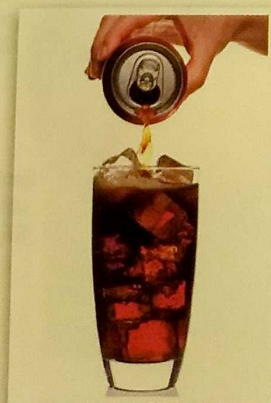
Apple iPhone Sales The bar chart below shows the sales (rounded to the nearest million units) of iPhones from 2007 to 2012. Use the bar chart to answer the questions in Problems 65 and 66.



Year	Sales (in millions)
2007	_____
2008	_____
2009	_____
_____	40
_____	72
2012	_____

Data from Apple Inc.

65. How many iPhones were sold in the first four years of sales (2007-2010)? Round your answer to the nearest ten million. (Remember that, since the units are in millions, the 12 over the bar for 2008 means 12,000,000.)
66. How many iPhones were sold in 2011 and 2012 combined? Round your answer to the nearest hundred million.
67. **Caffeine Content** The following table lists the amount of caffeine in five different soft drinks. Construct a bar chart from the information in the table.



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Drink (12-ounce serving)	Caffeine (in milligrams)
Jolt	143
Mtn Dew	55
Coca-Cola	34
Diet Pepsi	36
7 Up	0

68. **Caffeine Content** The following table lists the amount of caffeine in five different nonprescription drugs. Construct a bar chart from the information in the table.

Nonprescription drug (one tablet)	Caffeine (in milligrams)
Dexatrim	200
No Doz	100
Excedrin	65
Triaminicin	30
Dristan	16

69. **Exercise** The following table lists the number of calories burned in 1 hour of exercise by a person who weighs 150 pounds. Construct a bar chart from the information in the table.

Activity	Calories
Bicycling	374
Bowling	265
Handball	680
Jazzercise	340
Jogging	680
Skiing	544

70. **Fast Food** The following table lists the number of calories consumed by eating some popular fast foods. Construct a bar chart from the information in the table.



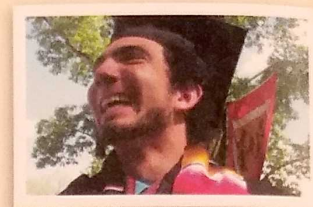
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Food	Calories
a. McDonald's hamburger	250
b. Burger King hamburger	240
c. Jack in the Box hamburger	290
d. McDonald's Big Mac	550
e. Burger King Whopper	630
f. Jack in the Box Jumbo Jack	540

SPOTLIGHT ON SUCCESS

Student Instructor Octavio

*The best thing about the future
is that it comes one day at a time.*
—Abraham Lincoln



For my family, education was always the way to go. Education would move us ahead, but the path through education was not always clear. My parents had immigrated to this country and had not had the opportunity to continue in education. Luckily though, with the help of school counselors and the A.V.I.D. (Advancement Via Individual Determination) program in our school district, my older sister and brother were able to get into some of their top colleges. Later, A.V.I.D. and with the guidance of my siblings I was able to take the right courses and was lucky enough to be accepted at my dream university.

Math has been my favorite subject ever since I can remember. When I got to higher level math classes, however, I struggled more than I had with previous levels of math. This struggle initially stopped me from enjoying the class, but as my understanding grew, I became more and more interested in seeing how things connected. I have found these connections at all levels of mathematics, including prealgebra. These connections continue to be a source of satisfaction for me.